U. S. ENVIRONMENTAL PROTECTION AGENCY
Washington, D.C. 20460

OFFICE OF CHEMICAL
SAFETY AND POLLUTION
PREVENTION

Date: May 17, 2010
Chemical: Flubendiamide
PC Code: 027602
DP Barcodes: 368029, 368036, 368040, and 368055
DECISION: 408445, 408447, 408440, 408446

MEMORANDUM

SUBJECT: Environmental Fate and Effects Division Risk Assessment for Legume Vegetable and Christmas tree New Uses for the Insecticide Flubendiamide

TO: Carmen Rodia, Risk Manager
Registration Division
Mail Code: 7505P

5/17/10

FROM: Fred Jenkins, MS, Biologist
James Lin, PhD, Environmental Engineer
Environmental Risk Branch I
Environmental Fate and Effects Division (7507P)

From Jim Lin 5/17/10

THROUGH: Anita Pease, MS, Acting ERBI Branch Chief
Brian Anderson, MS, Risk Assessment Process Leader
Environmental Risk Branch I
Environmental Fate and Effects Division (7507P)

APease 5/17/10

Please find the attached the Environmental Fate and Effects Division (EFED) environmental risk assessment for the proposed new uses of flubendiamide on legumes including legume vegetables such as soybeans and Christmas trees. These proposed new uses entail two different flubendiamide formulated products, 480 SC and 24 WG. This assessment is based on the highest proposed use rates for the new uses, which are similar to rates currently registered for flubendiamide. These use rates are based on the 480 SC formulation, which is proposed to be used on Christmas trees and legume vegetables including soybeans. The 24 WG formulation is intended only for rotational plant-back interval use for legume vegetables (The use rates for this formulation are not higher than the rates for the 480 SC formulation). The maximum application rates for the proposed legume vegetables and Christmas tree uses (which may be applied via ground and aerial methods) are 2 applications of 0.94 lbs ai/A at 5 day intervals and 2 applications of 0.156 lbs ai/A at 7 day intervals, respectively.

The results of the screening-level risk assessment for the proposed new uses of flubendiamide include the following:

- **Birds**: Acute LOCs are not exceeded. However, there are chronic risks to birds posed by the proposed use on Christmas trees only.

- **Benthic Invertebrates**: LOCs are exceeded for both flubendiamide and its des-iodo degradate.

- **Aquatic Invertebrates**: The formulated products 480 SC and 24 WG (which are more toxic than the parent to aquatic invertebrates) pose direct acute and chronic risks to freshwater invertebrates.

- **Freshwater fish, marine/estuarine fish, aquatic plants, terrestrial plants, and mammals**: No LOCs are exceeded.

- Sensitive terrestrial invertebrates such as Lepidoptera species may be affected. Impacts to bees and earthworms are expected to be minimal.

Listed Species

Aquatic and terrestrial invertebrates (non-target Lepidoptera species and beetles) were identified as being of potential concern for direct effects for listed species for the proposed uses (**Table 1**). There is potential for flubendiamide to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering pollination and/or dispersal, etc. With additional refinement, such as exploring more detailed use patterns and species biology (*e.g.*, geographic location, specific feeding habits, time of year likely to utilize crop fields), it may be determined that some (or all) listed species may not be affected.

Table 1. Listed species risks associated with direct or indirect effects due to applications of flubendiamide

Listed Taxonomy	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants – monocots	No	Yes[a]
Terrestrial and semi-aquatic plants – dicots	No	Yes[a]
Terrestrial invertebrates	Yes[a]	No
Birds (surrogate for terrestrial-phase amphibians and reptiles)	Yes (risk is only applicable to the use on Christmas trees)	Yes [a]
Mammals	No	Yes[a]
Aquatic vascular plants	No	No
Aquatic non-vascular plants [a]	No	No
Freshwater fish (surrogate for aquatic-phase amphibians)	No	Yes[b]
Freshwater Invertebrates	Yes – due to exposure to formulations [b]	Yes[b]
Freshwater Benthic Invertebrates	Yes – due to exposure to both flubendiamide and the des-iodo degradate [c]	Yes[b]
Estuarine/Marine Fish	No	No
Estuarine/Marine Crustaceans	Yes - presumed due to exposure to formulations	No

Table 1. Listed species risks associated with direct or indirect effects due to applications of flubendiamide		
Listed Taxonomy	**Direct Effects**	**Indirect Effects**
Estuarine/Marine Mollusks	Yes - presumed due to exposure to formulations	No

[a] Potential risk to non-target insects (Lepidoptera) and adult ladybird beetles due to ingestion of food items (aphids and pollen) containing flubendiamide residues

[b] Acute and Chronic LOC exceeded for daphnids exposed to the formulations

[c] Potential risk to benthic invertebrates exposed to the des-iodo degradate

Key Uncertainties and Information Gaps

The following uncertainties, limitations, and assumptions were identified in this environmental risk assessment:

Uncertainties

The following uncertainties, limitations, and assumptions were identified in this environmental risk assessment:

Ecological toxicity data gaps

- The available data indicate that the formulated products of flubendiamide are more toxic to freshwater invertebrates than the parent compound. However, formulated product toxicity data for marine/estuarine invertebrates are not available. Therefore, the potential for acute risk to estuarine/marine invertebrates cannot be precluded based on exposure to the formulated products of flubendiamide. Submittal of a marine/estuarine acute toxicity invertebrate (850.1035; mysid acute toxicity study test) study testing the formulated products in accordance with the guideline requirements would reduce the uncertainty regarding potential toxicity of the formulations to marine/estuarine invertebrates.

- Two 28-day chronic toxicity studies indicate that flubendiamide and its des-iodo degradate are toxic to the midge, *Chironomus riparius*, in an overlying-water spiked system. Based on the available chronic data, there is a potential for direct effects to benthic invertebrates exposed to the parent and degradate. Neither of the two chronic toxicity midge studies followed sediment toxicity guidelines, which require the sediment to be spiked as opposed to the overlying water. The mean measured pore water concentrations demonstrated in the study along with the available mesocosm data may provide sufficient evidence regarding the potential risk to benthic invertebrates. Thus, no additional sediment toxicity study is currently being requested.

Fate Data Gaps

Data gaps in the environmental fate database for flubendiamide and des-iodo exist. The following studies are recommended in order to reduce uncertainties associated with the exposure assessment and refinement of the ecological risk assessment for flubendiamide and des-iodo:

<u>Flubendiamide</u>

effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA."

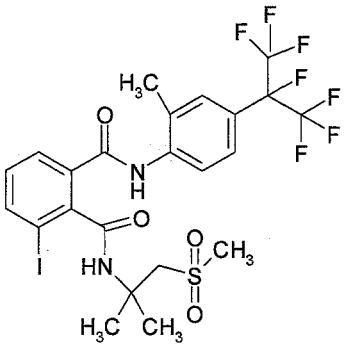
Surface Water and Ground Water Advisory

Flubendiamide and its degradate may also impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water. These chemicals are classified as having a medium potential for reaching both surface water and aquatic sediment via runoff several months or more after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of flubendiamide and its degradate NNI-0001-des-iodo from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours.

The environmental fate data evaluated in this assessment demonstrate that both flubendiamide and its primary degradate, des-iodo may reach ground water, particularly in vulnerable soils with lower organic carbon content. Thus, the following ground water advisory language is recommended to be placed on the flubendiamide's use label:

"This chemical has properties and characteristics associated with chemicals detected in ground water. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow".

Ecological Risk Assessment for the Section 3 New Use Registration of Flubendiamide (PC027602) on Legume vegetables (including Soybeans), and Christmas Trees



Prepared by:
Fred Jenkins, M.S., Biologist
James Lin, Ph.D., Environmental Engineeer

Reviewed by:
Stephen Wente, Ph.D., Biologist
Sujatha Sankula, Ph.D., Biologist
Brain Anderson, M.S. RAPL
Acting Branch Chief:
Anita Pease, M.S., Senior Biologist

U. S. Environmental Protection Agency
Office of Pesticide Programs
Environmental Fate and Effects Division
Environmental Risk Branch I
1200 Pennsylvania Ave., NW
Mail Code 7507P
Washington, DC 20460

April 2010

1 EXECUTIVE SUMMARY

This environmental risk assessment evaluates the potential ecological risks of the proposed new uses of the insecticide, flubendiamide, on legume vegetables including soybeans and Christmas trees to protect against certain types of insect infestation. These proposed new uses entail two different flubendiamide formulated products (480 SC and 24 WG). The product 480 SC is a white liquid suspension containing 490 g ai/L or 39% ai, and the 24 WG is a suspension concentration formulation containing 24% ai. This assessment is based on the maximum proposed application rates for the proposed new uses. The 480 SC formulation is proposed for use on Christmas trees and legume vegetables including soybeans, and the 24 WG formulation is intended for rotational plant-back interval use for legume vegetables.

The maximum application rates for the proposed legume vegetables and Christmas tree uses (which may be applied via ground and aerial methods) are 2 applications of 0.94 lbs ai/A at 5 day intervals and 2 applications of 0.156 lbs ai/A at 7 day intervals, respectively The application rates for the proposed new uses are equivalent to the maximum rates for the previously assessed currently registered uses of flubendiamide.

1.1 Nature of Chemical Stressor

Flubendiamide *(N^2-[1,1-Dimethyl-2-(methylsulfonyl)ethyl]-3-iodo-N^1-[2-methyl-4-[1,2,2,2- tetrafluoro-1-(trifluoromethyl)ethyl]phenyl]-1,2-benzenedicarboxamide)* belongs to the phthalic acid diamide class of insecticides for control of adult and larval Lepidoptera. It acts by targeting the ryanodine cell receptor and interfering with the calcium release channel, which is involved in muscle contraction. It is known to stabilize insect ryanodine receptors in an open state in a species-specific manner and to desensitize the calcium dependence of channel activity. Continuous stimulation of muscle contraction by "locking" the calcium channel in an "open" state, leads to muscle paralysis and eventual death of the organism. Whole organism symptoms may include feeding cessation, lethargy, paralysis, and death (Lahm *et al* 2005).

This assessment evaluates risks posed by the parent compound, the formulated products, and the primary degradate, des-iodo, because the available fate and toxicity data indicate that each of these compounds are of toxicological concern.

1.2 Potential Risks to Non-target Organisms

The primary potential risks identified in this assessment are to birds, aquatic pelagic and benthic invertebrates, and sensitive terrestrial invertebrates as described below.

Birds: There are potential chronic risk to birds posed by the Christmas tree use only. However since this risk conclusion presumes that birds diet consist of 100% short grass, this particular conclusion may be overly conservative.

Organisms with no expected significant direct risk concerns: Potential risks to other taxonomic groups including mammals, terrestrial plants, fish, and aquatic plants were lower than concern levels.

Listed Species

Birds, terrestrial-phase amphibians, reptiles, and aquatic and terrestrial invertebrates (non-target Lepidoptera species) were identified as being of potential concern for direct effects for listed species for the proposed new uses (**Table 1**). There is potential for flubendiamide to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering pollination and/or dispersal, *etc.* With additional refinement, such as exploring more detailed use patterns and species biology (*e.g.*, geographic location, specific feeding habits, time of year the listed species are likely to utilize crop fields), it may be determined that some (or all) listed species may not be affected.

Table 1. Listed species risks associated with direct or indirect effects due to applications of flubendiamide for proposed new uses (unless otherwise noted)

Listed Taxonomy	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants – monocots	No	Yes[a]
Terrestrial and semi-aquatic plants – dicots	No	Yes[a]
Terrestrial invertebrates	Yes[a]	Yes
Birds (surrogate for terrestrial-phase amphibians and reptiles)	Yes - risk is only applicable to the use on Christmas trees.	Yes [a]
Mammals	No	Yes[a]
Aquatic vascular plants	No	No
Aquatic non-vascular plants	No	No
Freshwater fish (surrogate for aquatic-phase amphibians)	No	Yes[b]
Freshwater Invertebrates	Yes – due to exposure to formulations [b]	Yes[b]
Freshwater Benthic Invertebrates	Yes – due to exposure to TGAI and des-iodo degradate [c]	Yes[b]
Estuarine/Marine Fish	No	Yes
Estuarine/Marine Crustaceans	Yes - presumed due to exposure to formulations	Yes
Estuarine/Marine Mollusks	Yes - presumed due to exposure to formulations	Yes

[a] Potential risk to non-target insects (Lepidoptera) and adult ladybird beetles due to ingestion of food items (aphids and pollen) containing flubendiamide residues

[b] Acute and chronic LOCs exceeded for daphnids exposed to the formulations

[c] Potential risk to benthic invertebrates exposed to the des-iodo degradate

1.3 Conclusions: Exposure Characterization

Environmental fate and transport data indicate that flubendiamide is stable to hydrolysis, aerobic and anaerobic soil metabolism, and aerobic aquatic metabolism. Photolysis and anaerobic aquatic metabolism appear to be the main routes of degradation for flubendiamide. Flubendiamide degrades to des-iodo under anaerobic aquatic conditions

Flubendiamide is not toxic to aquatic vascular and non-vascular plants at the limit of its solubility.

1.4.3. Terrestrial Organisms

Avian Toxicity

Flubendiamide technical is practically non-toxic to birds on an acute oral and subacute dietary basis. In addition, the 480 SC formulation is practically non-toxic to birds on an acute oral basis. Reproductive effects were observed in the mallard duck (*Anas platyrhynchos*) at the 289 mg a.i./kg diet treatment level with a corresponding NOAEC value of 98 mg a.i./kg-diet. The effects included a 17% reduction in the number of viable embryos of eggs set and a 3% decrease in percentage of hatchling survivors relative to controls. For bobwhite quail (*Colinus virginianus*), no treatment-related effects were observed at the highest treatment level with a corresponding NOAEC value of 1059 mg a.i./kg-diet.

Mammalian toxicity

Three acute oral mammalian studies showed flubendiamide to be practically non-toxic. In addition, no reproductive effects were observed in the two-generation rat reproduction study.

Terrestrial Invertebrate toxicity

Flubendiamide technical and the 480 SC formulation are classified as practically non-toxic based on the acute contact honey bee study (LD_{50} > 200 µg/bee).
Acute and chronic earthworm toxicity studies show no toxic effects based on exposure to flubendiamide technical, the 480 SC formulation, and the des-iodo degradate. However, in the 24 WG formulation chronic test, a significant reduction in the number of juveniles produced was observed, resulting in a NOAEC of 562 mg a.i./kg-dw soil.

The formulated products of flubendiamide were tested via non-guideline supplemental studies with several natural predators of Lepidopterous insects including the parasitoid wasp (*Aphidius rhopalosiphi*), predatory mite (*Typhlodromas pyri*), and ladybird beetle (*Coccinella septempunctata*). In the parasitoid wasp test with 24 WG formulation, significant reductions in survival and reproduction were observed (NOAEC = 0.17 lb a.i./A). In the parasitoid wasp test with 480 SC formulation, reproduction was not inhibited; however, survival was affected (NOAEC values were <0.2 and 0.39 lb a.i./A; LD_{50} were 0.423 and 0.60 lb a.i./A; This study entailed two different NOAEC and LC_{50} values because the study conducted two different tests that evaluated toxic effects within two different ranges of toxicity). In the predatory mite test with the 24 WG formulation, significant reductions in survival and reproduction were observed (NOAEC = 0.31 lb a.i./A, LD_{50} > 0.55 lb a.i./A). Three extended laboratory experiments were conducted exposing the ladybird beetle to the 480 SC formulation. There were no significant adverse effects to ladybird beetles observed due to contact with residues; however, adult

with the exposure assessment and refinement of the ecological risk assessment for flubendiamide and des-iodo:

Flubendiamide

(Non-guideline) **Small-scale Runoff/Vegetative buffer strip Study** – EFED is currently awaiting the submission of the runoff study was which was requested in the most recent previously conducted flubendiamide assessment. The runoff study was requested to determine the magnitude of the parent, flubendiamide, retained in buffer strips of various widths. EFED believes that the efficacy of buffers for flubendiamide use is uncertain. It appears that a program of monitoring receiving waters and storm water conveyances under varying conditions of use would greatly benefit any evaluation of potential utility of buffers to reduce flubendiamide loadings to receiving waters.

Des-iodo Degradate

(161-1) **Hydrolysis** – The hydrolysis study is requested to establish the significance of chemical hydrolysis as a route of degradation for NNI-0001-des-iodo and to identify, if possible, the hydrolytic products formed which may adversely affect non-target organisms.

(161-2) **Photodegradation in Water** – Pesticides introduced into aqueous systems in the environment can undergo photolytic transformation by sunlight. Data on rates of photolysis are needed to establish the importance of this transformation process and the persistence characteristics of the photoproducts formed.

(162-3) **Anaerobic Aquatic Metabolism** – The anaerobic aquatic metabolism is needed to assess the effects, the nature, and extent of formation of NNI-0001-des-iodo residues in water and in hydrosoil since anaerobic conditions are more likely to exist in aquatic environments.

(162-4) **Aerobic Aquatic Metabolism** – The requested study is needed to determine the effects on NNI-0001-des-iodo to aerobic conditions in water and sediments during the period of dispersal of NNI-0001-des-iodo throughout the aquatic environment and to compare rates and formation of metabolites. The data from this study would provide the aerobic aquatic input parameter for PRZM/EXAMS reducing modeling uncertainty.

(164-1) **Terrestrial Field Dissipation Studies** – NNI-0001-des-iodo is persistent and moderately mobile which increases the likelihood for run-off and leaching. No definitive studies on the field dissipation and degradation properties of the major degradate have been submitted to the Agency.

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- **Benthic Invertebrates**: LOCs are exceeded for both flubendiamide and its des-iodo degradate.

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Listed Species

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Key Uncertainties and Information Gaps

The following uncertainties, limitations, and assumptions were identified in this environmental risk assessment:

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Fate Data Gaps

Data gaps in the environmental fate database for flubendiamide and des-iodo exist. The following studies are recommended in order to reduce uncertainties associated with the exposure assessment and refinement of the ecological risk assessment for flubendiamide and des-iodo:

<u>Flubendiamide</u>

(Non-guideline) **Small-scale Runoff/Vegetative buffer strip Study** – EFED is currently awaiting the submission of the runoff study was which was requested in the most recent previously conducted flubendiamide assessment. The runoff study was requested to determine the magnitude of the parent, flubendiamide, retained in buffer strips of various widths. EFED believes that the efficacy of buffers for flubendiamide use is uncertain. It appears that a program of monitoring receiving waters and storm water conveyances under varying conditions of use would greatly benefit any evaluation of potential utility of buffers to reduce flubendiamide loadings to receiving waters.

Des-iodo Degradate

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(161-2) **Photodegradation in Water** – Pesticides introduced into aqueous systems in the environment can undergo photolytic transformation by sunlight. Data on rates of photolysis are needed to establish the importance of this transformation process and the persistence characteristics of the photoproducts formed.

(162-3) **Anaerobic Aquatic Metabolism** – The anaerobic aquatic metabolism is needed to assess the effects, the nature, and extent of formation of NNI-0001-des-iodo residues in water and in hydrosoil since anaerobic conditions are more likely to exist in aquatic environments.

(162-4) **Aerobic Aquatic Metabolism** – The requested study is needed to determine the effects on NNI-0001-des-iodo to aerobic conditions in water and sediments during the period of dispersal of NNI-0001-des-iodo throughout the aquatic environment and to compare rates and formation of metabolites. The data from this study would provide the aerobic aquatic input parameter for PRZM/EXAMS reducing modeling uncertainty.

(164-1) **Terrestrial Field Dissipation Studies** – NNI-0001-des-iodo is persistent and moderately mobile which increases the likelihood for run-off and leaching. No definitive studies on the field dissipation and degradation properties of the major degradate have been submitted to the Agency.

Labeling Recommendations

According to the Label Review Manual , the following label statements are recommended (the Label Review Manual is available at: http://www.epa.gov/oppfead1/labeling/lrm/).

Environmental Hazards

"This pesticide is toxic to aquatic invertebrates. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge

effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA."

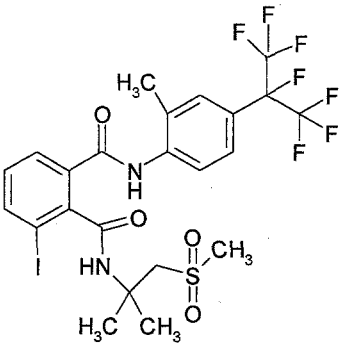
Surface Water and Ground Water Advisory

Flubendiamide and its degradate may also impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water. These chemicals are classified as having a medium potential for reaching both surface water and aquatic sediment via runoff several months or more after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of flubendiamide and its degradate NNI-0001-des-iodo from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours.

The environmental fate data evaluated in this assessment demonstrate that both flubendiamide and its primary degradate, des-iodo may reach ground water, particularly in vulnerable soils with lower organic carbon content. Thus, the following ground water advisory language is recommended to be placed on the flubendiamide's use label:

"This chemical has properties and characteristics associated with chemicals detected in ground water. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow".

Ecological Risk Assessment for the Section 3 New Use Registration of Flubendiamide (PC027602) on Legume vegetables (including Soybeans), and Christmas Trees



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1.1 Nature of Chemical Stressor

Flubendiamide *(N^2-[1,1-Dimethyl-2-(methylsulfonyl)ethyl]-3-iodo-N^1-[2-methyl-4-[1,2,2,2- tetrafluoro-1-(trifluoromethyl)ethyl]phenyl]-1,2-benzenedicarboxamide)* belongs to the phthalic acid diamide class of insecticides for control of adult and larval Lepidoptera. It acts by targeting the ryanodine cell receptor and interfering with the calcium release channel, which is involved in muscle contraction. It is known to stabilize insect ryanodine receptors in an open state in a species-specific manner and to desensitize the calcium dependence of channel activity. Continuous stimulation of muscle contraction by "locking" the calcium channel in an "open" state, leads to muscle paralysis and eventual death of the organism. Whole organism symptoms may include feeding cessation, lethargy, paralysis, and death (Lahm *et al* 2005).

This assessment evaluates risks posed by the parent compound, the formulated products, and the primary degradate, des-iodo, because the available fate and toxicity data indicate that each of these compounds are of toxicological concern.

1.2 Potential Risks to Non-target Organisms

The primary potential risks identified in this assessment are to birds, aquatic pelagic and benthic invertebrates, and sensitive terrestrial invertebrates as described below.

Birds: There are potential chronic risk to birds posed by the Christmas tree use only. However since this risk conclusion presumes that birds diet consist of 100% short grass, this particular conclusion may be overly conservative.

Terrestrial Invertebrates: A range of sensitivity was observed in available studies in terrestrial invertebrates. Effects to earthworms and honey bees appear unlikely to occur; however, sensitive species may be impacted. Particular concern was identified for Lepidoptera species (i.e., butterflies and moths), including endangered species. Lepidoptera may occur within and adjacent to treated fields where they may be exposed to flubendiamide directly and via spray drift. Additionally, the larvae of some lepidopteran species are aquatic (Merrit and Cummins, 1984) and, therefore, may be exposed to the parent, formulations, and des-iodo degradates that may be present in aquatic habitats. There is also potential for adverse effects to adult ladybird beetles (a beneficial insect) due to ingestion of food items (aphids and pollen) containing flubendiamide residues.

Benthic Invertebrates: Based on the fate profile, flubendiamide is expected to bind to sediment where it may persist for an extended period of time. The chronic Level of Concern (LOC) of 1.0 was exceeded for both the parent chemical and its des-iodo degradate for benthic invertebrates. The RQ values ranged from 1.2 to 3.7 for the parent and 1.4 to 19 for the degradate. Exposure to the des-iodo degradate is likely to occur because this degradate has been shown to form up to approximately 60% of parent chemical in anaerobic soil metabolism studies. In addition, estimated environmental concentrations (EECs) for the degradate des-iodo exceed the NOAEC in a 28-day chronic toxicity chironomid study in an overlying-water spiked system.

Aquatic Invertebrates: Acute or chronic effects are not expected from the technical grade material. However, formulated products have been shown to be more toxic to freshwater invertebrates than the TGAI. The acute endangered species LOC (0.05) and the acute restricted use LOC (0.1) are exceeded based on one aerial application of the proposed new uses of formulated products to legume vegetables and Christmas trees. Based on the potential for direct effects to these taxa, there may be potential indirect effects to species of concern that depend on these taxa as a source of food. Potential risks to aquatic and benthic invertebrates have been confirmed in mesocosm studies. However, given the risk for freshwater invertebrates exposed to the formulations, there is uncertainty regarding risk to marine invertebrates because no toxicity data for the formulated products has been submitted for marine/estuarine invertebrates. Therefore, the potential for acute risk to estuarine/marine invertebrates cannot be precluded based on exposure to the formulated products of flubendiamide.

The probit dose response relationship was used to determine the probability of an individual mortality occurrence for freshwater invertebrates exposed to the formulations based on the slope of the dose response curve observed in the acute toxicity tests. The estimated chance of an individual acute mortality to freshwater invertebrates exposed to the 480 SC formulation at the highest RQ of 0.17 is 1 in 19.2. The estimated chance of an individual acute mortality to the freshwater invertebrates exposed to the 24 WG formulation at the highest RQ of 0.18 is 1 in 11.7.

Organisms with no expected significant direct risk concerns: Potential risks to other taxonomic groups including mammals, terrestrial plants, fish, and aquatic plants were lower than concern levels.

Listed Species

Birds, terrestrial-phase amphibians, reptiles, and aquatic and terrestrial invertebrates (non-target Lepidoptera species) were identified as being of potential concern for direct effects for listed species for the proposed new uses (**Table 1**). There is potential for flubendiamide to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering pollination and/or dispersal, *etc.* With additional refinement, such as exploring more detailed use patterns and species biology (*e.g.*, geographic location, specific feeding habits, time of year the listed species are likely to utilize crop fields), it may be determined that some (or all) listed species may not be affected.

Table 1. Listed species risks associated with direct or indirect effects due to applications of flubendiamide for proposed new uses (unless otherwise noted)

Listed Taxonomy	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants – monocots	No	Yes[a]
Terrestrial and semi-aquatic plants – dicots	No	Yes[a]
Terrestrial invertebrates	Yes[a]	Yes
Birds (surrogate for terrestrial-phase amphibians and reptiles)	Yes - risk is only applicable to the use on Christmas trees.	Yes [a]
Mammals	No	Yes[a]
Aquatic vascular plants	No	No
Aquatic non-vascular plants	No	No
Freshwater fish (surrogate for aquatic-phase amphibians)	No	Yes[b]
Freshwater Invertebrates	Yes – due to exposure to formulations [b]	Yes[b]
Freshwater Benthic Invertebrates	Yes – due to exposure to TGAI and des-iodo degradate [c]	Yes[b]
Estuarine/Marine Fish	No	Yes
Estuarine/Marine Crustaceans	Yes - presumed due to exposure to formulations	Yes
Estuarine/Marine Mollusks	Yes - presumed due to exposure to formulations	Yes

[a] Potential risk to non-target insects (Lepidoptera) and adult ladybird beetles due to ingestion of food items (aphids and pollen) containing flubendiamide residues

[b] Acute and chronic LOCs exceeded for daphnids exposed to the formulations

[c] Potential risk to benthic invertebrates exposed to the des-iodo degradate

1.3 Conclusions: Exposure Characterization

Environmental fate and transport data indicate that flubendiamide is stable to hydrolysis, aerobic and anaerobic soil metabolism, and aerobic aquatic metabolism. Photolysis and anaerobic aquatic metabolism appear to be the main routes of degradation for flubendiamide. Flubendiamide degrades to des-iodo under anaerobic aquatic conditions

($T_{½}$ = 364 days) and direct aqueous photolysis ($T_{½}$ = 11.58 day) and by soil photolysis ($T_{½}$ = 35.3 days). Volatilization from soil and water surfaces is not expected to be an important process since flubendiamide has a relatively low vapor pressure (7.5×10^{-7} mm Hg) and Henry's Law constant (8.9×10^{-11} atm·m^3/mol). Flubendiamide and des-iodo have potential to contaminate surface water through run-off due to their persistence in soil. Flubendiamide and des-iodo also have the potential for groundwater contamination in vulnerable soils with low organic carbon content, after very heavy rainfall, and/or the presence of shallow groundwater. Flubendiamide and its degradate's overall stability/persistence suggests that they will accumulate in soils, water column, and sediments with each successive application.

1.4 Conclusions: Effects Characterization

1.4.1 Aquatic Animals

Based on the available data, flubendiamide does not result in acute or chronic effects in freshwater or saltwater organisms at levels up to its water solubility limit. However, the degradate and the formulated products 480 SC and 24 WG do result in toxicity to aquatic freshwater invertebrates. Similarly, the des-iodo metabolite was also not toxic at its limit of solubility to *Daphnia magna.*

Formulated products are considerably more toxic (at least 37 times more toxic) to freshwater invertebrates than technical grade material, based on the available information. EC_{50} values of 1.5 µg a.i./L (24 WG formulation) and 2.6 µg a.i./L (480 SC formulation) have been reported indicating that these formulated products are very highly toxic to freshwater invertebrates. Acute testing with the freshwater benthic organism, midge (*Chironomus riparius*) indicates that the 480 SC formulation is moderately toxic with an LC_{50} value of 1650 µg a.i./L, and the 24 WG formulation is highly toxic with an LC_{50} value of 130 µg a.i./L.

In a freshwater invertebrate life cycle test with 480 SC formulation, parental mortality, sub-lethal effects, and an inhibition in time to first offspring emergence were observed. The NOAEC and LOAEC values were 0.38 and 1.18 µg a.i./L, respectively. In addition, available mesocosm data on the 480 SC formulation confirms the laboratory toxicity data for freshwater invertebrates. In the mesocosm study, *Daphnia longispina* was identified as the most sensitive species with a corresponding NOAEC value of 1.0 µg/L, based on significant reduction in population abundance.

Based on the available benthic sediment toxicity data demonstrating effects to percent emergence of *C. riparius*, the des-iodo degradate appears to be more toxic than the flubendiamide parent to benthic invertebrates, Based on pore water concentrations, a NOAEC of 1 µg/L was reported for the parent flubendiamide (see Section 4.1.1.5) and a NOAEC of 0.28 µg/L was reported for the des-iodo degradate in benthic midge species.

1.4.2. *Aquatic plant toxicity*

Flubendiamide is not toxic to aquatic vascular and non-vascular plants at the limit of its solubility.

1.4.3. Terrestrial Organisms

Avian Toxicity

Flubendiamide technical is practically non-toxic to birds on an acute oral and subacute dietary basis. In addition, the 480 SC formulation is practically non-toxic to birds on an acute oral basis. Reproductive effects were observed in the mallard duck (*Anas platyrhynchos*) at the 289 mg a.i./kg diet treatment level with a corresponding NOAEC value of 98 mg a.i./kg-diet. The effects included a 17% reduction in the number of viable embryos of eggs set and a 3% decrease in percentage of hatchling survivors relative to controls. For bobwhite quail (*Colinus virginianus*), no treatment-related effects were observed at the highest treatment level with a corresponding NOAEC value of 1059 mg a.i./kg-diet.

Mammalian toxicity

Three acute oral mammalian studies showed flubendiamide to be practically non-toxic. In addition, no reproductive effects were observed in the two-generation rat reproduction study.

Terrestrial Invertebrate toxicity

Flubendiamide technical and the 480 SC formulation are classified as practically non-toxic based on the acute contact honey bee study (LD_{50} > 200 µg/bee).
Acute and chronic earthworm toxicity studies show no toxic effects based on exposure to flubendiamide technical, the 480 SC formulation, and the des-iodo degradate. However, in the 24 WG formulation chronic test, a significant reduction in the number of juveniles produced was observed, resulting in a NOAEC of 562 mg a.i./kg-dw soil.

The formulated products of flubendiamide were tested via non-guideline supplemental studies with several natural predators of Lepidopterous insects including the parasitoid wasp (*Aphidius rhopalosiphi*), predatory mite (*Typhlodromas pyri*), and ladybird beetle (*Coccinella septempunctata*). In the parasitoid wasp test with 24 WG formulation, significant reductions in survival and reproduction were observed (NOAEC = 0.17 lb a.i./A). In the parasitoid wasp test with 480 SC formulation, reproduction was not inhibited; however, survival was affected (NOAEC values were <0.2 and 0.39 lb a.i./A; LD_{50} were 0.423 and 0.60 lb a.i./A; This study entailed two different NOAEC and LC_{50} values because the study conducted two different tests that evaluated toxic effects within two different ranges of toxicity). In the predatory mite test with the 24 WG formulation, significant reductions in survival and reproduction were observed (NOAEC = 0.31 lb a.i./A, LD_{50} > 0.55 lb a.i./A). Three extended laboratory experiments were conducted exposing the ladybird beetle to the 480 SC formulation. There were no significant adverse effects to ladybird beetles observed due to contact with residues; however, adult

survival was affected due to ingestion of food items (aphids and pollen) containing flubendiamide residues yielding LD_{50}, NOAEC, and LOAEC values of 0.089, 0.04, and 0.079 lb a.i./A, respectively. There were no effects to larval survival or reproduction.

Terrestrial Plant toxicity

In four Tier I studies assessing the effects of the 24 WG and 480 SC formulations on the seedling emergence and vegetative vigor of monocot and dicot terrestrial plant species, none of the species tested exhibited reductions of ≥25% in survival or dry weight, except the sunflower in which a 33% reduction in percent emergence was observed. In the Tier II seedling emergence study in which the sunflower was exposed to the 24 WG formulation, percent emergence was not inhibited by more than 5% at the highest treatment level (0.16 lbs a.i./A). Additionally, percent survival, dry weight, and plant height were not inhibited by more than 5% at any treatment level.

1.5 Uncertainties and Data Gaps

1.5.1. Uncertainties

The following uncertainties, limitations, and assumptions were identified in this environmental risk assessment:

- No toxicity data have been submitted that evaluated the effects of the formulated products on marine/estuarine organisms. Therefore, the potential for acute risk to estuarine/marine invertebrates cannot be precluded based on exposure to the formulated products of flubendiamide. However, submittal of a marine/estuarine acute toxicity invertebrate study testing the formulated products in accordance with the guideline requirements would reduce the uncertainty regarding potential toxicity of the formulations to marine/estuarine invertebrates.

- Two 28-day chronic toxicity studies indicate that flubendiamide and its des-iodo degradate are toxic to the midge, *Chironomus riparius*, in an overlying-water spiked system. Based on the RQs calculated from these studies' endpoints, there is a potential for direct effects to benthic invertebrates exposed to the parent and degradate. Neither of the two chronic toxicity midge studies followed sediment toxicity guidelines which require the sediment to be spiked as opposed to the overlying water. The mean measured pore water concentrations demonstrated in the study along with the available mesocosm data may provide sufficient evidence regarding the potential risk to benthic invertebrates. Thus, no new sediment toxicity data is requested at this time.

1.5.2 Data Gaps

- Data gaps in the environmental fate database for flubendiamide and des-iodo exist. The following studies are recommended in order to reduce uncertainties associated

with the exposure assessment and refinement of the ecological risk assessment for flubendiamide and des-iodo:

Flubendiamide

(Non-guideline) **Small-scale Runoff/Vegetative buffer strip Study** – EFED is currently awaiting the submission of the runoff study was which was requested in the most recent previously conducted flubendiamide assessment. The runoff study was requested to determine the magnitude of the parent, flubendiamide, retained in buffer strips of various widths. EFED believes that the efficacy of buffers for flubendiamide use is uncertain. It appears that a program of monitoring receiving waters and storm water conveyances under varying conditions of use would greatly benefit any evaluation of potential utility of buffers to reduce flubendiamide loadings to receiving waters.

Des-iodo Degradate

(161-1) **Hydrolysis** – The hydrolysis study is requested to establish the significance of chemical hydrolysis as a route of degradation for NNI-0001-des-iodo and to identify, if possible, the hydrolytic products formed which may adversely affect non-target organisms.

(161-2) **Photodegradation in Water** – Pesticides introduced into aqueous systems in the environment can undergo photolytic transformation by sunlight. Data on rates of photolysis are needed to establish the importance of this transformation process and the persistence characteristics of the photoproducts formed.

(162-3) **Anaerobic Aquatic Metabolism** – The anaerobic aquatic metabolism is needed to assess the effects, the nature, and extent of formation of NNI-0001-des-iodo residues in water and in hydrosoil since anaerobic conditions are more likely to exist in aquatic environments.

(162-4) **Aerobic Aquatic Metabolism** – The requested study is needed to determine the effects on NNI-0001-des-iodo to aerobic conditions in water and sediments during the period of dispersal of NNI-0001-des-iodo throughout the aquatic environment and to compare rates and formation of metabolites. The data from this study would provide the aerobic aquatic input parameter for PRZM/EXAMS reducing modeling uncertainty.

(164-1) **Terrestrial Field Dissipation Studies** – NNI-0001-des-iodo is persistent and moderately mobile which increases the likelihood for run-off and leaching. No definitive studies on the field dissipation and degradation properties of the major degradate have been submitted to the Agency.

2 PROBLEM FORMULATION

The purpose of this problem formulation is to provide the foundation for the ecological risk assessment being conducted for the insecticide, flubendiamide. As such, it articulates the purpose and objectives of the risk assessment, evaluates the nature of the problem, and provides a plan for analyzing the data and characterizing the risk (U.S. EPA 1998).

2.1 Nature of Regulatory Action

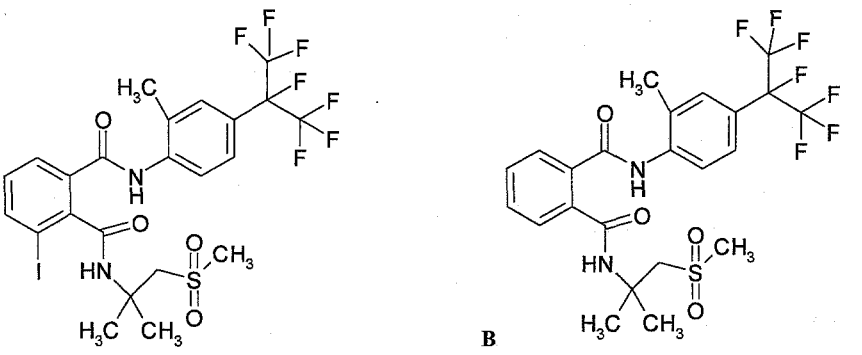
This regulatory action is for the proposed new use of flubendiamide on legume vegetables including soybeans, and Christmas trees. This screening-level ecological risk assessment assesses potential risks of these proposed uses to non-target organisms.

The maximum application rates for each proposed use are evaluated in this assessment. The maximum application rates for the proposed legume vegetables and Christmas tree uses are 2 applications of 0.94 lbs a.i./A at 5 day intervals and 2 applications of 0.156 lbs a.i./A at 7 day intervals, respectively. These maximum application rates are equivalent to the maximum rates for the previously assessed current registered uses.

2.1.1 Nature of the Chemical Stressor

Flubendiamide, a systemic insecticide, belongs to the phthalic acid diamide class of insecticides for control of both adult and larval Lepidoptera (including armyworms, corn borers, loopers, bollworms, cutworms, fruitworms, and diamondback moths). It acts by targeting the ryanodine cell receptor and interfering with the calcium release channel, which is involved in muscle contraction. It is active through ingestion and results in the rapid cessation of feeding and extended residual control. Moreover, flubendiamide as a systemic insecticide is quickly absorbed into plant tissue and can move up, but not down, in the plant (Bayer CropScience, 2006).

Environmental fate and transport data and reported physical-chemical properties indicate that flubendiamide is expected to be persistent in soil and aquatic environments (**Table 6**). Volatilization from soil and water surfaces is not expected to be an important process since flubendiamide has a relatively low vapor pressure (7.5×10^{-7} mm Hg) and Henry's Law constant (8.9×10^{-11} atm·m^3/mol). Physical and chemical properties of flubendiamide can be found in **Table 2.** Flubendiamide is stable under laboratory hydrolysis, aerobic metabolism, and aerobic and anaerobic soil metabolism conditions. Under field conditions, flubendiamide also degrades very slowly ($T_{½}$ = 210-770.2 days). However, flubendiamide degrades to des-iodo under laboratory aquatic and soil photolysis ($T_{½}$ = 11.59 to 35.3 days) as well as anaerobic aquatic conditions ($T_{½}$ = 364 days). **Figure 1** shows the molecular structure of flubendiamide, and its major degradate, NNI-0001-des-iodo (referred to as des-iodo hereafter).



a B

Figure 1. Chemical structure of flubendiamide (a) and its major metabolite NNI-0001-des-iodo (b).

Although des-iodo was only detected in minor amounts (<3.4% of the applied) at the 0-15 cm soil depth at three sites in the field, under anaerobic aquatic conditions in the laboratory, 60.4% of the applied (total system) was identified as des-iodo at study termination (365 days). Flubendiamide is expected to be slightly to non-mobile (K_{Foc}= 1076 to 3318 mL/g) in the environment, and its main transformation product, des-iodo, is expected to be moderately mobile (K_{Foc}= 234 to 581 mL/g). The octanol-water partition coefficients (log K_{ow}) of flubendiamide are 3.36 to 4.2 (4.1 at pH 7), which suggests it has some potential for bioaccumulation. However, available bioconcentration studies produced a bioconcentration factor of approximately 200 L/kg in fish, which suggests that bioconcentration is not a primary concern for this chemical. Flubendiamide and des-iodo have the potential to contaminate surface water through runoff due to their persistence in the soil. Flubendiamide may also reach surface water via spray drift. The overall stability of the compound suggests that flubendiamide will tend to accumulate in the soil and its degradate in sediments with successive applications year to year.

Table 2. Physical-chemical properties of flubendiamide

Parameter	Value	Reference
Chemical Name	3-Iodo-*N*'-(2-mesyl-1,1-dimethylethyl)-*N*-{4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]-*o*-tolyl}phthalamide (IUPAC) *N*^{2}-[1,1-dimethyl-2-(methylsulfonyl)ethyl]-3-iodo-*N*^{1}-[2-methyl-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]phenyl]-1,2-benzenedicarboxamide (CAS)	
Chemical Class	Insecticide	
CAS Number	272451-65-7	
Synonyms	NNI-0001; R-41576; K-1155; AMSI 0085; M22919; AS-96576	
PC Code	027602	
Empirical Formula	$C_{23}H_{22}F_7IN_2O_4S$	Product Chemistry
Molecular Weight	682.4 g/mole	Product Chemistry
Melting Point	217.5-220.7°C	Product Chemistry
Octanol-Water Partition Coefficient (log K_{ow}, 25°C)	3.4-4.2 at pH 4 through 9	MRID 46816915
Vapor pressure (20/25°C)	7.5×10^{-7} mm Hg	Product Chemistry
Water Solubility (pH 6, 20°C)	29.9 µg/L	Product Chemistry

Table 2. Physical-chemical properties of flubendiamide		
Parameter	**Value**	**Reference**
Henry's law constant (K_H)	8.9×10^{-11} atm·m^3/mole	MRID 96816915

Flubendiamide's major transformation product, NNI-0001-des-iodo, has the potential to contaminate groundwater. NNI-0001-des-iodo is persistent (stable in an aerobic soil environment), and is expected to be moderately mobile (K_{Foc} values were approximately 234 to 581 mL/g). **Table 3** summarizes the physical and chemical properties of NNI-0001-des-iodo.

Table 3. Physical-chemical properties of NNI-0001-des-iodo		
Parameter	**Value**	**Reference**
Molecular weight	556.50 g/mole	
Molecular formula	$C_{23}H_{23}F_7N_2O_4S$	
Water Solubility	<1 mg/L <1 mg/L 390 µg/L (method = Banerjee's hypothesis) 450 µg/L (method = Irmann's procedure) 310 µg/L (method = WSKOW v1.41) 11 µg/L (method = Fragments)	MRID # 46816911 MRID # 46816920 MRID # 46816933 MRID # 46816933 EPI Suite EPI Suite
Vapor Pressure/Volatility	1.59×10^{-14} mm Hg, 25 deg C	EPI Suite
Henry's Law Constant	9.18×10^{-14} atm m^3/mole	EPI Suite
Octanol-water partition coefficient (log K_{ow})	3.40 ± 0.01	MRID # 46816911
Log K_{oa}	14.936	EPI Suite
Freundlich K_{oc}	8.365, 3.514, 2.574, 1.379, and 6.400 in treated soils	MRID # 46816906
Aerobic Soil Metabolism $t_{½}$	[^{14}C]Des-iodo was relatively stable in the treated soils, decreasing by ≤2% in the sand, sandy loam and silt soils and by 6-8% in the loamy sand soil during 212 days of incubation. In all soils, the measured concentrations were variable over time. Reviewer-calculated first-order linear half-lives were >6 years and are of uncertain value since they are extrapolated well beyond the duration of the study and assume that the pattern of degradation remains linear, and because the r^2 values are very low.	MRID # 46816911
Anaerobic Aquatic Metabolism	Desiodo-NNI-0001 was detected at maximums (individual samples) of 22.6%, 37.8% and 60.4% of the applied in the water, sediment and total system, respectively, at 365 days. 360 days	MRID # 46816914 EPI Suite
Pka	No dissociation between pH 2-11	MRID # 46816911
Stability of compound at room temperature, if provided	Stable in stock solution	MRID # 46816911

2.1.2 Overview of Pesticide Usage

Flubendiamide (trade name Belt®) is a broad-spectrum lepidopterous insecticide currently registered for use on corn, cotton, tobacco, pome fruit, stone fruit, tree nuts,

grape, cucurbit vegetables, fruiting vegetables, leafy vegetables, and brassica (cole) and leafy vegetables. This ecological risk assessment is evaluating the proposed use of flubendiamide on legume vegetables including soybeans and Christmas trees. The proposed maximum application rates for this assessment are equivalent to the maximum rates for the previously assessed uses.

2.2 Receptors

2.2.1 Aquatic and Terrestrial Effects

The receptor is the biological entity that is exposed to the stressor (U.S. EPA 1998). Consistent with the process described in the Overview Document (U.S. EPA 2004), this risk assessment uses a surrogate species approach in its evaluation of flubendiamide. Toxicological data generated from surrogate test species, which are intended to be representative of broad taxonomic groups, are used to extrapolate to potential effects on a variety of species (receptors) included under these taxonomic groupings.

Acute and chronic toxicity data from studies submitted by pesticide registrants along with the available open literature are used to evaluate the potential direct effects of flubendiamide to the aquatic and terrestrial receptors identified in this section. This includes toxicity data on the technical grade active ingredient, degradates, and when available, formulated products (*e.g.* "Six-Pack" studies). The open literature studies are identified through U.S. EPA's ECOTOX database (http://cfpub.epa.gov/ecotox/), which employs a literature search engine for locating chemical toxicity data for aquatic life, terrestrial plants, and wildlife. The evaluation of both sources of data can also provide insight into the direct and indirect effects of flubendiamide on biotic communities from loss of species that are sensitive to the chemical and from changes in structure and functional characteristics of the affected communities.

2.2.2 Ecosystems Potentially at Risk

The ecosystems at risk are often extensive in scope, and as a result it may not be possible to identify specific ecosystems during the development of a baseline risk assessment. However, in general terms, terrestrial ecosystems potentially at risk could include the treated field and areas immediately adjacent to the treated field that may receive drift or runoff. Areas adjacent to the treated field could include cultivated fields, fencerows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats and other uncultivated areas. Aquatic ecosystems potentially at risk include water bodies adjacent to, or downstream from, the treated field and might include lakes and impounded bodies of water such as ponds and reservoirs, or flowing waterways such as streams and rivers. For uses in coastal areas, aquatic habitat also includes marine ecosystems, including estuaries.

2.2.3 Assessment Endpoints

Assessment endpoints are intended to be representative estimates of biological entities to be protected, and their attributes that might be affected by exposure to the pesticide stressor. The typical assessment endpoints for screening-level pesticide ecological risks are reduced survival, and reproductive and growth impairment for both aquatic and terrestrial animal species. Aquatic animal species of potential concern include freshwater fish and invertebrates, estuarine/marine fish and invertebrates, and amphibians. Terrestrial animal species of potential concern include birds, mammals, and beneficial insects. For both aquatic and terrestrial animal species, direct acute and direct chronic exposures are considered. In order to protect threatened and endangered species, all assessment endpoints are measured at the individual level. Although endpoints are measured at the individual level, they provide insight about risks at higher levels of biological organization (*e.g.*, populations and communities). For example, pesticide effects on individual survivorship have important implications for both population rates of increase and habitat carrying capacity.

Each assessment endpoint requires one or more "measures of ecological effect," which are defined as changes in the attributes of an assessment endpoint itself or changes in a surrogate entity or attribute in response to exposure to a pesticide. Ecological measurement endpoints for this risk assessment are based on a suite of registrant-submitted toxicity studies performed on a limited number of organisms in the following broad groupings:

1. Birds (mallard duck and bobwhite quail), also used as a surrogate for terrestrial-phase amphibians and reptiles,
2. Mammals (laboratory rat and mouse),
3. Freshwater fish (rainbow trout), also used as a surrogate for aquatic-phase amphibians,
4. Freshwater invertebrates (daphnid, chironomid),
5. Estuarine/marine fish (sheepshead minnow),
6. Estuarine/marine invertebrates (Eastern oyster),
7. Terrestrial plants (monocots and dicots),
8. Aquatic plants (freshwater vascular plants, freshwater and estuarine/marine non-vascular plants),
9. Terrestrial invertebrates (earthworm, honeybee, natural lepidopteran predators)

Within each of these very broad taxonomic groups, an acute and chronic endpoint is selected from the available test data, as the data sets allow. Additional ecological effects data were available for other taxa and have been incorporated into the risk characterization as other lines of evidence, including terrestrial invertebrates for natural lepidopteran predators.

2.3 Conceptual Model

For a pesticide to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a pesticide moves in the environment from a source to an ecological receptor. For an

ecological pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure.

A conceptual model provides a written description and visual representation of the predicted relationships between flubendiamide, potential routes of exposure, and the predicted effects for the assessment endpoint. A conceptual model consists of two major components: risk hypotheses and a conceptual diagram (U.S. EPA 1998).

2.3.1 Risk Hypotheses

- Terrestrial and aquatic organisms are subject to adverse direct effects such as reduced survival, growth, and reproduction when exposed to flubendiamide/degradate residues as a result of labeled use of the pesticide.
- Non-target terrestrial, semi-aquatic, and aquatic plants are subject to adverse effects such as reductions in vegetative vigor and seedling emergence (terrestrial) or biomass and growth rate (aquatic) when exposed to flubendiamide/degradate residues as a result of labeled use of the pesticide
- Indirect effects, such as food web dynamics, perturbing forage or prey availability, and altering the extent and nature of nesting, will potentially occur if residue concentrations exceed levels of concern for acute or chronic exposure for terrestrial and/or aquatic species.
- Listed species are subject to adverse effects if calculated risk quotients exceed acute listed species or chronic levels of concern.

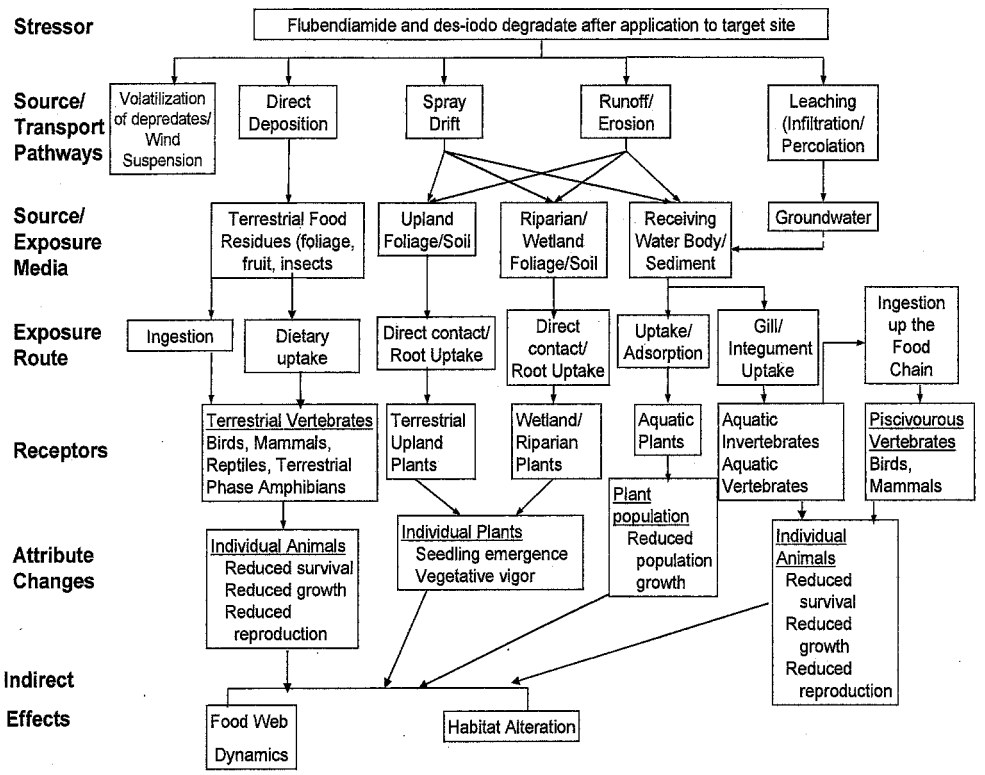
2.3.2 Conceptual Diagram

In order for a chemical to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a contaminant moves in the environment from a source to an ecological receptor. For an ecological exposure pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure. In addition, the potential mechanisms of transformation (*i.e.*, which degradates may form in the environment, in which media, and how much) must be known, especially for a chemical whose metabolites/degradates are of greater toxicological concern. The assessment of ecological exposure pathways, therefore, includes an examination of the source and potential migration pathways for constituents, and the determination of potential exposure routes (*e.g.*, ingestion, inhalation, and dermal absorption).

Based on the labels submitted by the registrant, the source and mechanisms of release for flubendiamide are aerial and/or ground application in the form of suspension concentrate formulation and chemigation in the form of water dispersible granule formulation. The conceptual model and subsequent analysis of exposure and effects are all based on the

parent flubendiamide and des-iodo degradate. Potential emission of volatile compounds is not considered as a viable release mechanism for flubendiamide, because vapor pressure information (7.5×10^{-7} mm Hg at 20°C) suggests that volatilization is not expected to be a significant route of dissipation for this chemical (indicated by dashed lines in the diagram). The conceptual model shown in **Figure 2** generically depicts the potential source of flubendiamide, release mechanisms, abiotic receiving media, and biological receptor types.

Figure 2. Conceptal Model for Flubendiamide' proposed uses



2.4 Analysis Plan

2.4.1 Conclusions from Previous Risk Assessments

The last flubendiamide ecological risk assessment conducted was a Section 3 assessment of flubendiamide's uses on corn, cotton, tobacco, pome fruit, stone fruit, tree nuts, grape, cucurbit vegetables, fruiting vegetables, leafy vegetables, and brassica (cole) and leafy vegetables (DP Barcodes: 329594, 329613, 329606, and 329599; Dated June, 2008). The maximum use rates in this previous risk assessment are equivalent to the rates evaluated in this current assessment. This assessment identified potential risks to benthic invertebrates exposed to flubendiamide and its des-iodo degradates and to sensitive terrestrial invertebrates.

The conclusions demonstrated that there were no significant risks posed to other taxonomic groups including freshwater and marine fish, marine crustaceans, marine mollusks, terrestrial and aquatic plants, or mammals.

2.4.2 Measures of Effect and Exposure

All exposure modeling and resulting risk conclusions are based on the application methods and maximum application rates on product labels. Measures of exposure are based on aquatic and terrestrial models that predict estimated environmental concentrations (EECs) of flubendiamide. The models used to predict aquatic EECs for parent flubendiamide and des-iodo degradate are the Pesticide Root Zone Model coupled with the Exposure Analysis Model System (PRZM/EXAMS). The model used to predict terrestrial EECs on food items is T-REX. These models are parameterized using relevant reviewed environmental fate data from registrant submissions and the literature; model input values will be consistent with the most recent version of the input parameter.

Potential exposures to terrestrial plants were not evaluated because available data suggest that effects are not expected to occur at up to the maximum labeled application rate.

Table 4 lists the measures of environmental exposure and ecological effects used to assess the potential risks of flubendiamide to non-target organisms (U.S. EPA 2004).

Table 4. Measures of environmental exposure and ecological effects used to assess the potential risks of flubendiamide to non-target organisms

Assessment Endpoint	Measures of Effect	Measures of Exposure
1. Abundance (*i.e.*, survival, reproduction, and growth) of individuals and populations of birds	1a. Bobwhite quail acute oral LD_{50} 1b. Bobwhite quail/ mallard duck sub-acute dietary LC_{50} 1c. Bobwhite quail/ mallard duck chronic reproduction NOAEC and LOAEC	Maximum residues on food items (foliar)
Abundance (*i.e.*, survival, reproduction, and growth) of individuals and populations of mammals	Laboratory rat acute oral LD_{50} Laboratory rat 1-generation NOAEC and LOAEC	
Survival and reproduction of individuals and communities of freshwater fish	Rainbow trout, common carp, bluegill sunfish, fathead minnow LC_{50}	Peak EEC[1]
	Fathead minnow early-life NOAEC and LOAEC	60-day average EEC[1]
Survival and reproduction of individuals and communities of freshwater invertebrates	Daphnid EC_{50} Chironomid LC_{50}	Peak EEC[1]
	Daphnid life cycle NOAEC and LOAEC	21-day average EEC[1]
Survival of individuals and communities of estuarine/marine fish and invertebrates	Sheepshead minnow acute LC_{50} Eastern oyster EC_{50} Mysid shrimp LC_{50}	Peak EEC[1]
	Mysid shrimp NOAEC and LOAEC	21-day average EEC[1]
Survival of beneficial insect populations and natural Lepidoptera predators	5a. Honeybee, bumblebee acute contact LD_{50} 5b. Earthworm EC_{25} 5c. Parasitoid Wasp LD_{50} 5d. Predatory Mite LD_{50} 5e. Ladybird Beetle LD_{50} 5f. White springtail soil arthropod LD_{50} 5g. Green lacewing LD_{50}	Single Maximum application rate
6. Maintenance and growth of individuals and populations of terrestrial plants from standing crop or biomass	6a. Monocot EC_{25} values for seedling emergence and vegetative vigor (survival and growth rate) 6b. Dicot EC_{25} values for seedling emergence and vegetative vigor (survival and growth rate)	Estimates of runoff and spray drift to non-target areas

Table 4. Measures of environmental exposure and ecological effects used to assess the potential risks of flubendiamide to non-target organisms		
Assessment Endpoint	**Measures of Effect**	**Measures of Exposure**
7. Maintenance and growth of individuals and populations of aquatic plants from standing crop or biomass	6a. Vascular plant (*i.e.*, Lemna) EC_{50} values for growth rate and biomass measurements 6b. Non-vascular plant (*i.e.*, green algae) EC_{50} values for growth rate and biomass measurements	Peak EEC[1]

[1] One in 10-year return frequency.

3 ANALYSIS

3.1 Use Characterization

Flubendiamide, trade name Belt©, is a broad spectrum lepidopterous insecticide that is proposed for new use on legume vegetable crops including soybeans and Christmas trees orchards in the United States.

Table 5 provides the proposed maximum use rates and management practices for flubendiamide for each crop based on the proposed labels. These rates are equivalent to the current registered uses.

Table 5. Application rate information for proposed new flubendiamide Uses Based on BELT™ SC Labels (This information applies to both ground and aerial applications).				
Crops	**Max. Application Rate (lbs ai/A)**	**Max. # of Applications**	**Recommended Interval Between Apps. (days)**	**Max. Seasonal Use Rate (lbs a.i.)**
Legume vegetables except Soybean: Crops of Crop groups 6 and 7 including Edible-podded and Succulent Shelled Pea and bean, Dried Shelled Pea and Bean and Foliage of Legume Vegetables	0.094	2	5	0.188
Soybean	0.094	2	5	0.188
Christmas Tree	0.156	2	7	0.312

3.2 Exposure Characterization

3.2.1 Environmental Fate and Transport Characterization

Based on the submitted environmental fate data and reported physical-chemical properties, flubendiamide is expected to be persistent in the environment **(Table 7).** Volatilization from soil and water surfaces is not expected to be an important dissipation route since flubendiamide has a relatively low vapor pressure (7.5×10^{-7} mm Hg) and Henry's Law constant (8.9×10^{-11} atm·m^3/mol).

3.2.1.1 Degradation

Flubendiamide is stable to hydrolysis, aquatic aerobic metabolism, and aerobic and anaerobic soil metabolism under laboratory conditions. Flubendiamide degrades to des-iodo under laboratory soil photolysis ($T_{½}$ = 35.3 days) study. In laboratory aerobic soil studies, using four soils ranging from loamy sand to silt, flubendiamide was stable with <5% of the applied dissipating at 371 days post treatment. In field experiments, flubendiamide half-lives in three soils ranging from loamy sand to silt loam were 210-770.2 days, and in a sandy loam soil under outdoor conditions the half-life was 322 days.

Flubendiamide degrades by direct aqueous photolysis ($T_{½}$ = 11.56 day) and soil photolysis ($T_{½}$ = 35.3 days). Flubendiamide is stable to hydrolysis at pH's 4, 5, 7, and 9. In aerobic and anaerobic aqueous environments, flubendiamide is expected to dissipate somewhat faster than in aerobic soil, likely as a result of metabolism. Laboratory experiments using anaerobic and aerobic aquatic systems resulted in flubendiamide half-lives (water plus soil/sediment) of 127-364 days and 32.8-533.2 days, respectively. Under anaerobic aquatic conditions, 60.4% of applied radioactivity was identified as des-iodo (in the total system) at the time of study termination (365 days). **Table 6** summarizes the environmental fate and transport properties of flubendiamide.

Table 6. Environmental fate and transport properties of flubendiamide

Parameter	Value	Reference
Chemical Name	3-Iodo-*N'*-(2-mesyl-1,1-dimethylethyl)-*N*-{4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]-*o*-tolyl}phthalamide (IUPAC) N^2-[1,1-dimethyl-2-(methylsulfonyl)ethyl]-3-iodo-N^1-[2-methyl-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]phenyl]-1,2-benzenedicarboxamide (CAS)	
CAS Number	272451-65-7	
Synonyms	NNI-0001; R-41576; K-1155; AMSI 0085; M22919; AS-96576	
PC Code	027602	
Empirical Formula	$C_{23}H_{22}F_7IN_2O_4S$	Product Chemistry
Molecular Weight	682.4 g/mole	Product Chemistry
Appearance	Crystalline powder	Product Chemistry
Color	White	Product Chemistry
Melting Point	217.5-220.7°C	Product Chemistry
Octanol-Water Partition Coefficient (log K_{ow}, 25°C)	4.1 at pH 7	MRID 46816915
Vapor pressure (20/25°C)	7.5×10^{-7} mm Hg	Product Chemistry
Water Solubility (pH 6, 20°C)	0.04 mg/L	Product Chemistry
Henry's law constant (K_H)	8.9×10^{-11} atm·m^3/mole	MRID 96816915
Hydrolysis half-life (25°C)	Stable at pH 4,5,7 and 9	MRID 46816907
Aqueous photolysis half-life	11.58 days	MRID 46816908
Soil photolysis half-life (20°C, 75% of 1/3 bar)	35.3 days	MRID 46816909
Aerobic soil metabolism half-life (20°C, 75% of 1/3 bar)	Stable	MRID 46816910

Table 6. Environmental fate and transport properties of flubendiamide		
Parameter	**Value**	**Reference**
Anaerobic soil metabolism half-life (20°C, 75% of 1/3 bar)	Stable (total system)	MRID 46816912
Aerobic aquatic metabolism half-life (20°C)	Stable	MRID 46816913
Anaerobic aquatic half-life	$t_{1/2}$ = 364 days (in sediment)	MRID 46816914
Freundlich adsorption coefficient (K_F)	18.3 (German silt) 23.5 (German sandy loam) 30.0 (Kansas silty clay) 17.3 (Washington loamy sand) 24.8 (Canadian loam)	MRID 46816905
Freundlich coefficient normalized to organic carbon content (K_{Foc})	1076 (Canadian loam) 1172 (German silt) 1596 (German sandy loam) 2609 (Kansas silty clay) 3318 (Washington loamy sand)	MRID 46816905
Terrestrial field dissipation half-life (flowable suspension concentrate, 4.8% ai)	$t_{1/2}$ = 770.2 days; California sandy loam; detected below a depth of 30 cm at only one sampling event (3DAT, 30-45 cm). $t_{1/2}$ = 693.1 days; Mississippi silt loam; detected below a depth of 30 cm at three sampling events (547 DAT, 30-45 cm; 265, 547 DAT, 45-60 cm). $t_{1/2}$ = 210 days; Washington loamy sand; detected below a depth of 30 cm at only two sampling events (62DAT, 30-45 cm; 3DAT, 45-60 cm).	MRID 46816915

3.2.1.2 Degradates

The major transformation products (formed in amounts greater than or equal to 10% of applied radioactivity) resulting from the degradation of flubendiamide are: des-iodo (due to soil photolysis and anaerobic aquatic metabolism) and NNI-0001-oxalinic acid (soil photolysis). Flubendiamide degrades mainly to NNI-0001-des-iodo (**Table 7**), which is formed in large amounts (total system basis maximums of 17.6% and 12.8% in soil photolysis and aqueous photolysis, respectively, and 60.4% in anaerobic aquatic metabolism). Des-iodo further degrades to NNI-0001-oxalinic acid (maximum of 10.8% of applied), CO_2 and bound soil residues in the soil photolysis study.

Table 7. Physical-chemical properties of NNI-0001-des-iodo:		
Parameter	**Value**	**Reference**
Molecular weight	556.50 g/mole	
Molecular formula	$C_{23}H_{23}F_7N_2O_4S$	
Water Solubility	<1 mg/L <1 mg/L	MRID # 46816911 MRID # 46816920
Vapor Pressure/Volatility	1.59E-014 mm Hg, 25 deg C	EPI Suite
Henry's Law Constant	9.18E-014 atm m^3/mole	EPI Suite
Octanol-water partition coefficient (log K_{ow})	3.40 ± 0.01	MRID # 46816911
Log Koa	14.936	EPI Suite
Freundlich K_{oc}	8.365, 3.514, 2.574, 1.379, and 6.400 in treated soils	MRID # 46816906
Aerobic Soil Metabolism $t_{½}$	[^{14}C]Des-iodo was relatively stable in the treated soils, decreasing by ≤2% in the sand, sandy loam and silt soils and by 6-8% in the loamy sand soil during 212 days of incubation. In all soils, the measured concentrations were variable over time. Reviewer-calculated first-order linear half-lives were >6 years and are of uncertain value since they are extrapolated well beyond the duration of the study and assume that the pattern of degradation remains linear, and because the r^2 values are very low.	MRID # 46816911
Anaerobic Aquatic Metabolism	Desiodo-NNI-0001 was detected at maximums (individual samples) of 22.6%, 37.8% and 60.4% of the applied in the water, sediment and total system, respectively, at 365 days. 360 days	MRID # 46816914 EPI Suite
Pka	No dissociation between pH 2-11	MRID # 46816911
Stability of compound at room temperature, if provided	Stable in stock solution	MRID # 46816911

Flubendiamide degrades to des-iodo by removal of the iodide on the phthalic acid ring. Theoretically, des-iodo can further degrade to des-iodo-alkylphthalimide by loss of the aniline ring. Des-iodo can also degrade to des-iodo-des-mesyl-carboxy and ultimately to trace metabolites, CO_2 and nonextractable residues. Flubendiamide can also degrade to NNI-0001-benzyl alcohol (a postulated intermediate), which is further degraded to NNI-0001-benzoic acid as the aniline methyl ortho-substituent is oxidized. Finally, flubendiamide can degrade to NNI-0001-3-OH with the replacement of the iodine atom with a hydroxyl substituent. Theoretically, flubendiamide is ultimately degraded to polar compounds.

3.2.1.3 Mobility and Transport

Flubendiamide is expected to be slightly to hardly mobile (K_{FOC} = 1076 to 3318 L/Kg) according to FAO classification (FAO 2000) in the environment, and its major transformation product, des-iodo, is expected to be moderately mobile (K_{FOC} = 234 to 581 L/kg). Since the exponents of the Freundlich isotherm (1/N) range from 0.9 to 1.1, the estimated K_Fs are assumed to be equal to K_Ds. The desorption K_Ds values ranged from 43.3 to 68.4 and the desorption K_{FOC} values ranged from 2061 to 13154. The main transformation product, des-iodo is more mobile than the parent. However, des-iodo was only detected in a small quantity (<3.4% of the applied) at the 0-15 cm soil depth at three sites in the terrestrial field studies.

Flubendiamide will enter surface water through spray drift when applied using a ground spray or aerial spray, through dissolution into runoff water, and through runoff of sediment bound residues (erosion) from agricultural fields. Des-iodo will also reach surface water in runoff. Although flubendiamide is not very mobile, and des-iodo is only moderately mobile, they are both persistent in the soil and flubendiamide has been detected below 30 cm at three sites in the terrestrial field studies. This indicates flubendiamide and des-iodo may reach ground water, particularly in vulnerable soils with lower organic carbon content. Concentrations of flubendiamide in ground water are anticipated to be higher in areas with high water tables (because there is less depth to travel before reaching ground water) and during times when heavy rainfall occurs, especially soon after application. Thus, the following ground water advisory language is recommended for the label of the proposed flubendiamide uses.

Recommended Ground Water Advisory

This chemical has properties and characteristics associated with chemicals detected in ground water. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow.

3.2.1.4 Field Studies

Dissipation of flubendiamide in soil, predicted from laboratory studies, appear to be consistent with the three terrestrial field dissipation studies (MRIDs 46816915, 46816916, and 46816917). These studies were conducted at three sites in the United States. The field data show that flubendiamide was persistent in the soil, dissipating from the top soil layer with half-lives of 210 to 770.2 days, and leaching to a depth of 30 to 60 cm. There were no significant degradates, however, des-iodo, NNI-0001-3-OH and NNI-0001-benzoic acid were detected in minor amounts in the top 0-15 cm soil depths. A non-guideline soil under outdoor conditions study (MRID 46816922) also indicated flubendiamide was persistent in the soil, dissipating with a half-life of 322 days. There were no significant degradates, however, des-iodo, NNI-0001-3-OH, NNI-0001-benzyl-alcohol, and NNI-0001-benzoic acid were detected in minor amounts.

The terrestrial field studies did not document to where and in what form flubendiamide residues dissipate. Based on laboratory experiments, flubendiamide residues are likely to degrade further to polar compounds, bind to soil particles and possibly be incorporated by soil microorganisms. Prior to binding, solubilized residues and polar compounds may move off site over the soil surface through runoff, downward through soil through leaching, or laterally with soil through subsurface flow. The small amounts of bound flubendiamide residues may dissipate through erosion or movement of wind-borne soil particles may occur. It is highly unlikely that volatilization is significant. With the exception of leaching, none of these dissipation routes were observed because run-off of bound or unbound residues, volatilization, and wind transport were not measured.

3.2.1.5 Bioaccumulation

Flubendiamide has a potential for bioaccumulation in fish because it is stable to hydrolysis and has a relatively high log K_{ow} (4.1 at pH 7). However, in general, chemicals are a concern for bioaccumulation when the BCF $\geq$ 1000 and log $K_{ow} \geq$ 4.5 - 5.0. Flubendiamide residues in bluegill sunfish in the high dose study had a maximum mean fish bioconcentration factors (BCF) of 109.9X, 57.0X, and 206.3X for edible, non-edible, and whole fish tissue, respectively. After a 14-day depuration period, flubendiamide residues in the whole fish declined by a mean of 83% (low dose) and 86% (high dose). The residues depurated with a half-life of 4.6 and 4.8 days, from the low and high dose studies.

The des-iodo degradate is also not of concern for bioaccumulation in that its calculated mean BCF values based on total radioactive residues are 12.6, 20.4, and 7.7 for whole fish, viscera, and edible tissues, respectively.

The estimated log octanol-air partition coefficient (Log K_{OA}) of 15 (EPIsuite, v.3.20) suggests that bioaccumulation in air breathing organisms is possible (Kelly *et al.* 2007); however, bioaccumulation may be limited by metabolism and other degradates that are not of toxicological concern. Potential bioaccumulation in air breathing organisms may be further considered in future risk assessments.

3.2.2 Measures of Aquatic Exposure

The available aquatic toxicity data for this assessment includes pelagic and benthic toxicity studies testing the TGAI, the formulated products, and the des-iodo degradates. Thus, aquatic EECs were calculated for: 1) aquatic exposure in the water column for the flubendiamide, the parent compound, 2) benthic pore water for the parent compound, 3) surface water concentrations of formulations based on drift only, and 4) surface water and benthic pore water concentrations for the des-iodo degradate. Potential exposures to formulated products were estimated only from drift deposition because it was assumed that other products within the formulation dissipated at different rates such that the composition of the formulated product that reaches the water from runoff would be considerably different than the initial formulated product.

3.2.2.1 Modeling Estimates

The estimated environmental concentrations in surface water were derived from Tier II PRZM (Pesticide Root Zone Model; Version 3.12.2, May 12, 2005) and EXAMS (Exposure Analysis Modeling System; Version 2.98.04.06, Apr. 25, 2005). PRZM simulated pesticide transport as a result of runoff, erosion, and off-target spray drift from an agricultural field. EXAMS estimates environmental fate and transport of pesticides in surface water. Additionally, a graphical interface shell, PE5.pl (dated 7/27/2007), was employed to facilitate an input of use-specific information in the PRZM input (**Table 8**) and the EXAMS chemical files.

Table 8. PRZM/EXAMS input parameters for proposed flubendiamide uses

Parameter	Input Value and Unit	Comment	Source
Chemical Application Method (CAM)	2	Foliar Application	Guidance
Hydrolysis ($t_{1/2}$)	0	Stable	MRID 46816907
Spray drift and application efficiency*	Aerial: 0.05 Ground: 0.01	Efficiency – Aerial: 0.95 Ground: 0.99	Guidance
Aerobic soil metabolism ($t_{1/2}$)	0	Stable	MRID 46816910
Aerobic aquatic metabolism ($t_{1/2}$)	0	Stable	MRID 46816913
Anaerobic aquatic metabolism ($t_{1/2}$)	1092 days	364 days × 3[a]	MRID 46816914
Aquatic photolysis ($t_{1/2}$)	11.58 days	5.79 × 2[b]	MRID 46816909
Henry's Law constant (20 C)	8.9×10^{-11} atm·m^3/mole		MRID 96816915
Vapor pressure	7.5×10^{-7} mm Hg		Product Chemistry
Solubility in water (pH 7, 20 C)	0.03 mg/L		
Molecular weight	682.4 g/mole		
Partition coefficient K_{FOC}	1954.2 mg/L	Average of 5 Soils	MRID 46816905
Foliar Extraction Rate (FEXTRC)	0.5	Default Value	Guidance

* There is a 15-ft vegetative filter strip language on the label. However, it has not been considered as part of this assessment. Vegetative filter strips may reduce loading from runoff; however, the magnitude of potential reductions in runoff resulting from the presence of a vegetative filter strip is expected to be highly variable and cannot be quantified. Using AgDRIFT to quantify spray drift deposition from a 15-foot buffer would result in higher spray drift deposition than EFED's default values that were used in the modeling.

[a] Selected input parameters were multiplied by 3 according to Guidance for selecting input parameters in modeling for environmental fate and transport of pesticides. Version II. November 2009.

[b] Multiplied by 2 to model day/night cycle from continuous light study results.

Linked crop-specific scenarios and meteorological data were used to estimate exposure as a result of flubendiamide uses on various crops. Simulations were done using the standard farm pond scenario in EXAMS, which is a surrogate for a permanent surface water aquatic environment. Weather and agricultural practices were simulated over 30 years to estimate the 1-in-10 year exceedance probability at the site.

The application rate used in each scenario is the recommended maximum label application rate for each use. Application dates were chosen to fall between typical emergence date and maturation date. The standard scenarios were developed by EFED to

represent nationwide crop coverage and high-end vulnerability sites to runoff and erosion and, therefore, pesticide transport. The crop/region specificity of the scenarios may require that several regional scenarios be run for a given crop depending on the need to capture the most conservative set of results due to regional differences in precipitation and soil characteristics. Twelve EFED standard modeling scenarios are used for this modeling purpose. The application information for these modeling scenarios is provided in **Table 9.**

Table 9. Standard EFED modeling scenarios for proposed flubendiamide new uses

PRZM Crop Scenario	First Application Date dd-mm	Max Number of Applications	Minimum Application Interval (days)	Maximum Single Application Rate (lb ai/A)
Soybean (2 applications @ 0.094 lb ai/A with 5 days interval)				
Mississippi Soybeans	01-06	2	5	0.094
Legume vegetables except soybean. Crops of Crop Groups 6 and 7				
Illinois Beans	01-07	2	5	0.094
Michigan Beans	01-07	2	5	0.094
Oregon Snap Beans	01-07	2	5	0.094
Washington Beans	01-07	2	5	0.094
Christmas Tree (2 applications @ 0.156 lb ai/A with 7 days interval)				
Oregon Christmas Trees	01-05	2	7	0.156

Flubendiamide Parent Exposure

PRZM/EXAMS models were used to estimate flubendiamide parent concentrations in both the water column and benthic pore water. Water column EECs are used for comparison with toxicity endpoints for fish and invertebrates that live in the water column and are considered to be exposed to the active ingredient through spray drift, runoff, and erosion as to all components of the formulations (active ingredients and inerts) through spray drift alone. Benthic pore water EECs are used for comparison with toxicity endpoints for benthic invertebrates that live in or on the sediment.

The PRZM/EXAMS EECs for water column exposure to the active ingredient through spray drift, runoff, and erosion for all scenarios are presented in **Table 10.** For surface water EECs, the Illinois Beans scenario with aerial applications has the highest EEC values of 11.89 µg/L, 11.66 µg/L and 11.43 µg/L, respectively for 1 in 10 year annual peak concentration, 1 in 10 year 21-day mean concentration, and 1 in 10 year 60-day mean concentration. The Illinois Beans scenario with ground applications has the second highest EECs. The lowest EECs are for Washington Beans scenario with ground applications. The EECs for the modeled PRZM/EXAMS scenarios are located in **Appendix B**. Peak EEC values were used to determine acute risks to organisms associated with the water column. The 21-day average EEC values were used to determine chronic risks to aquatic invertebrates. The 60-day average EEC values were used to determine chronic risks to aquatic fish.

Table 10. Estimated Environmental Concentrations of Flubendiamide in Surface Water (µg/L)

PRZM Crop Scenario	1 in 10 year peak concentration	1 in 10 year 21-day mean concentration	1 in 10 year 60-day mean concentration
Soybean			
Mississippi Soybeans: aerial	7.45	7.04	6.60
Mississippi Soybeans: ground	6.87	6.46	6.11
Legume vegetables except soybean. Crops of Crop Groups 6 and 7			
Illinois Beans: aerial	**11.89**	**11.66**	**11.43**
Illinois Beans: ground	11.23	11.01	10.87
Michigan Beans: aerial	9.30	9.06	8.85
Michigan Beans: ground	8.43	8.20	7.99
Oregon Snap Beans: aerial	10.69	10.54	10.30
Oregon Snap Beans: ground	9.96	9.82	9.59
Washington Beans: aerial	2.80	2.66	2.50
Washington Beans: ground	1.60	1.49	1.39
Christmas Tree			
Oregon Christmas Trees: aerial	4.39	4.17	4.01
Oregon Christmas Trees: ground	2.22	2.16	2.06

Acute and chronic toxicity data indicate that the flubendiamide formulations are more toxic to freshwater invertebrates tested than the technical grade flubendiamide. Formulations may contain inert substances that help to keep the active ingredient in suspension, or keep the active ingredient stable, *etc.* For example, emulsifiers, which keep chemicals of low solubility in suspension may also be disruptive to biological membranes and therefore exhibit toxicity.

To assess the risk of the formulations, it is assumed that the inert ingredient(s) dissipate at different rates than the active ingredient such that the proportions of the formulation will be dramatically different compared to the formulation that is initially released. According to EFED policy, the spray drift fraction that falls on the standard PRZM/EXAMS pond is assumed to be 5% of the application rate for aerial applications and 1% for ground. The following equation was used to calculate EECs for comparison with the formulation toxicity endpoints (**Table 11**):

$$EEC = \frac{AppRate(\text{lbs./A}) \times 1.12 \frac{\text{kg/ha}}{\text{lbs./A}} \times SDFraction \times 10^9 \,\mu\text{g/kg}}{2 \times 10^7 \,\text{L/ha of Pond}}$$

Table 11. Estimated water column concentrations of flubendiamide formulations due to spray drift alone (no runoff or erosion contributions) after aerial and ground application

	Legume vegetables	Soybean	Christmas Tree
Application Rate	**0.094 lbs. ai/A**	**0.094 lbs. ai/A**	**0.156 lbs. ai/A**
Aerial	0.263 µg/L	0.263 µg/L	0.437 µg/L
Ground	0.053 µg/L	0.053 µg/L	0.087 µg/L

The PRZM/EXAMS benthic pore water EECs are presented in **Table 12**. For benthic pore water EECs, the Illinois Beans scenario with aerial applications has the highest EEC values of 10.98 µg/L, 10.97 µg/L and 10.96 µg/L, respectively for 1 in 10 year annual peak concentration, 1 in 10 year 21-day mean concentration, and 1 in 10 year 60-day mean concentration. The Illinois Beans with ground applications has the second highest EECs. The lowest EECs are for Washington Beans with ground applications.

Table 12. Estimated Environmental Concentrations of Flubendiamide in Benthic Pore Water (µg/L)

PRZM Crop Scenario	1 in 10 year peak concentration	1 in 10 year 21-day mean concentration	1 in 10 year 60-day mean concentration
Soybean			
Mississippi Soybeans: aerial	6.21	6.21	6.20
Mississippi Soybeans: ground	5.71	5.71	5.70
Legume vegetables except soybean. Crops of Crop Groups 6 and 7			
Illinois Beans: aerial	**10.98**	**10.97**	**10.96**
Illinois Beans: ground	10.42	10.41	10.40
Michigan Beans: aerial	8.44	8.44	8.43
Michigan Beans: ground	7.61	7.61	7.60
Oregon Snap Beans: aerial	9.79	9.79	9.78
Oregon Snap Beans: ground	9.10	9.09	9.08
Washington Beans: aerial	2.32	2.31	2.31
Washington Beans: ground	1.28	1.26	1.26
Christmas Tree			
Oregon Christmas Trees: aerial	3.72	3.71	3.71
Oregon Christmas Trees: ground	1.94	1.92	1.90

Figures 3 and **4** present the temporal variation in the accumulation of flubendiamide over time in the standard EXAMS pond for both the lowest (WA Beans) and highest (IL Beans) exposure scenarios for the water column concentrations (**Figure 3**) and pore water concentrations (**Figure 4**). Based on the temporal trend of the high exposure scenario shown in **Figures 3** and **4**, it can be seen that flubendiamide concentrations accumulate for the first 20 years of application before leveling off over the last ten years of the simulation.

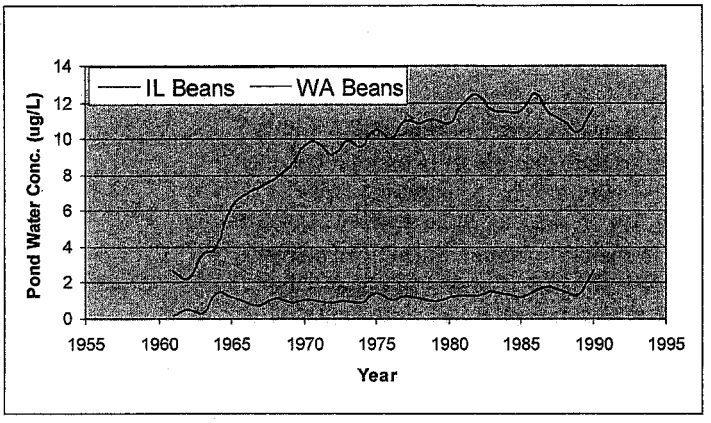


Figure 3. Accumulation of flubendiamide in water column of the PRZM/EXAMS standard pond under a low exposure scenario with Washington Beans and a high exposure scenario with Illinois Beans based on annual peak concentrations.

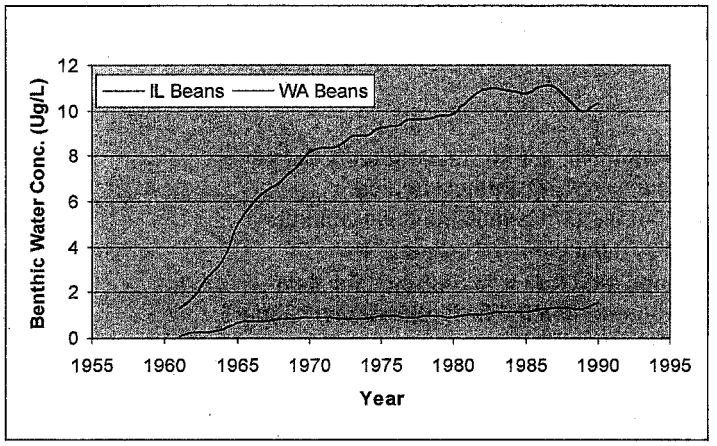


Figure 4. Accumulation of flubendiamide in benthic pore water of the PRZM/EXAMS standard pond under a low exposure scenario with Washington Beans and a high exposure scenario with Illinois Beans based on annual peak concentrations.

Degradate EECs

The toxicity of the des-iodo degradate was tested with aquatic freshwater invertebrates (daphnid EC_{50} >881 µg metabolite/L and chironomid chronic NOAEC = 1.0 µg metabolite/L). Because the degradate is more toxic than parent flubendiamide and it is toxic at levels that are lower than its aqueous solubility (450 µg/l), EECs for the des-iodo degradate were calculated to determine if the degradate poses risk to freshwater invertebrates.

The des-iodo degradate does not appear to degrade in aquatic environments. In the anaerobic aquatic metabolism study (MRID 46816914), the des-iodo degradate was the

only degradate identified over this 365-day-long study. At the end of this study, 60.4% of applied radioactivity had been converted to the des-iodo degradate, while 39.7% remained as the parent compound.

In the aquatic photolysis study (MRID 46816908), 3 degradates were generated in this 7-day-long study. The degradates in the distilled-water aquatic photolysis experiments were the des-iodo degradate (11.9 and 21.6% of applied radioactivity in the phthalic- and aniline-labeled flubendiamide experiments, respectively, at study end), NNI-0001-3-OH (2.0 and 2.3% of applied in the phthalic- and aniline-labeled flubendiamide experiments, respectively, at study end), and dihydroxy-NNNI-0001 (8.2 and 11.6% of applied in the phthalic- and aniline-labeled flubendiamide experiments, respectively, at study end). At the end of these experiments, 51.7 and 35.4% of applied radioactivity remained as flubendiamide in the phthalic- and aniline-labeled flubendiamide experiments, respectively.

The aquatic photolysis study indicates two separate degradation pathways. The first produces the des-iodo degradate directly from flubendiamide by substituting a hydrogen atom for iodine. The second produces the NNI-0001-3-OH degradate directly from flubendiamide by substituting a hydroxyl group for iodine and then produces dihydroxy-NNNI-0001 from NNI-0001-3-OH by substituting a second hydroxyl group for a fluorine atom.

In order to estimate the des-iodo degradate concentrations in both water column and pore water, PRZM/EXAMS simulations were performed using the chemical and fate properties of the des-iodo degradate (**Table 8**) using the same application dates, number of applications, and minimum re-treatment interval as the parent. To estimate an appropriate des-iodo application rate, the parent application rate was corrected for the difference in molecular weight of the degradate and multiplied by the highest conversion rate observed in any of the fate studies (60.4%; MRID 46816914).

The results of peak des-iodo degradate concentrations for surface water and benthic pore water are presented in **Tables 13** and **14**, respectively.

Table 13. Estimated peak surface water concentrations (µg/L) of the des-iodo degradate over time

Crop	1-year	10-years	20-years	30-years
Soybean				
Mississippi Soybeans: ground	0.03581	2.658	5.474	10.21
Legume vegetables except soybean. Crops of Crop Groups 6 and 7				
Illinois Beans: ground	0.141	5.404	11.45	19.91
Michigan Beans: ground	0.0894	5.469	10.19	14.44
Oregon Snap Beans: ground	0.2176	3.249	4.731	7.161
Washington Beans: ground	2.69e-6	0.1028	0.4206	0.8965
Christmas Tree				
Oregon Christmas Trees: ground	1.283e-14	0.01434	0.1057	0.3876

Table 14. Estimated peak benthic pore water concentrations (µg/L) of the des-iodo degradate over time				
Crop	**1-year**	**10-years**	**20-years**	**30-years**
Soybean				
Mississippi Soybeans: ground	0.03344	2.646	5.46	10.2
Legume vegetables except soybean. Crops of Crop Groups 6 and 7				
Illinois Beans: ground	0.1265	5.396	11.44	19.82
Michigan Beans: ground	0.07857	5.386	10.03	14.43
Oregon Snap Beans: ground	0.1979	3.196	4.73	7.16
Washington Beans: ground	4.78e-7	0.01028	0.4206	0.8601
Christmas Tree				
Oregon Christmas Trees: ground	8.556e-15	0.01433	0.1057	0.3875

Figures 5 and **6** present the temporal variation in the accumulation of the des-iodo degradate over time in the standard EXAMS pond for both the lowest (OR Christmas Tree) and highest (IL Beans) exposure scenarios for the water column concentrations (**Figure 5**) and pore water concentrations (**Figure 6**). Examining the temporal trend of the high exposure scenario, it can be seen that des-iodo concentrations continuously accumulates over the 30 years of the simulation. Because the des-iodo degradate does not appear to degrade in the aquatic environment according to the registrant-submitted fate studies, this degradate is assumed to be persistent and, therefore, will continuously accumulate in aquatic environments. Given the persistence of the degradate, the different time average values (i.e., 21-days, 60-days averages) are not expected to be significantly different from the peak concentration values.

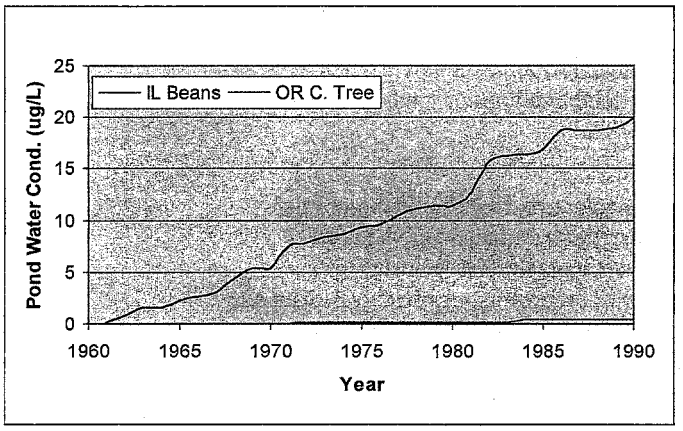


Figure 5. Accumulation of the flubendiamide des-iodo degradate in water column of the PRZM/EXAMS standard pond under a low exposure scenario of Oregon Christmas Tree and a high exposure scenario of Illinois Beans.

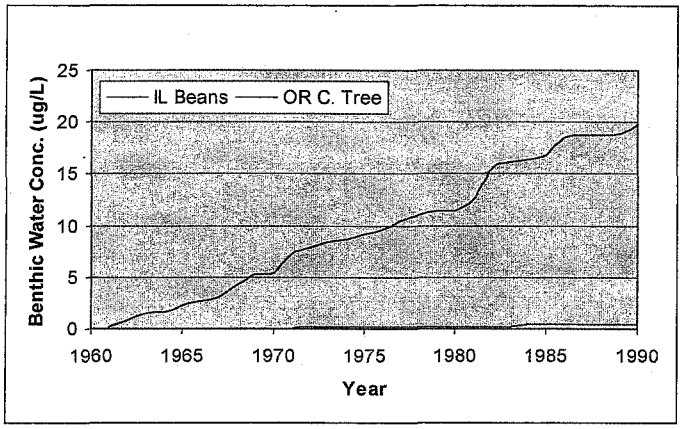


Figure 6. Accumulation of the flubendiamide des-iodo degradate in benthic pore water of the PRZM/EXAMS standard pond under a low exposure scenario of Oregon Christmas Tree and a high exposure scenario of Illinois Beans.

Typically EFED characterizes EECs in terms of 1-in-10-year concentrations and uses these EECs to calculate RQs. However, because the des-iodo concentrations continuously accumulate over time, the EEC or RQ value for a scenario is expected to continuously increase with time and cannot be adequately described with a single EEC or RQ value.

3.2.2. Monitoring Data

Because flubendiamide was recently registered in August of 2008 as a new pesticide, there are no available monitoring data at this time for flubendiamide or its degradates.

3.2.3 Terrestrial Wildlife Exposures

Terrestrial wildlife exposure estimates are typically calculated for birds and mammals emphasizing a dietary exposure route for uptake of pesticide residues on vegetative matter and insects. These exposures are considered as surrogates for terrestrial-phase amphibians as well as reptiles. For exposure to terrestrial organisms, pesticide residues on food items are estimated based on the assumption that organisms are exposed to a single pesticide residue in a given exposure scenario. The residue estimates from spray applications are based on a nomogram by Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994) that correlated residue levels, based on application rate, on various terrestrial items immediately following application in the field. The "maximum" residue concentration, an upper bound defined by Fletcher *et al.* (1994), for each food group was derived from literature and tolerance data.

Determination of residue dissipation over time on food items following single and multiple applications are predicted using a first-order residue degradation half-life with EFED's "T-REX_v1.4.1" model. The risk assessment uses a default foliar dissipation half-life estimate of 35 days. This half-life is used in lieu of representative foliar dissipation data for flubendiamide, because no suitable foliar dissipation data were

provided to EFED that evaluated foliar dissipation. The predicted maximum residues for application to a variety of crops as calculated by T-REX are provided in **Table 15.**

Table 15. Dietary-based EECs on avian and mammalian food items (ppm) at maximum application rates.

	Food Items			
Crop	**Short grass**	**Tall grass**	**Broadleaf/forage plants and small insects**	**Fruits, pods, seeds, and large insects**
Legume vegetables (including soybeans)	42.99	19.71	24.18	2.69
Christmas trees	70.03	32.10	39.39	4.38

The residues or EECs on food items may be compared directly with sub-acute dietary toxicity data or converted to an ingested whole-body dose (single oral dose, as the later is the case for small mammals and birds. Single-oral dose estimates represent, for many pesticides, an exposure scenario where absorption of the pesticide is maximized over a single ingestion event. Sub-acute dietary estimates provide for possible effects of the dietary matrix and more extended time of gut exposure to pesticide absorption across the gut. However, dietary exposure endpoints are limited in their utility because the current food ingestion estimates are uncertain and may not be directly comparable from laboratory conditions to field conditions. The EEC is converted to an oral dose by multiplying the EEC by the percentage of body weight consumed as estimated through allometric relationships. These consumption-weighted EECs (*i.e.,* EEC equivalent dose) are determined for each food source and body size for mammals (15, 35, and 1000 g) and birds (20, 100, and 1000 g). The EEC equivalent doses for birds and mammals based on application to legume vegetables and Christmas trees are given in Tables 16, 17, 18, and 19.

Table 16. Avian EEC equivalent dose adjusted for body weight for flubendiamide application to Legume vegetables (including soybeans).

EEC Equivalent Dose [1] (mg/kg-body weight)	**Avian Classes and Body Weights**		
	Small	**Mid**	**Large**
	20 g	**100 g**	**1000 g**
Percent Body Weight Consumed	**114%**	**65%**	**29%**
Short Grass	48.96	27.92	12.50
Tall Grass	22.44	12.80	5.73
Broadleaf plants/small insects	27.54	15.71	7.03
Fruits/pods/large insects	3.06	1.75	0.78

[1] EEC equivalent dose = EEC (from Table 15) * (percent body weight consumed / 100)

Table 17. Avian EEC equivalent dose adjusted for body weight for flubendiamide application to Christmas trees.

EEC Equivalent Dose [1] (mg/kg-body weight)	**Avian Classes and Body Weights**		
	Small	**Mid**	**Large**
	20 g	**100 g**	**1000 g**
Percent Body Weight Consumed	**114%**	**65%**	**29%**

Short Grass	79.76	45.48	20.36
Tall Grass	36.56	20.85	9.33
Broadleaf plants/small insects	44.87	25.58	11.45
Fruits/pods/large insects	4.99	2.84	1.27

[1] EEC equivalent dose = EEC (from Table 15) * (percent body weight consumed / 100)

Table 18. Mammalian Dose-based EECs for flubendiamide application to legume vegetables including soybeans

Mammalian food item	15 g	35 g	1000 g
Short Grass	40.99	28.33	6.57
Tall Grass	18.79	12.98	3.01
Broadleaf plants/sm Insects	23.06	15.94	3.69
Fruits/pods/seeds/lg insects	2.56	1.77	0.41
Granivores	0.57	0.39	0.09

Table 19. Mammalian Dose-based EECs for flubendiamide application to Christmas trees

Mammalian food item	15 g	35 g	1000 g
Short Grass	66.77	46.15	10.70
Tall Grass	30.60	21.15	4.90
Broadleaf plants/sm Insects	37.56	25.96	6.02
Fruits/pods/seeds/lg insects	4.17	2.88	0.67
Granivores	0.93	0.64	0.15

3.2.4 Terrestrial and Semi-Aquatic Plant Exposures

Potential exposures to terrestrial plants were not evaluated because the available toxicity data indicate that flubendiamde does not impact terrestrial plants at up to the maximum labeled application rate. Therefore, potential risks to terrestrial plants are presumably lower than concern levels.

3.3 Ecological Effects Characterization

A summary of the available toxicity data is presented below. Additional information can be found in DP Barcodes: 329594, 329613, 329606, and 329599; dated June, 2008.

In screening-level ecological risk assessments, effects characterization describes the types of effects a pesticide can produce in an animal or plant. This characterization is based on registrant-submitted studies that describe acute and chronic effects toxicity information for various aquatic and terrestrial animals and plants. Typically "acceptable" ECOTOX data is also utilized for risk assessment purposes if they are applicable. A search of the Public ECOTOX database revealed 3 papers that were classified as acceptable based on ECOTOX and OPP criteria (**Appendix E**). These papers evaluate the insecticidal efficacy of flubendiamide against bollworms on cotton (Narayana 2006; Dhawan 2006; Tomar 2005); however, data from these studies were not used in this risk assessment because no information about toxicity to non-target species was provided.

Appendix D summarizes the results of all of the registrant-submitted toxicity studies for this risk assessment. Toxicity testing reported in this section does not represent all species of birds, mammals, or aquatic organisms. Only a few surrogate species for both freshwater fish and birds are used to represent all freshwater fish (2000+) and bird (680+) species in the United States. For mammals, toxicity studies are typically limited to the laboratory rat. Estuarine/marine testing is limited to a crustacean, a mollusk, and a fish. Also, neither reptiles nor amphibians are tested. The risk assessment assumes that avian and reptilian and terrestrial-phase amphibian toxicities are similar. The same assumption is used for fish and aquatic-phase amphibians. The most sensitive ecological toxicity endpoints for aquatic organisms, terrestrial organisms, and aquatic and terrestrial plants were used for risk characterization.

The most sensitive ecological toxicity endpoints for aquatic organisms (**Table 20**), aquatic and terrestrial plants (**Table 21**), terrestrial vertebrates (**Table 22**), and terrestrial invertebrates (**Table 23**) which were used for risk characterization of flubendiamide and the formulations are summarized below. **Table 24** summarizes the toxicity endpoints tested with the des-iodo degradate. Discussions of the effects of flubendiamide and the formulations on aquatic and terrestrial taxonomic groups are also presented below. In addition, a review of the Ecological Incident Information System (EIIS) and the ECOTOX database was conducted to further refine the characterization of potential ecological effects.

Table 20. Summary of acute toxicity data on aquatic organisms used for risk determination for flubendiamide applications.

	Acute Toxicity (LC/EC50 µg a.i./L)			**Chronic Toxicity** (NOAEC/LOAEC µg a.i./L)	
Species	**Technical**	**Formulation 480 SC**	**Formulation 24 WG**	**Technical**	**Formulation 480 SC**
Freshwater Fish Rainbow trout(*Oncorhynchus mykiss*)	>65.1 Not Toxic at Limit of Solubility [1] (468169-40)	>91.1 Not Toxic at Limit of Solubility [1] (468169-43)	----	----	----

Table 20. Summary of acute toxicity data on aquatic organisms used for risk determination for flubendiamide applications.					
	Acute Toxicity (LC/EC50 µg a.i./L)			Chronic Toxicity (NOAEC/LOAEC µg a.i./L)	
Species	**Technical**	**Formulation 480 SC**	**Formulation 24 WG**	**Technical**	**Formulation 480 SC**
Freshwater Fish Bluegill sunfish (*Lepomis macrochirus*)	>67.7 Not Toxic at Limit of Solubility [1] (468169-39)	>80.2 Not Toxic at Limit of Solubility [1] (468169-42)	----	----	----
Freshwater Fish Fathead minnow *(Pimephales promales)*	>66.5 Not Toxic at Limit of Solubility [1] (468169-37)	----	----	60.5/>60.5 No Effects (468169-47)	---
Freshwater Invertebrate Water flea *(Daphnia magna)*	>54.8 Not Toxic at Limit of Solubility[1] (468169-30)	2.6 Very Highly Toxic (468169-31)	1.5 Very Highly Toxic (468169-32)	41.1/68.5 # of Aborted Eggs, # of Dead Neonates, Sub-Lethal Effects of Neonates (468169-44)	0.38/1.18 Parental mortality, time to first brood (468169-45)
Estuarine/Marine Fish Sheepshead minnow	>29.8 Not Toxic at Limit of Solubility[1] (468169-38)	----	----	----	----
Estuarine/Marine Invertebrate Mysid shrimp *Americamysis bahia*	>28 Not Toxic at Limit of Solubility[1] (468169-36)	----	----	>20/>20 No Effects (468169-46)	----
Estuarine/Marine Mollusks Eastern oyster *Crassostrea virginica*	>49 Not Toxic at Limit of Solubility[1] (468169-35)			----	----
Freshwater Benthic Midge *Chironomus riparius*	LOAEC = 3 [2] (Chronic endpoint, based on pore water measured) Emergence Inhibition (468170-22)	1650 Mortality (468170-13)	130 Mortality (468170-14)	----	----

Note: 1) The water solubility limit of flubendiamide is 29.9 µg/L.

Note: 2) During this study measured concentrations were only taken in the 10, 80, and 160 µg a.i./L treatment groups. Therefore, the pore water concentration at the NOAEC level is unknown. The time-weighted average pore water concentration at the LOAEC is 3 µg a.i./L. Using the LOAEC as a NOAEC, RQs were calculated to demonstrate the risk to benthic organisms by estimated benthic pore water concentrations of flubendiamide. The NOAEC and LOAEC values based on emergence were 40 µg a.i./L (nominal) and 80 µg a.i./L (nominal, 69 µg a.i./L 1-hr initial water column measurement), respectively.

Table 21. Summary of aquatic and terrestrial plant toxicity data used for risk determination for flubendiamide application.			
Species	**Technical**	**Formulation 480 SC**	**Formulation 24 WG**
Vascular Plant Duckweed *Lemna gibba*	>54.6 No effects (468170-39)	----	----
Nonvascular Plant Green algae	>69.3 No effects *Pseudokirchneriella subcapitata* (468170-41)	>50,500 No effects *Pseudokirchneriella subcapitata* (468170-40)	----
Terrestrial Plants: Seedling Emergence	----	EC25 > 0.363 lb a.i./A NOAEC =0.363 lb a.i./A (468170-36 (a))	EC25 >0.158 lb a.i./A NOAEC = 0.158 lb a.i./A (468170-34) (468170-38)
Terrestrial Plants: Vegetative vigor	----	EC25 > 0.426 lb a.i./A NOAEC = 0.426 lb a.i./A (468170-36 (b))	EC25 >0.158 lb a.i./A NOAEC =0.158 lb a.i./A (468170-37)

Table 22. Summary of terrestrial acute and chronic toxicity data used for risk determination for flubendiamide application.					
	Acute Oral Toxicity (mg/kg bw)		Subacute Toxicity (mg/kg diet)	Chronic Toxicity (mg/kg diet)	
Species	Technical	Formulation 480 SC	Technical	Technical	Affected Endpoints (MRID)
Northern Bobwhite Quail *Colinus virginianus*	LD_{50}>2,000 Practically Non-Toxic (468170-03)	LD_{50}>2,000 Practically Non-Toxic (468170-04)	LC_{50}>5,199 Practically Non-Toxic (468170-06)	LOAEC > 1,059 NOAEC= 1,059	No Effects (468170-08)
Mallard duck *Anas platyrhynchos*	----	----	LC_{50}>4,535 Practically Non-Toxic (468170-05)	LOAEC = 289 NOAEC= 98	viable embryos of eggs set (17% reduction and percentage of hatchling survivors (3%, reduction) (468170-07)
Laboratory rat *(Rattus norvegicus)*	>5,000 Practically non-toxic (468171-43)	----	----	NOAEC= > 20,000 mg/kg-diet	No effects on survival, reproduction, and growth (468172-16)

Table 23. Summary of terrestrial invertebrate acute and chronic toxicity data used for risk determination for flubendiamide application.

Species	Acute Toxicity			Chronic Toxicity	
	Technical	Formulation 480 SC	Formulation 24 WG	Formulation 24 WG	Formulation 480 SC
Earthworm (*Eisenia fetida*)	LD50>1000 mg a.i./kg (468170-28)	LD50>1000 mg a.i./kg (468170-29)	----	LD50>1000 mg a.i./kg NOAEC = 562 mg a.i./kg- reproduction effects (468170-32)	LD50>1000 mg a.i./kg (468170-31)
Honey bee (*Apis mellifera*)	LD50 > 200 µg a.i./bee (468170-09)	LD50>200 µg a.i./bee (468170-10)	----	----	----
Parasitoid Wasp (*Aphidius rhopalosiphi*)	----	Rate response test LD50>0.423 lb a.i./A (468170-21)	LD50>0.55 lb a.i./A (468170-20)	----	----
Predatory mite (*Typhlodromas pyri*)	----	----	LD50>0.55 lb a.i./A (468170-19)	----	----
Ladybird Beetle (*Coccinella septempunctata*)	----	----	----	----	45-day LD50=0.089 lb a.i./A NOAEC = 0.04 lb a.i./A (468170-15)
	----	----	----	----	47-day Life Cycle LD50=0.41 lb a.i./A NOAEC = 0.24 lb a.i./A (468170-17)
White springtail soil arthropod *(Folsomia candida)*	----	----	----	----	NOAEC = 31.6 mg a.i./kg (dw) LOAEC= 31.6 mg a.i./kg (dw) (468170-27)
Green lacewing (*Chrysoperla carnea*)	----	----	----	----	LD50=0.160 lb a.i./A (468170-18)

Table 24. Summary of toxicity data used for risk determination for flubendiamide degradate, des-iodo

Species	Degradate, des-iodo Acute Toxicity	Comment	MRID
Freshwater Invertebrate Water flea *(Daphnia magna)*	EC50 >881 µg a.i./L	Not Toxic at Limit of Solubility (assuming solubility is 881 µg/L or less – highest Episuite estimate of solubility was 450 µg/L)	468169-33
Midge *Chironomus riparius*	NOAEC = 0.28 µg a.i./L (based a 1.5% reduction in emergence compared to the control; also based on measured pore water concentration) LOAEC = Not Determined based on measured pore water concentration[1]	Supplemental	468170-23

Table 24. Summary of toxicity data used for risk determination for flubendiamide degradate, des-iodo			
Species	Degradate, des-iodo Acute Toxicity	Comment	MRID
Earthworm (*Eisenia fetida*) 14-day test	LD50 > 1000 mg a.i./kg	No effects on mortality or percent weight change	468170-30

Note 1: The overlying water concentrations evaluated in the study were 0.25, 0.50, 1, 2, 4, 8, 16, and 32 µg a.i./L. The mean measured pore water concentrations were only measured in the 4 µg a.i./L (the determined NOAEC) and 32 µg a.i./L overlying water concentration compartment which had a mean measured pore water concentrations of 0.28 µg a.i./L and 3.91 µg a.i./L respectively. The LOAEC based on the **overlying water** concentration was 8 µg a.i./L however the pore water concentration for this value was "Not Determined".

3.3.1 Aquatic Field Study

In a mesocosm study (46817002), the ecological effects of the 480 SC formulation were determined for different trophic levels including phytoplankton, zooplankton, aquatic macroinvertebrates, and emergent insects (no fish). The SC formulation was applied once onto the water surface in May 2003 and included five treatment levels 0.4, 1.0, 2.3, 5.3 and 12 µg a.i./L. There were two replicates of the 0.4 – 5.3 µg a.i./L groups and no replication of the 12 µg a.i./L treatment group. There were three control tanks. The mesocosms were observed two weeks before and 16 weeks after treatment.

A significant number of taxa developed in the mesocosms: 36 zooplankton species, 21 macrozoobenthic organisms, 49 emerging insect species, and 7 classes of phytoplankton. Of these, the Cladocera *Daphnia longispina* was the most sensitive species.

Based on the observed effects on *Daphnia longispina* as the most sensitive species, the NOAEC on the population and community level for the zooplankton was 1.0 µg/L. Persistent effects were not observed for any taxon in the study up to the highest treatment level (12 µg/L), but there was no replication at this level. As a result, the NOAEC for this study is 5.3 µg/L for the zooplankton.

Regarding macroinvertebrates, the artificial substrate samplers did not indicate persistent effects for any taxon as well as for the macroinvertebrate community for all treatment levels. Additionally, no direct effects were observed on the phytoplankton.

Some deviations from guidance included a finfish population was not investigated; the 12 µg/L level was not replicated, and only two replicates were included for the remainder of treatment levels (excluding controls, where three replicate ponds were maintained); and flubendiamide levels in biota were not determined. Thus, this study is classified as supplemental.

3.3.3 Review of Incident Data

A review of the Agency's Ecological Incident Information System (EIIS) database for ecological incidents for flubendiamide was conducted on April 8, 2010. The review demonstrated that there were in no reported incidents. This is expected with recently registered pesticides because such chemicals have typically not been used widely in the

environment. Although there were no reported incidences for this chemical, the lack of reported incidents does not rule out any existing risks that may potentially impact terrestrial and aquatic organisms.

3.3.4 Review of ECOTOX Data

A search of the Public ECOTOX database was completed on April 30, 2010 in which 3 papers were classified as "Acceptable" based on ECOTOX and OPP criteria (**Appendix E**). These papers evaluate the insecticidal efficacy of flubendiamide against bollworms on cotton (Narayana 2006; Dhawan 2006; Tomar 2005); however, data from these studies were not used in this risk assessment because no information about toxicity to non-target species was provided.

4 RISK CHARACTERIZATION

Risk characterization is the integration of exposure and effects characterization to determine the ecological risk from the use of flubendiamide and the likelihood of effects on aquatic life, wildlife, and plants based on different pesticide-use scenarios. The risk characterization provides an estimation and description of the risk; articulates risk assessment assumptions, limitations, and uncertainties; synthesizes an overall conclusion; and provides the risk managers with information to make regulatory decisions.

4.1 Risk Estimation: Integration of Exposure and Effects Data

Results of the exposure and toxicity effects data are used to evaluate the likelihood of adverse ecological effects on non-target species. For the assessment of flubendiamide risks, the risk quotient (RQ) method is used to compare exposure and measured toxicity values:

$$RQ = EEC \,/\, (\text{Acute or Chronic Toxicity Values})$$

where: *EEC* is the estimated environmental concentration generated by the exposure scenarios. The RQs are compared to the Agency's levels of concern (LOCs). These LOCs are the Agency's interpretive policy and are used to analyze potential risk to non-target organisms and the need to consider regulatory action. These criteria are used to indicate when a pesticide's use as directed on the label has the potential to cause adverse effects on non-target organisms.

4.1.1 Non-target Aquatic Animals, Invertebrates, and Plants

Surface water concentrations resulting from flubendiamide application were predicted for flubendiamide parent alone, des-iodo degradate (up to the limit of solubility for des-iodo, 450 µg/L) and formulation exposure which is based only on the spray drift fraction and does not include runoff or erosion contributions. Application scenarios were selected to represent the entire range of soil and environmental conditions of the proposed actions.

Peak EECs were compared to acute toxicity endpoints to derive acute risk quotients. The 21-day EECs were compared to chronic toxicity endpoints (NOAEC values) to derive chronic risk quotients for invertebrates. The 60-day EECs were compared to chronic toxicity endpoints (NOAEC values) to derive chronic risk quotients (RQs) for fish.

4.1.1.1 Fish

No toxicity was observed in freshwater and estuarine/marine at the highest test concentrations of parent and formulation grades of flubendiamide, which were at the limit of solubility. Therefore, acute RQs were not calculated for freshwater and estuarine/marine fish. Similarly, chronic RQs for fish were also not derived, given that no chronic effects were observed at the limit of solubility for parent flubendiamide.

4.1.1.2 Freshwater Pelagic Invertebrates

For acute risk to freshwater pelagic invertebrates, no toxicity was observed at the highest concentration of the technical grade flubendiamide tested, which was at the limit of solubility (flubendiamide solubility and freshwater invertebrate LC_{50} respectively 29 µg/L and 54.8 µg/L). Therefore, freshwater invertebrate acute risk quotients were not calculated for flubendiamide entering surface water via combined runoff, erosion, and off-target spray drift from an agricultural field. The degradate, des-iodo, is not acutely toxic at the limit of its solubility (des-iodo solubility: < 0.001 µg/L; freshw) to freshwater invertebrates. Therefore, acute risk quotients were not calculated for the des-iodo degradates entering surface water via combined runoff, erosion, and off-target spray drift from an agricultural field.. Because no effects were observed at up to the water solubility limit for flubendiamide or its des-iodo degradate, risk does not exceed concern levels for acute effects to daphnids.

However, the formulated products of flubendiamide are expected to enter surface primarily via spray drift. Thus, freshwater invertebrate RQs were calculated to assess the risk posed by the formulation entering surface water by spray drift only.

The 480 SC formulation is very highly toxic to freshwater invertebrates (daphnids) on an acute basis. Using the EC_{50} (2.6 µg a.i./L), acute RQs exceed the acute listed species LOC (0.05) and the acute restricted use LOC (0.1) when compared to the formulation EECs for one aerial application to both legume vegetables and Christmas trees (The RQ LOC exceedances range from 0.10-0.17; **Table 25**). There are no LOC exceedances for ground applications

The 24 WG formulation is also very highly toxic to freshwater invertebrates (daphnids) on an acute basis. Using the EC_{50} (1.5 µg a.i./L), acute RQs exceed the acute listed species LOC and the acute restricted use LOC (0.1) when compared to the formulation EECs for one aerial application to legumes (**Table 25**). The 24 WG formulation is only intended for rotational plant-back interval use for legume vegetables and not for use on Christmas trees.

Table 25. Acute Risk Quotients for freshwater invertebrates based on formulation drift only EECs following one application and formulation toxicity values				
Crops	**Formulation EEC (µg/L)**		**480 SC RQ EC_{50} = 2.6 µg/L**	**24 WG RQ EC_{50} = 1.5 µg/L**
Legume Vegetables	Aerial	0.263 µg/L	****0.1**	****0.18**
	Ground	0.053 µg/L	0.02	0.04
Christmas trees	Aerial	0.437 µg/L	****0.17**	**NA*****
	Ground	0.087 µg/L	0.03	**NA*****

* Exceeds Acute Endangered Species Risk LOC (≥0.05)
** Exceeds Acute Endangered Species Risk LOC and Acute Restricted Use LOC (≥0.1)
*** The 24 WG formulation is only intended for rotational plant-back interval use for legume vegetables

In the daphnid life cycle test, an increase in the number of eggs aborted and the number of dead neonates was observed at 68.5 µg a.i./L (the LOAEC value) which was the highest concentration of the technical grade flubendiamide tested . This concentration is above the limit of solubility of 29 µg a.i./L for the flubendiamide technical (the chemical was made more soluble in the study via the use of a solvent). At the NOAEC (41.1 µg a.i./L; which is also above the solubility limit), RQs do not exceed the chronic LOCs when compared to the 21-day parent only EECs (**Table 26**).

Table 26. Chronic Risk Quotients for freshwater invertebrates based on EECs following one application of flubendiamide		
PRZM Crop Scenario	**1 in 10 year 21-day concentration (µg/L; ppb)**	**Flubendiamide Parent RQ NOAEC = 41.1 µg a.i./L**
Soybean		
Mississippi Soybeans: aerial	7.04	0.17
Mississippi Soybeans: ground	6.46	0.16
Legume vegetables except soybean. Crops of Crop Groups 6 and 7		
Illinois Beans: aerial	11.66	0.28
Illinois Beans: ground	11.01	0.27
Michigan Beans: aerial	9.06	0.22
Michigan Beans: ground	8.20	0.20
Oregon Snap Beans: aerial	10.54	0.26
Oregon Snap Beans: ground	9.82	0.24
Washington Beans: aerial	2.66	0.06
Washington Beans: ground	1.49	0.04
Christmas Tree		
Oregon Christmas Trees: aerial	4.17	0.10
Oregon Christmas Trees: ground	2.16	0.05

+ Exceeds Chronic Risk LOC (≥1.0)

4.1.1.3 Freshwater Benthic Invertebrates

The available freshwater benthic invertebrate studies produce multiple lines of evidence that flubendiamide and its des-iodo degradate will adversely affect benthic invertebrate populations. This evidence is presented in this section and the mesocosm study discussion below.

A 28-day chronic toxicity study with flubendiamide technical was submitted investigating the emergence and development rate of the midge, *Chironomus riparius*, in an overlying-water spiked system with nominal concentrations of 10 – 640 µg a.i./L (MRID 468170-22). The NOAEC and LOAEC values based on emergence were 40 µg a.i./L (nominal) and 80 µg a.i./L (nominal, 69 µg a.i./L 1-hr initial water column measurement), respectively. Measured concentrations were taken only in the 10, 80, and 160 µg a.i./L treatment groups. Therefore, the pore water concentration at the NOAEC is unknown. The time-weighted average pore water concentration at the LOAEC is 3 µg a.i./L. Using the LOAEC as a NOAEC, RQs were calculated to demonstrate the risk to benthic organisms by estimated benthic pore water concentrations of flubendiamide. Based on these calculations, the LOCs were exceeded for the all modeled scenarios except for the Washington beans scenario and ground application to Christmas trees in Oregon (**Table 27**).

Table 27. Risk quotients for flubendiamide in benthic pore water based on aerial and ground applications to various legume vegetable scenarios including soybeans and Christmas trees

Spray Application	21-day EEC in benthic Pore Water (µg/L)	MRID 468170-22 LOAEC = 3 µg a.i./L
Soybeans		
Aerial	6.21	**2.07**
Ground	5.71	**1.9**
Legume vegetables except soybean. Crops of Crop Groups 6 and 7		
Illinois Beans: aerial	10.97	**3.65**
Illinois Beans: ground	10.41	**3.47**
Michigan Beans: aerial	8.44	**2.81**
Michigan Beans: ground	7.61	**2.53**
Oregon Snap Beans: aerial	9.79	**3.26**
Oregon Snap Beans: ground	9.09	**3.03**
Washington Beans: aerial	2.31	0.77
Washington Beans: ground	1.26	0.42
Christmas tree		
Oregon Christmas Trees: aerial	3.72	**1.24**
Oregon Christmas Trees: ground	**1.94**	0.64

In a 28-day chronic toxicity midge, *Chironomus riparius,* study with des-iodo degradate (MRID 468170-23), the percent emergence was adversely affected at 8.0, 16 and 32.0 µg

metabolite/L, based on nominal overlying water concentrations. The NOAEC value is 1.9 µg metabolite/L (time-weighted measured overlying water) and 0.28 µg metabolite/L (time-weighted measured pore water), based on 1.5% reductions in percent emergence compared to the control (**Table 28**). Based on the RQ calculations shown in **Table 28**, chronic RQs exceed LOCs for all the modeled legume vegetable scenarios except for the Washington State Beans and Oregon Christmas tree scenarios.

Table 28. Risk quotients for the des-iodo degradate based on benthic water column and pore water endpoint concentrations for aerial and ground applications to legumes and Christmas trees

	Water Column Concentrations		Pore Water Concentrations	
Spray Application	**1 in 10-years EEC in Water Column (µg/L)**	**RQ MRID 468170-23 NOAEC = 1.9 µg/L**	**1 in 10-years EEC in Benthic Pore Water (µg/L)**	**RQ MRID 468170-23 NOAEC = 0.28 µg/L**
Soybean				
Ground	2.658	**1.4**	2.646	**9.45**
Legume vegetables except soybean. Crops of Crop Groups 6 and 7				
Illinois Beans: ground	5.404	**2.84**	5.396	**19.27**
Michigan Beans: ground	5.469	**2.88**	5.386	**19.24**
Oregon Snap Beans: ground	3.249	**1.71**	3.196	**11.41**
Washington Beans: ground	0.1028	0.05	0.01028	0.04
Christmas tree				
Oregon Christmas Trees: ground	1.283e-14	6.75e-11	0.01433	0.05

Consideration of benthic fauna effects data in comparison with the mesocosm results

The EFED risk assessment reports a 28-day sediment toxicity test NOAEC of 40 µg a.i./L and a LOAEC of 80 mg a.i./L nominal in overlying water (MRID 46817022). However, the study does report measured time weighted average concentrations in pore water corresponding to some of these dose groups. For example, the pore water concentration corresponding to the LOAEC is 3 µg a.i./L while the pore water was not measured at the NOAEC, the relationship between overlying water nominal and pore water measured at the LOAEC, when applied to the NOAEC would yield an estimated pore water concentration of 1 µg/L. These pore water concentrations can be compared to benthic invertebrate results from the mesocosm study.

The mesocosm study does not present sediment concentrations in pore water units. However, the study does present total dry weight sediment concentrations and the data from the study suggest that there were no effects on chironomid numbers or general benthic invertebrate abundance at even the highest dose group of 12 µg a.i./L in overlying water. Measured sediment concentrations at this dose group ranged from 21 to 57 µg a.i./kg dry weight. Converting this range of sediment concentrations to a

conservative estimate of a corresponding pore water concentration can be made using the following formula:

$$\text{Concentration in pore water} = \text{Concentration in bulk sediment}/(K_{oc} \times F_{oc})$$

where: Dry weight sediment is a conservative substitute for bulk sediment concentration
K_{oc} is 1954 for the active ingredient
F_{oc} is 0.039 as reported in the mesocosm study

This yields a range in estimated pore water concentrations of 0.27 to 0.74 µg a.i./L. It should be noted that these are likely overestimates of pore water concentrations as the water fraction of sediment is removed in the dry sediment measurements, thereby inflating the bulk sediment concentrations.

It can be seen from a comparison of estimated mesocosm pore water to chironomid chronic sediment NOAEC and LOAEC values, that the mesocosm study does not achieve sufficient pore water concentrations (0.27 to 0.74 µg a.i./L) to approach concentrations in single species sediment testing that elicit adverse effects (LOAEC = 3 µg a.i./L). Therefore there is insufficient information in the mesocosm study to refute the accuracy of effects concentrations achieved with a single species sediment toxicity study. In essence, the mesocosm study only confirms that pore water concentrations of 1 µg/a.i./L or lower are not likely to cause adverse effects on benthic invertebrates. **Table 29** provides RQs based on this estimation of the NOAEC (1 µg a.i./L).

Table 29. Risk quotients for flubendiamide in benthic pore water based on aerial and ground applications to various legume vegetables including soybeans and Christmas tree scenarios

Spray Application	21-day EEC in benthic Pore Water (µg/L)	(Extrapolated from Multiple Studies) NOAEC = 1 µg a.i./L
Soybean (legume vegetable)		
Aerial	6.21	**6.21**
Ground	5.71	**5.71**
Legume vegetables except soybean. Crops of Crop Groups 6 and 7		
Illinois Beans: aerial	10.97	**10.97**
Illinois Beans: ground	10.41	**10.41**
Michigan Beans: aerial	8.44	**8.44**
Michigan Beans: ground	7.61	**7.61**
Oregon Snap Beans: aerial	9.79	**9.79**
Oregon Snap Beans: ground	9.09	**9.09**
Washington Beans: aerial	2.31	**2.31**
Washington Beans: ground	1.26	**1.26**
Christmas tree		
Oregon Christmas Trees: aerial	3.71	**3.71**
Oregon Christmas Trees: ground	1.92	**1.92**

Although the available data for single species daphnid testing suggests the des-iodo degradate is more toxic than the parent, the toxicity of both compounds appears to be equivalent when expressed on a pore water basis.

Mesocosm Study

The study designated as MRID 46817002 is a mesocosm study involving application of flubendiamide product 480 SC to the aqueous compartment. Initial evaluation of effects endpoints expressed the values in terms of nominal additions of the active ingredient per liter of overlying water. Reliance on overlying water concentration units for effects endpoints might be appropriate for organisms residing in the aqueous layer; however, it is not the optimal expression of effects endpoints for benthic and sediment-dwelling organisms.

Consideration of cladoceran effects data in comparison with the mesocosm results

The acute effects 480 SC formulation endpoint (EC_{50}) for the cladoceran, *Daphnia magna* is 2.6 µg a.i./L with a correspoding NOAEC value of 0.45 µg a.i./L. The risk assessment also reports a chronic reproduction NOAEC of 0.38 a.i./L and a LOAEC of 1.18 µg a.i./L for the same formulation in the same cladoceran species. These endpoints can be compared to cladoceran endpoints from the mesocosm study, expressed as overlying water concentrations to determine if the two suggest similar effects levels.

Based on the results of the mesocosm study, administration of SC 480 to the overlying water at a concentration of 12 µg a.i./L caused a decrease in the number of cladoceran individuals through 35 days post treatment with indication of recovery toward the end of the 35 day exposure period. Table 30 presents the corresponding measured water concentrations for this time period.

Table 30. Estimates of bioavailable water column flubendiamide concentrations in the first 35 days of the mesocosm study

Day	Water Concentration µg a.i./L	Bioavailable Water Concentration µg a.i./L*
0	3.52	2.8
2	10.4	8.3
4	9.88	7.9
7	9.1	7.3
14	9.1	7.3
21	8.0	6.4
28	7.4	5.9
35**	6.2	5.0

* Assumes 80% dissolved fraction as per page 204 of the study
** Recovery potentially observed for *D. longispina*

From the above table it appears that daphnia show recovery as the concentration of the active ingredient falls below 6 µg a.i./L. Based on the EEC results listed in Table 30, the results confirm impacts to freshwater invertebrates at environmentally relevant concentrations.

4.1.1.4 Estuarine/Marine Invertebrates

Acute RQs were not derived for estuarine/marine invertebrates because no toxicity was observed in either the acute mysid and/or oyster studies at the limit of parent flubendiamide's solubility in water. However, given the risk for freshwater invertebrates exposed to the formulations, there is uncertainty regarding risk to marine invertebrates because no toxicity data have been submitted that evaluated effects of formulated products to marine/estuarine organisms. Therefore until marine/estuarine data testing the formulated products are submitted, the potential for acute risk to estuarine/marine invertebrates cannot be precluded based on exposure to the formulated products of flubendiamide.

Chronic RQs for estuarine/marine were not derived because no chronic effects were observed to mysid at the limit of solubility for parent flubendiamide.

4.1.1.5 Aquatic Plants

RQs were not derived for aquatic plants because no toxicity was observed in the available studies with vascular and non-vascular plants at the limit of technical grade flubendiamide's solubility. In addition, no toxicity was observed at the highest concentration of the 480 SC formulation tested, in the non-vascular (*Pseudokirchneriella subcapitata*) aquatic plant tests.

4.1.2 Non-target Terrestrial Animals and Plants

4.1.2.1 Avian Risk

The LD_{50} and LC_{50} for birds were both non-definitive values of >2000 mg/kg bw and >4535 mg/kg diet, respectively, and no treatment related mortality (or sublethal effects) were observed. Also, the endpoints are well below the highest EECs for birds (70 ppm for dietary exposures and 79 mg/kg-bw for acute oral exposures). Thus, avian acute RQs were not calculated. In addition, the LD_{50} > 2000 mg/kg bw for bobwhite quail exposed to the 480 SC formulation was non-definitive because no treatment related mortality (or sublethal effects) was observed.

The most sensitive avian chronic toxicity was a NOAEC and LOAEC respectively of 98 mg a.i./kg and 298 mg a.i./kg based on the results of a mallard duck reproductive toxicity study. The effects included a 17% reduction in the number of viable embryos of eggs set and a 3% decrease in percentage of hatchling survivors relative to controls. Using NOAEC of this mallard duck study, there is one chronic LOC exeedance (RQ = 1.52) for Christmas trees for birds consuming short grass; however, the chronic LOCs are not exceeded for the other proposed use on legumes (**Table 31**).

Table 31. Avian chronic risk quotient calculations based on the proposed use on Christmas trees which was the maximum proposed use rate	
Avian Dietary Item	**Chronic Dietary-based RQs (Dietary-based EEC/ NOAEC)**
Short Grass	1.52
Tall Grass	0.70
Broadleaf plants/sm Insects	0.86
Fruits/pods/seeds/lg insects	0.10

4.1.2.2 Mammalian Risk

Since the LD_{50} for mammals was non-definitive (values of >2000 mg/kg bw and no treatment related mortality was observed), RQs were not calculated. The highest EEC for mammals was estimated to be approximately 66 mg/kg-bw, which is well below 2000 mg/kg-bw. Therefore, risk is lower than concern levels for acute effects to mammals.

In a two-generation rat reproduction study, frank developmental and reproductive effects were not observed (MRID 46817216). The NOAEC for reproductive toxicity is 20,000 ppm in that no reproductive toxicity was observed. Risk Quotients were not calculated because of the lack of frank reproductive effects.

4.1.2.3 Terrestrial Invertebrates

Risk to Lepidotera species

Nontarget Lepidotera species (including federally list species) are of particular concern due to their potential exposure to flubendiamide's mode of action as an insecticide. Sec 4.2.2.2 of the Risk Description provides further information regarding the potential risks to Lepidotera species.

Risk to soil dwelling invertebrates

Data from the acute earthworm toxicity studies demonstrated that flubendiamide technical, formulations 24 WG and 480 SC, and the degradate des-iodo all have a LD_{50} > 1000 mg a.i./kg (based on mortality). In the earthworm chronic toxicity data only the 24 WG formulation demonstrated effects as indicated by a NOAEC of 562 mg a.i./kg that was based on a significant reduction in the number of juveniles.

Chronic toxicity data for the white springtail soil arthropod demonstrated a chronic toxicity NOAEC of 31. 6 based on the number of juveniles produced.

In order to determine the risk of the proposed uses to soil dwelling organisms, EFED calculated estimated concentrations of flubendiamide in the soil to determine if soil

dwelling invertebrates may be exposed to concentrations that may pose adverse effects based on the available toxicity data.

The soil concentrations were calculated based on the following factors:

1) a single maximum application rate of 0.94 lbs a.i./acre

2) the range of bulk densities in the PRZM EXAMS scenario soils which were 0.37 to 1.8 g/cm^3 in the top 10 cm of soil

3) an assumed soil incorporation depth of 1 cm (assumed depth since this is not a soil incorporated product. Using

Thus based on these factors, soil concentrations were calculated as follows:

> *C_{soil} = application rate (mg/cm^2) / [(soil incorporation depth cm) * bulk density (kg/cm^3)]*
>
> *When bulk density = 0.37 g/cm^3, C_{soil} = 28.476 mg /kg soil; below all acute and chronic toxicity endpoint values for soil dwelling terrestrial invertebrates.*
>
> *When bulk density = 1.8 g/cm^3, C_{soil} = 5.583 mg /kg soil; below all acute and chronic toxicity endpoint values for soil dwelling terrestrial invertebrates.*

Based on the above calculations, the estimated concentrations of flubendiamide in the soil are below any levels that have been shown to cause adverse toxic effects to soil dwelling terrestrial invertebrates.

Toxicity to Bees - Beneficial Pollinators

Flubendiamide technical and 480 SC formulation were classified as practically non-toxic based on the acute contact honey bee study (LD_{50} > 200 µg/bee); therefore, a label statement is not required to protect honey bees.

4.1.3 Terrestrial and Semi-aquatic Plant Risk

As previously discussed, EFED does not expect there to be significant risk to terrestrial plants because the available toxicity data indicate that flubendiamde does not impact terrestrial plants at up to the maximum labeled application rate. Therefore, potential risks to terrestrial plants are presumably lower than levels of concern.

4.2 Risk Description

A screening-level risk assessment, based on proposed uses of flubendiamide, suggests that levels of flubendiamide, and its des-iodo degradate in the environment, when

compared with toxicity values, may result in direct acute and chronic effects to freshwater invertebrates exposed to the TGAI, formulations and des-iodo degradate. There is also presumed risk to estuarine/marine invertebrates based on risk to FW invertebrates. The Christmas tree use may pose a chronic risk to birds. Sensitive beneficial arthropods, particularly Lepidoptera species, including endangered species may be impacted by the labeled use of flubendiamide. Lepidoptera may occur in areas adjacent to treated fields (where they may be exposed to spray drift) and will likely move through treated fields. Additionally, the larvae of some lepidopteran species are aquatic (Merrit and Cummins, 1984) and, therefore, may be exposed to both the TGAI, formulations, and des-iodo degradate. Based on the potential for direct effects to these taxa, there may be potential indirect effects to species of concern that depend on these taxa as a source of food or pollination.

4.2.1 Risks to Aquatic Organisms

Potential acute and chronic risk is lower than concern levels for freshwater and marine fish, marine crustaceans, marine mollusks, and aquatic plants exposed to flubendiamide (technical grade and formulated products) at its limit of solubility of 29 µg/L. The toxicity endpoints were > 29 µg/L for all these taxa.

Although LOCs are not exceeded for technical grade material, there is potential for acute risk to freshwater invertebrates (daphnid) exposed to the formulations 480 SC and 24 WG. The acute listed species and acute restricted use LOCs are exceeded based on the 480 SC and 24WG formulations' EECs for aerial application to legume vegetables and Christmas trees (The RQ LOC exceedances range from 0.06-0.29). These effects have been confirmed in a mesocosm study (see additional discussion below).

Due to the increased toxicity of the formulated products to freshwater invertebrates relative to technical grade material, there is uncertainty regarding risk to marine invertebrates. Formulated product toxicity data to saltwater invertebrates have not been submitted. Therefore, potential risk to marine invertebrates exposed to the formulation cannot is presumed to exceed concern levels.

Flubendiamide and the des-iodo degradate pose chronic risks to benthic invertebrate organisms at levels of concern based on the chronic RQs. The potential for these risks are expected to be high especially since flubendiamide and its degradates are very persistent in soils and are likely to accumulate in soils, water column, and sediments with each successive application.

Based on the available guideline toxicity data, formulations of flubendiamide are more toxic to freshwater invertebrates than the active ingredient. This conclusion is supported by the results of the formulation-based mesocosm study results for daphnid species which show effects concentrations on par with single species testing endpoints for the same formulation. Confidence in the risk conclusions is high given that the laboratory data are supported by results of mesocosm studies for aquatic organisms.

Comparison of estimated bioavailable pore water exposure concentrations ranging from 1.26 to 10.98 µg a.i./L (**Table 12**) with available sediment toxicity data indicates that pore water EECs are similar to or exceed pore water effects thresholds for single species chironomid testing. Moreover, predicted EECs exceed the mesocosm NOAEC for benthic invertebrates in general. Therefore, the available single species and mesocosm data indicate that flubendiamide levels in sediment pore water are sufficiently high to cause adverse effects in certain benthic invertebrate species.

Implications for aquatic resources

The acute and chronic endpoints based on chironomid toxicity data serve as the primary basis for conducting the freshwater invertebrate risk assessment. It is not surprising that aquatic insect larvae, such a chironomids, are sensitive to flubendiamide and its toxic degradates, given that flubendiamide is an insecticide. However, it is notable that, compared to the other freshwater invertebrates tested, insect larvae may possibly be more sensitive than other tested freshwater invertebrate species. The following provides a discussion on the ecological implications of effects to chironomids and other aquatic invertebrates.

The significance of the order of Chironomidae in aquatic systems

Coffman and Ferrington (1996) provide some insight in their characterization of the family. They maintain that the Chironomidae family is an ecologically important group of aquatic insects that often is found in high densities. Densities of up to 50,000 larvae per square meter of benthic substrate have been reported. Aquatic systems exhibit a high diversity of chironomids as well. The number of chironomid species in most systems accounts for at least 50% of the total macroinvertebrates present. Natural lakes, ponds, and streams may exhibit 50, 100, or more chironomid species. The short life cycles of these organisms, coupled with the large larval biomass in aquatic systems indicates a significance in the overall energy flow through aquatic systems. Chironomids feed on a great variety of organic substrates including coarse leaf litter, medium and fine detrital particulate, algae, vascular plants, fungi, and animals. In turn, most aquatic predators feed extensively on chironomids (larvae, pupae, or adults) at some point in their life cycles. Pennak (1978) further states that, from and economic standpoint, chironomid larvae form an important item in the food of young and adult fishes.

Even more significant is the degree to which the disparate sensitivity among freshwater aquatic invertebrates is cause for concern that other potentially high sensitivity species may exist in aquatic taxonomic groups. There exists considerable uncertainty as to the potential for even more sensitive invertebrates, in particular other families of aquatic insects. Representative aquatic insect families may be found in 11 of the 30 to 35 orders of insects (Pennak, 1978).

Would spray drift buffers provide sufficient protection to surface water resources?

One potential measure for controlling pesticide exposures is to require buffers around surface water bodies (ponds, lakes, streams, *etc.*) where pesticides cannot be applied. Based on a spray drift analysis conducted by the previous ecological risk assessment for for flubendiamide's use on corn, cotton, tobacco, grapes, pome fruit, stone fruit, and tree nut crops, grape, cucurbit vegetables, fruiting vegetables, leafy vegetables, brassica (cole) and leafy vegetables (DP Barcodes: 329594, 329613, 329606, and 329599; Dated June, 2008), EFED concluded that buffer zones would not prevent flubendiamide usage from posing a significant risk to aquatic invertebrates. Since these conclusions were based on maximum use rates equivalent to the maximum proposed use rates in this current ecological assessment, these conclusions also apply to this assessment.

4.2.2 Risks to Terrestrial Organisms

4.2.2.1 Birds and Mammals

The screening assessment for flubendiamide suggests that potential acute risk to birds and mammals is below concern levels for all of the proposed uses. There are potential chronic risks to birds, but no expected chronic risks to mammals.

In the mallard duck toxicity test, significant reproductive effects were observed at the treatment levels of 289 and 960 mg a.i./kg diet; therefore the NOAEC is 98 mg a.i./kg diet. In the bobwhite quail toxicity test, no treatment related effects were observed and the NOAEC is 1059 mg a.i./kg diet. Using the mallard duck study results, there is one chronic LOC exeedance (RQ = 1.52) for Christmas trees for birds consuming short grass; however the chronic LOCs are not exceeded for the other proposed uses. Since the LOC exceedance assumes that a bird is consuming exclusively short grass for its diet, this conclusion may be overly conservative. If the maximum application rate for Christmas trees were reduced from 0.156 lbs a.i./acre to 0.1 lbs a.i/acre, there would be no chronic risks LOC exceedances for birds.

In a two-generation rat reproduction study, frank developmental and reproductive effects were not observed (MRID 46817216). There was no evidence of reproductive impairment in males or females. The NOAEC for reproductive toxicity is 20,000 ppm in that no reproductive toxicity was observed. Risk Quotients were not calculated because of the lack of frank reproductive effects. However, the highest EEC in mammals is not expected to approach 20,000 mg/kg-food.

4.2.2.2 Non-target Terrestrial Invertebrates

Toxicity to beneficial insects

EFED currently does not routinely quantify risks to terrestrial non-target insects. Flubendiamide technical and 480 SC formulation were classified as practically non-toxic based on the acute contact honey bee study (LD_{50} >200 µg/bee); therefore, there is little potential for flubendiamide to have acute contact adverse effects on bees. In addition, based on the following information describing formulated toxicity studies significant side

effects to bumblebees and honey bees are not expected following application of both formulations at the proposed application rates.

The effects of the 480 SC formulation on the honey bee were also evaluated under semi-field conditions by exposing honey bees to plots of the wildflower, lacy phacelia (*Phacelia tanacetifolia*), treated at application rates of 0.08 and 0.16 lb a.i./A. No adverse effects were observed in mortality, flight intensity, or behavior during the test. Brood development was slightly reduced following initiation in the 0.16 lb a.i./A, but recovery was observed. The effects of the 24 WG formulation on the bumblebee (*Bombus terrestris*) exposed for 27 days to plots of tomatoes (*Lycopersicon esculentum*) treated with the 24 WG formulation at 0.160 lb a.i./A in a greenhouse was studies. The test material did not yield any deleterious impacts on pollination activity, flight frequency, or hive condition. The single maximum application rates of the proposed crops range from 0.03 – 0.156 lb ai/A. Significant side effects to bumble bees and honey bees are not expected following application of both formulations to the proposed crops.

Toxicity to soil dwelling invertebrates

As demonstrated in the Risk Estimation section, data from the acute and chronic earthworm and White springtail studies demonstrate that no toxic effects for flubendiamide technical, the formulated products, and the degradate des-iodo are expected to occur at the estimated environmental concentrations in soil. Thus, EFED concludes that flubendiamide is not expected to pose a significant risk to soil dwelling invertebrates.

Potential risks to natural Lepidoptera predators

Flubendiamide is an insecticide to treat against Lepidoptera agricultural pests. It was also tested against several natural predators of Lepidopterous insects including the parasitoid wasp (*Aphidius rhopalosiphi*), predatory mite (*Typhlodromas pyri*), ladybird beetle (*Coccinella septempunctata*) and green lacewing (*Chrysoperla carnea*). This chemical was designed to be effective against several Lepidoptera pests, but safe for beneficial natural predators of Lepidoptera so it could be used in integrated pest management (IPM) programs (Tohnishi *et al* 2005).

Extended laboratory studies were conducted by exposing the parasitoid wasp (*Aphidius rhopalosiphi*) and predatory mite (*Typhlodromas pyri*) to the 24 WG and the 480 SC formulations. The WG formulation resulted in significant reductions in survival and reproduction for the wasp yielding NOAEC = 0.17 and LD_{50} >0.55 lb a.i./A. The results of the predatory mite study exposed to the 24 WG formulation showed significant reductions in survival (14%) and reproduction (24%) with reported NOAEC and LOAEC values of 0.31 and 0.55 lb a.i./A, respectively. The LD_{50} was >0.55 lb ai/A. However, because the single maximum application rates to the proposed new uses are below the NOAEC; significant adverse effects to parasitoid wasps and predatory mite are not expected for the WG formulation.

The SC formulation resulted in significant reductions in survival in the parasitoid wasp in two tests (different range of concentrations tested), and the resulting NOAEC values were <0.2 and 0.39 lb a.i./A. The LD_{50} values were 0.423 and 0.60 lb a.i./A. In the first test, significant morality was observed at all test concentrations resulting in NOAEC <0.2 lb a.i./A. However, mortality was not observed in the second test at the same concentration; therefore, there is uncertainty regarding the NOAEC values for mortality. Because the single maximum application rates to the proposed legume vegetables for the SC formulation, which range from 0.094 – 0.156 lb a.i./A, are below the LD_{50} (and the NOAEC for test #2), significant adverse effects to parasitoid wasps are not expected for the SC formulation.

Three extended laboratory experiments were conducted exposing the ladybird beetle (*Coccinella septempunctata*) to the 480 SC formulation. When the ladybird beetle larvae were placed on apple leaves (*Malus domestica*) treated with the test material, larval survival was affected yielding LD_{50}, NOAEC, and LOAEC values of 0.41, 0.24, and 0.60 lb a.i./A, respectively. Because the single maximum application rates to the proposed vegetables for the SC formulation, which range from 0.094 – 0.156 lb a.i./A, are less than the NOAEC, adverse effects to ladybird beetles due to contact with residues are not expected for the SC formulation. When the beetles were exposed to freshly-dried and 14-day old residues on vine (*Vicia faba*) plants and fed treated aphids, survival and reproduction remained unaffected during both assays, yielding LD_{50}, NOAEC, and LOAEC values of >0.17, 0.17, and >0.17 lb a.i./A, respectively. However, there is a potential for adverse effects to adult ladybird beetles due to ingestion of food items (aphids and pollen) containing flubendiamide residues. When the ladybird beetles were exposed to treated apple leaves and fed treated aphids (*Acyrthosiphon pisum*) and pollen, adult survival was affected yielding LD_{50}, NOAEC, and LOAEC values of 0.089, 0.04, and 0.079 lb a.i./A, respectively. There were no effects to larval survival or reproduction.

An extended toxicity study was conducted with the green lacewing *Chrysoperla carnea* to determine the effect of 480 SC on larval mortality and reproduction. There was no significant dose-response relationship for larval mortality (LD_{50}> 0.16 lb a.i./A) and no significant effect on reproduction (hatching rate and fertile eggs/female/day). Because the single maximum application rates for the proposed new uses of the SC formulation, which range from 0.094 – 0.156 lb a.i./A, are below the LD_{50}, adverse effects to green lacewings due to contact with residues are not expected for SC formulation.

Risk to Lepidotera species

Flubendiamide is an insecticide proposed to control Lepidopteran agricultural pests. Lepidoptera may exist either within and adjacent to treated fields where they may be exposed to flubendiamide directly and via spray drift. Additionally, the larvae of some lepidopteran species are aquatic (Merrit and Cummins, 1984) and, therefore, may be exposed to the parent, formulations, and des-iodo degradates that may be present in aquatic habitats. Because of these potential routes of exposure, EFED presumes that there is a potential for risk to non-target Lepidopteran species, including endangered species.

4.2.2.3 Terrestrial Plants

Terrestrial and semi-aquatic plants may be exposed to pesticides from runoff, spray drift or volatilization. Based on the proposed maximum single application rate for the proposed new uses, risks to terrestrial plants are unlikely.

4.2.3 Endocrine Disruption Assessment

EPA is required under the Federal Food, Drug, and Cosmetic Act (FFDCA), as amended by the Food Quality Protection Act (FQPA), to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) *"may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other such endocrine effects as the Administrator may designate."* Following the recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there were scientific bases for including, as part of the program, the androgen and thyroid hormone systems, in addition to the estrogen hormone system. EPA also adopted EDSTAC's recommendation that the Program include evaluations of potential effects in wildlife. For pesticide chemicals, EPA will use The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCA authority to require the wildlife evaluations. As the science develops and resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP). When the appropriate screening and/or testing protocols being considered under the Agency's EDSP have been developed, flubendiamide may be subjected to additional screening and/or testing to better characterize effects related to endocrine disruption.

The potential for endocrine disruptor related effects was observed in mammalian and avian toxicity studies submitted to the Agency. Significant reproductive effects were observed in the mallard duck study (MRID 468170-07), however at the proposed application rates, there is minimal potential risk to birds.

At higher doses (20,000 ppm or limit dose), possible endocrine effects following exposure to flubendiamide were noted in the adrenal (increased adrenal weight and

cortical cell hypertrophy in rats; cortical hypertrophy in dogs), ovary (interstitial cell vacuolation in rats), delay in balanopreputial separation compared to controls in the developmental neurotoxicity study and thyroid (increased thyroid weight and follicular cell hypertrophy in rats). The reversibility of histological thyroidal effects was demonstrated in subchronic female rats during a four-week recovery period. Thyroid follicular cell hypertrophy emerged as one major endpoint in all rat studies. Rats and mice are particularly sensitive to the decreased availability of thyroxine and triodothyronine and respond with hypertrophy and hyperplasia of follicular cells as evident in the flubendiamide toxicological database. However, there were no reproductive effects or signs of reproductive impairment in males or females observed in the two-generation test (468172-16).

4.3 Threatened and Endangered Species Concern

4.3.1 Action Area

For listed species assessment purposes, the action area is considered to be the area affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. At the initial screening-level, the risk assessment considers broadly described taxonomic groups and so conservatively assumes that listed species within those broad groups are co-located with the pesticide treatment area. This means that terrestrial plants and wildlife are assumed to be located on or adjacent to the treated site and aquatic organisms are assumed to be located in a surface water body adjacent to the treated site. The assessment also assumes that listed species are located within an assumed area, which has the relatively highest potential exposure to the pesticide, and that exposures are likely to decrease with distance from the treatment area. This risk assessment presents the use of flubendiamide and establishes initial co-location of species with treatment areas.

If the assumptions associated with the screening-level action area result in RQs that are below the listed species LOCs, a "no effect" determination conclusion is made with respect to listed species in that taxa, and no further refinement of the action area is necessary. Furthermore, RQs below the listed species LOCs for a given taxonomic group indicate no concern for indirect effects upon listed species that depend upon the taxonomic group covered by the RQ as a resource. However, in situations where the screening assumptions lead to RQs in excess of the listed species LOCs for a given taxonomic group, a potential for a "may affect" conclusion exists and may be associated with direct effects on listed species belonging to that taxonomic group or may extend to indirect effects upon listed species that depend upon that taxonomic group as a resource. In such cases, additional information on the biology of listed species, the locations of these species, and the locations of use sites could be considered to determine the extent to which screening assumptions regarding an action area apply to a particular listed organism. These subsequent refinement steps could consider how this information would impact the action area for a particular listed organism and may potentially include areas of exposure that are downwind and downstream of the pesticide use site.

4.3.2 Taxonomic Groups Potentially at Risk: Direct Effects

Based on available screening level information, for the proposed uses of flubendiamide, there is a potential for direct effects to listed aquatic invertebrates and non-target Lepidopteran insects due to exposure to the formulations. There is a potential for direct effects to benthic invertebrates exposed to the parent and des-iodo degradate. In addition, there is a potential for adverse effects (mortality) to adult ladybird beetles due to ingestion of food items (aphids and pollen) containing flubendiamide residues. There were no effects to larval survival or reproduction. There are also potential chronic risks to birds.

Consequently, there is a potential concern for indirect effects upon the listed organisms by, for example, perturbing forage or prey availability. In conducting a screen for indirect effects, direct effect LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms in these taxonomic groups as resources critical to their life cycle. A summary of the risk conclusions and direct and indirect effects determinations is presented in **Table 32**.

Table 32. Listed species risks associated with direct or indirect effects due to proposed new uses of flubendiamide on legumes and Christmas trees

Listed Taxonomy	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants – monocots	No	Yes[a]
Terrestrial and semi-aquatic plants – dicots	No	Yes[a]
Terrestrial invertebrates[a]	Yes[a]	No
Birds (surrogate for terrestrial-phase amphibians and reptiles)	Yes*	Yes [a]
Mammals	No	Yes[a]
Aquatic vascular plants	No	No
Aquatic non-vascular plants	No	No
Freshwater fish (surrogate for aquatic-phase amphibians)	No	Yes[b]
Freshwater Invertebrates	Yes – due to exposure to formulations [b]	Yes[b]
Freshwater Benthic Invertebrates	Yes – due to exposure to flubendiamide and the des-iodo degradate [c]	Yes[b]
Estuarine/Marine Fish	No	No
Estuarine/Marine Crustaceans	Yes- presumed risk to formulations	No
Estuarine/Marine Mollusks	Yes – presumed risk to formulations	No

[a] Potential risk to non-target insects (Lepidoptera) and adult ladybird beetles due to ingestion of food items (aphids and pollen) containing flubendiamide residues

[b] Acute and Chronic LOC exceeded for daphnids exposed to the formulations

[c] Potential risk to benthic invertebrates exposed to the des-iodo degradate

* Based on the proposed new use on Christmas trees

The LOCATES database (version 2.9.7) identifies those U.S. counties that grow legume vegetables and Christmas trees and that have federally-listed endangered or threatened species that may be directly (aquatic and terrestrial invertebrates and birds) or indirectly

(terrestrial plants, birds, mammals, fish, and benthic invertebrates) affected. The list of affected species derived from LOCATES was not included in this assessment because the uses cover most of the United States and the direct and indirect effects includes most species. With additional refinement by exploring more detailed use patterns and species biology (*e.g.*, geographic location, specific feeding habits, time of year likely to utilize crop fields), some species listed may be determined to be not likely to be affected.

4.3.3 Use of Probit Slope Response Relationship to Provide Information on the Endangered Species Levels of Concern

The Agency uses the probit dose response relationship as a tool for providing additional information on the listed animal species acute levels of concern. The acute listed species LOCs of 0.1 and 0.05 are used for terrestrial and aquatic animals, respectively. As part of the risk characterization, an interpretation of acute LOCs for listed species is discussed. This interpretation is presented in terms of the chance of an individual event (*i.e.*, mortality or immobilization) should exposure at the estimated environmental concentration actually occur for a species with sensitivity to flubendiamide on par with the acute toxicity endpoint selected for RQ calculation. To accomplish this interpretation, the Agency uses the slope of the dose response relationship available from the toxicity study used to establish the acute toxicity measurement endpoints for each taxonomic group. The individual effects probability associated with the LOCs is based on the mean estimate of the slope and an assumption of a probit dose response relationship. In addition to a single effects probability estimate based on the mean, upper and lower estimates of the effects probability are also provided to account for variance in the slope. The upper and lower bounds of the effects probability are based on available information on the 95% confidence interval of the slope. A statement regarding the confidence in the applicability of the assumed probit dose response relationship for predicting individual event probabilities is also included. Studies with good probit fit characteristics (*i.e.*, statistically appropriate for the data set) are associated with a high degree of confidence. Conversely, a low degree of confidence is associated with data from studies that do not statistically support a probit dose response relationship. In addition, confidence in the data set may be reduced by high variance in the slope (*i.e.*, large 95% confidence intervals), despite good probit fit characteristics.

Individual effect probabilities are calculated based on an Excel spreadsheet tool IECV1.1 (Individual Effect Chance Model Version 1.1) developed by Ed Odenkirchen of the U.S. EPA, OPP, Environmental Fate and Effects Division (June 22, 2004). The model allows for such calculations by entering the mean slope estimate (and the 95% confidence bounds of that estimate) as the slope parameter for the spreadsheet. In addition, the LOC (0.1 for terrestrial animals and 0.05 for aquatic animals) is entered as the desired threshold.

The acute endangered species risk LOC (0.05) and Acute Restricted Use LOC (0.1) are exceeded for freshwater invertebrates exposed to the 480 SC formulation based on use on legume vegetables and Christmas trees. The RQs range from 0.1 – 0.17. The acute toxicity test for the daphnid resulted in a LC_{50} = 2.6 µg a.i./L with a slope of 2.11 with

95% confidence limits of 1.65 and 2.58 (MRID 468169-31). The corresponding estimated chance of an individual acute mortality to the freshwater invertebrates at the LOC of 0.05 is 1 in 192. The estimated chance of an individual acute mortality to freshwater invertebrates exposed to the 480 SC formulation at the highest RQ of 0.17 is 1 in 19.2.

The acute endangered species risk LOC (0.05) is exceeded for freshwater invertebrates exposed to the 24 WG formulation based on use on legume vegetables and Christmas trees. The RQs range from 0.04 – 0.18. The acute toxicity test for the daphnid resulted in a LC_{50} = 1.5 µg a.i./L with a slope of 1.84 with 95% confidence limits of 1.32 and 2.40 (MRID 468169-32). The corresponding estimated chance of an individual acute mortality to the freshwater invertebrates at the LOC of 0.05 is 1 in 171. The estimated chance of an individual acute mortality to the freshwater invertebrates exposed to the 24 WG formulation at the highest RQ of 0.18 is 1 in 11.7.

Table 33. Probability of Individual Mortality at the Highest RQ

Taxa	**Most Sensitive LC_{50}**	**Highest RQ**	**LOC**	**Probit Slope**	**95% Confidence Interval**	**Probability of Individual Mortality at the RQ in this Assessment (C.I.)**		**MRID (Source of Probit Slope)**
Probability of Individual Mortality at the Highest RQ for the 480 SC formulation								
Fresh water Invertebrate	2.6 µg a.i./L	.17	0.05	2.11	1.65 - 2.58	1 in 19.2 based on highest RQ	1 in 331 based on LOC	468169-31
Probability of Individual Mortality at the Highest RQ for the WG 24 formulation								
Fresh water Invertebrate	1.5 µg a.i./L	.18	0.05	1.84	0.97 – 2.3 µg/L	1 in 11.7 based on highest RQ	1 in 120 based on LOC	468169-32

4.3.4 Indirect Effects Analysis

The Agency acknowledges that pesticides have the potential to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering the extent of nesting habitat, *etc.* In conducting a screen for indirect effects, direct effect LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms in these taxonomic groups as resources critical to their life cycle.

Based on the acute and chronic risk to freshwater invertebrates exposed to the formulations, direct effects to benthic invertebrates exposed to the degradate, there may be potential indirect effects to aquatic and terrestrial species that depend on these organisms (including their surrogates) as a source of food or pollination. There are also potential risks of direct effects to birds and terrestrial inverts.

4.3.5 Critical Habitat for Listed Species

In the evaluation of pesticide effects on designated critical habitat, consideration is given to the physical and biological features (primary constituent elements) of a critical habitat identified by the U.S Fish and Wildlife and National Marine Fisheries Services as essential to the conservation of a listed species and which may require special management considerations or protection. The evaluation of impacts for a screening level pesticide risk assessment focuses on the biological features that are primary constituent elements and is accomplished using the screening-level taxonomic analysis (RQs) and listed species' levels of concern (LOCs) that are used to evaluate direct and indirect effects to listed organisms.

The screening-level risk assessment for flubendiamide has identified potential concerns for direct effects on listed aquatic and terrestrial invertebrates (Lepidoptera species), birds and indirect effect to those organisms dependant upon them for food. In light of the potential for indirect effects, the next step for EPA and the Service(s) is to identify which listed species and critical habitat are potentially implicated.

Analytically, the identification of such species and critical habitat can occur in either of two ways. First, the agencies could determine whether the action area overlaps critical habitat or the occupied range of any listed species. If so, EPA would examine whether the pesticide's potential impacts on non-endangered species would affect the listed species indirectly or directly affect a primary constituent element of the critical habitat. Alternatively, the agencies could determine which listed species depend on biological resources, or have constituent elements that fall into the taxa that may be directly or indirectly impacted by a pesticide. Then EPA would determine whether or not use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA is not sufficient to permit use of either analytical approach to make a definitive identification of species that are potentially impacted indirectly or critical habitats that are potentially impacted directly by the use of pesticides. EPA and the Service(s) are working together to conduct the necessary analysis.

This screening-level risk assessment for critical habitat provides a listing of potential biological features that, if they are primary constituent elements of one or more critical habitats, would be of potential concern. These correspond to the taxa identified above as being of potential concern for indirect effects and include birds, reptiles, terrestrial phase amphibians, mammals, terrestrial plants and aquatic organisms. This list should serve as an initial step in problem formulation for further assessment of critical habitat impacts outlined above, should additional work be necessary.

5 LITERATURE CITED

Beyer, W.N., E.E. Connor, and S. Gerould. 1994. Estimates of Soil Ingestion by Wildlife. Journal of Wildlife Management. 58(2):375-382.

Coffman, W.P. and L.C. Ferrington, Jr. 1996. Chironomidae, In: Merritt, R.W. and K.W. Cummins (eds.). An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing, Dubuque, Iowa.

ECOFRAM. 1999. ECOFRAM Terrestrial Draft Report. Ecological Committee on FIFRA Risk Assessment Methods. U.S. EPA, Washington D.C.

Fletcher, J.S., J.E. Nellesson, and T. G. Pfleeger. 1994. Literature review and evaluation of the EPA food-chain (Kenaga) nomogram, an instrument for estimating pesticide residues on plants. Environ Toxicol Chem 13(9):1383–1391.

FAO (Food and Agriculture Organization of the United Nations). 2000. FAO PESTICIDE DISPOSAL SERIES 8. Assessing Soil Contamination: A Reference Manual. Appendix 2. Parameters of pesticides that influence processes in the soil. Editorial Group, FAO Information Division: Rome, http://www.fao.org/DOCREP/003/X2570E/X2570E00.htm

Gusey W.F., Z.D. Maturgo. 1973. Wildlife Utilization of Croplands. Environmental Conservation Department. Shell Oil Company, Houston, TX.

Hoerger, F. and E.E. Kenaga. 1972. Pesticide residues on plants: correlation of representative data as a basis for estimation of their magnitude in the environment. In F. Coulston and F. Korte, eds., Environmental Quality and Safety: Chemistry, Toxicology, and Technology, Georg Thieme Publ, Stuttgart, West Germany, pp. 9–28.

HSDB (Hazardous Substances Data Bank). 2002. National Library of Medicine. Last update: 6-8-2002. Access date: 6-5-2003. http://toxnet.nlm.nih.gov/cgibin/sis/htmlgen?HSDB.

Kirkwood, J. 1983. A limit to metabolizable energy intake in mammals and birds. Comp. Biochem. Physiol. 75A:1-3.

Lahm GP, Selby TP, Freudenberger JH, Stevenson TM, Myers BJ, Seburyamo G, Smith BK, Flexner L, Clark CE, and Cordova D. 2005. Insecticidal anthranilic diamides: a new class of potent ryanodine receptor activators. Bioorg Med Chem Lett. 2005 Nov 15;15(22):4898-906.

Martin, C.M., H.S. Zim, and A.C. Nelson. 1951. American Wildlife and Plants - A Guide to Wildlife Food Habits, Dover Publ. Inc., New York.

Merritt, R.W. and K.W. Cummins, eds. 1984. An Introduction to the Aquatic Insects of North America 2nd ed. Kendall/Hunt Publishing Company, Dubuque, Idaho. 722 pp.

Mineau, P., B. Jobin, and A. Baril. 1994. A critique of the avian 5-day dietary test (LC_{50}) as the basis of avian risk assessment. Technical Report No. 215, Headquarters, Canadian Wildlife Service, Hull, Quebec. p. 23.

NatureServe. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.5. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Pennak, R.W. 1978. Freshwater Invertebrates of the United States. John Wiley and Sons, New York.

Syracuse Research Corporation. 2006. Surface Water Scenario Development for the Pesticide Root Zone Model (PRZM) for Modeling Pesticide Exposure in Outdoor Nurseries: Supplement to Metadata. GSA Contract No. GS-00F-0019L, Report No. SRC TR-06-081, North Syracuse, NY.

M. Tohnishi, H. Nakao, T. Furuya, A. Seo, H. Kodama, K. Tsubata, S. Fujioka, H. Kodama, T. Hirooka, and T. Nishimatsu, "Flubendiamide, a Novel Insecticide Highly Active against Lepidopterous Insect Pests". *J. Pestic. Sci.* Vol. **30**, pp.354-360 (2005).

Urban D.J. and N.J. Cook. 1986. Hazard Evaluation Division Standard Evaluation Procedure Ecological Risk Assessment. EPA 540/9-85-001. U.S. Environmental Protection Agency, Office of Pesticide Programs, Washington, DC.

U.S. DA Crop Profiles. http://www.ipmcenters.org/cropprofiles/CP_form.cfm

U.S. EPA. 1993. Wildlife Exposure Factors Handbook. Volume I of II. EPA/600/R-93/187a. Office of Research and Development, Washington, D. C. 20460. EPA/600/R-93/187a.

U.S. EPA. 1998. Guidance for Ecological Risk Assessment. Risk Assessment Forum. EPA/630/R-95/002F, April 1998.

U.S. EPA. 2002. Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides Input Parameter Guidance. Version II February 28, 2002. U.S. Environmental Protection Agency, Office of Pesticide Programs, Environmental Fate and Effects Division.

U.S. EPA. 2004. Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs. Office of Prevention, Pesticides, and Toxic Substances. Office of Pesticide Programs. Washington, D.C. January 23, 2004.

APPENDIX A: Status of Fate and Ecological Effects Data Requirements

Comment [ap1]: Reference previous assessments?

Table A-1: Environmental Fate Data Requirements for Flubendiamide

Guideline #		Data Requirement	MRID #s	Study Classification
161-1	835.212	Hydrolysis	46816907	Acceptable
161-2	835.224	Photodegradation in Water	46816908	Acceptable
161-3	835.241	Photodegradation on Soil	46816909	Acceptable
161-4	835.237	Photodegradation in Air	NA[1]	NA
162-1	835.41	Aerobic Soil Metabolism	Parent: 46816910 Degradate:46816911	Acceptable Acceptable
162-2	835.42	Anaerobic Soil Metabolism	46816912	Supplemental
162-3	835.44	Anaerobic Aquatic Metabolism	46816914	Acceptable
162-4	835.43	Aerobic Aquatic Metabolism	46816913	Acceptable
163-1	835.1240 835.1230	Leaching-Adsorption/Desorption	Parent: 46816905 Degradate: 46816906	Supplemental Supplemental
163-2	835.141	Laboratory Volatility	NA	NA
163-3	835.81	Field Volatility	NA	NA
164-1	835.61	Terrestrial Field Dissipation	46816915 46816916 46816917	Acceptable Acceptable Acceptable
165-4	850.173	Accumulation in Fish	46816949 46817001	Acceptable Acceptable
		Quantum Yield in Water	46816919	Supplemental

[1] Not Available.

Table A-2 : Ecological Effects Data Requirement Table for Flubendiamide					
Guideline #		Data Requirement	Formulation	MRID (Accession #)	Study Classification
71-1	850.2100	Avian Oral LD_{50}	Technical 480 SC	46817003 46817004	Acceptable Acceptable
71-2	850.2200	Avian Dietary LC_{50}	Technical Technical	46817005 46817006	Acceptable Acceptable
71-4	850.2300	Avian Reproduction	Technical Technical	46817007 46817008	Supplemental Acceptable
72-1	850.1075	Freshwater Fish LC_{50}	Technical Technical Technical Technical 480 SC 480 SC	46816937 46816939 46816940 46816941 46816942 46816943	Acceptable Acceptable Acceptable Acceptable Acceptable Acceptable
72-2	850.1010	Freshwater Invertebrate LC_{50}	Technical 24 WG 480 SC 480 SC Des-iodo	46816930 46816932 46816931 46816934 46816933	Acceptable Acceptable Acceptable Supplemental Acceptable
72-3(a)	850.1075	Estuarine/Marine Fish LC_{50}	Technical	46816938	Acceptable
72-3(b)	850.1025	Estuarine/Marine Mollusk EC_{50}	Technical	46816935	Acceptable
72-3(c)	850.1035 850.1045	Estuarine/Marine Shrimp LC_{50}	Technical	46816936	Acceptable
72-4(a)	850.1400	Freshwater Fish Early Life Stage	Technical	46816947	Acceptable
72-4(b)	850.1300 850.1350 850.1300	Aquatic Invertebrate Life-cycle	Technical Technical 480 SC	46816944 46816946 46816945	Supplemental Acceptable Acceptable
	850.1790	Benthic Organisms	Technical 24 WG 480 SC Des-iodo	46817022 46817014 46817013 46817023	Supplemental Acceptable Acceptable Supplemental
		Mesocosm Study	480 SC	46817002	Supplemental
72-5	850.1500	Freshwater Fish Life-Cycle	Technical	46816948	Unacceptable
122-1(a)	850.4100	Seed Germination/ Seedling Emergence Tier 1	24 WG 480 SC	46817034 46817036(a)	Acceptable Acceptable
		Herbicidal Toxicity Terrestrial plants Tier 2	480 SC	46817035	Supplemental, Non-guideline
122-1(b)	850.4150	Vegetative Vigor Tier 1	Technical 24 WG	46817036(b) 46817037	Acceptable Supplemental
122-2	850.4400	Aquatic Plant (Non-Vascular) Tier 1&II	Technical 480 SC	46817041 46817040	Acceptable Acceptable
122-2	850.4400	Aquatic Plant (Vascular) Tier 2	Technical	46817039	Acceptable
123-1(a)	850.4225	Seed Germination/ Seedling Emergence Tier 2	24 WG	46817038	Acceptable

Table A-2 : Ecological Effects Data Requirement Table for Flubendiamide					
Guideline #		Data Requirement	Formulation	MRID (Accession #)	Study Classification
141-1	850.3020	Honey Bee Acute Contact LD_{50}	Technical	46817009	Acceptable
			480 SC	46817010	Acceptable
			480 SC	46817011	Acceptable
			WG 40	46817012	Supplemental, Non-guideline
	850.6200	Acute Toxicity to Earthworms	Technical	46817028	Supplemental
			480 SC	46817029	Supplemental
			Des-iodo	46817030	Supplemental
	850.6200	Chronic Toxicity to Earthworms	480 SC	46817031	Supplemental
			24 WG	46817032	Supplemental
141-2	850.3030	Honey Bee Residue on Foliage	NA	NA	NA
		Parasitoid Wasp	WG 40	46817020	Supplemental, Non-guideline
		Predatory Mite	WG 40	46817019	Supplemental, Non-guideline
		Ladybird Beetle (45 day study)	480 SC	46817015	Supplemental, Non-guideline
		Ladybird Beetle (Extended Study)	480 SC	46817016	Supplemental, Non-guideline
		Ladybird Beetle (Life Cycle Test)	480 SC	46817017	Supplemental, Non-guideline
		Parasitic Wasp (Side Effects Tests)	480 SC	46817021	Supplemental, Non-guideline
		White springtail (Reproduction Test)	480 SC	46817027	Supplemental
		Green lacewing (Extended Study)	480 SC	46817018	Supplemental

APPENDIX B: PRZM/ EXAMS Modeling Crop Application Scenarios and EECs

APPENDIX C: PRZM EXAMS Example Output File – MS Soybean

Appendix

stored as FLMSSoyA.out
Chemical: Flubendiamide
PRZM environment: MSsoybeanSTD.txt modified Tueday, 29 May 2007 at 12:58:06
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w03940.dvf modified Tueday, 26 August 2008 at 05:14:14
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.248	1.171	1.047	0.932	0.8196	0.4485
1962	1.319	1.29	1.194	1.092	1.083	0.9905
1963	2.81	2.707	2.39	2.049	1.932	1.557
1964	3.442	3.354	3.081	2.829	2.82	2.322
1965	4.346	4.225	3.859	3.467	3.33	2.89
1966	4	3.952	3.76	3.561	3.488	3.304
1967	3.951	3.901	3.824	3.765	3.716	3.507
1968	4.008	3.972	3.858	3.734	3.694	3.625
1969	4.036	3.993	3.864	3.726	3.731	3.631
1970	4.685	4.621	4.483	4.303	4.234	3.917
1971	4.83	4.778	4.626	4.361	4.34	4.176
1972	4.618	4.582	4.494	4.378	4.349	4.26
1973	4.569	4.533	4.382	4.27	4.238	4.164
1974	5.02	4.958	4.772	4.546	4.489	4.402
1975	5.968	5.897	5.708	5.381	5.278	4.847
1976	5.544	5.491	5.326	5.188	5.172	5.006
1977	5.579	5.53	5.38	5.18	5.11	5.022
1978	5.597	5.537	5.354	5.112	5.076	5.019
1979	7.799	7.664	7.239	6.827	6.688	5.997
1980	6.437	6.398	6.293	6.218	6.191	6.022
1981	7.564	7.47	7.054	6.576	6.421	6
1982	7.467	7.352	7.081	6.984	6.888	6.384
1983	6.95	6.884	6.766	6.6	6.557	6.428
1984	6.949	6.907	6.706	6.594	6.48	6.393
1985	7.207	7.121	6.851	6.554	6.495	6.324
1986	6.564	6.515	6.367	6.301	6.244	6.118
1987	7.232	7.135	6.89	6.536	6.413	6.074
1988	6.199	6.161	6.043	5.961	5.943	5.883
1989	7.271	7.161	6.908	6.603	6.443	6.052
1990	6.328	6.29	6.214	6.169	6.129	5.931
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	7.799	7.664	7.239	6.984	6.888	6.428
0.0645161290322581	7.564	7.47	7.081	6.827	6.688	6.393
0.0967741935483871	7.467	7.352	7.054	6.603	6.557	6.384

0.129032258064516	7.271	7.161	6.908	6.6	6.495	6.324
0.161290322580645	7.232	7.135	6.89	6.594	6.48	6.118
0.193548387096774	7.207	7.121	6.851	6.576	6.443	6.074
0.225806451612903	6.95	6.907	6.766	6.554	6.421	6.052
0.258064516129032	6.949	6.884	6.706	6.536	6.413	6.022
0.290322580645161	6.564	6.515	6.367	6.301	6.244	6
0.32258064516129	6.437	6.398	6.293	6.218	6.191	5.997
0.354838709677419	6.328	6.29	6.214	6.169	6.129	5.931
0.387096774193548	6.199	6.161	6.043	5.961	5.943	5.883
0.419354838709677	5.968	5.897	5.708	5.381	5.278	5.022
0.451612903225806	5.597	5.537	5.38	5.188	5.172	5.019
0.483870967741936	5.579	5.53	5.354	5.18	5.11	5.006
0.516129032258065	5.544	5.491	5.326	5.112	5.076	4.847
0.548387096774194	5.02	4.958	4.772	4.546	4.489	4.402
0.580645161290323	4.83	4.778	4.626	4.378	4.349	4.26
0.612903225806452	4.685	4.621	4.494	4.361	4.34	4.176
0.645161290322581	4.618	4.582	4.483	4.303	4.238	4.164
0.67741935483871	4.569	4.533	4.382	4.27	4.234	3.917
0.709677419354839	4.346	4.225	3.864	3.765	3.731	3.631
0.741935483870968	4.036	3.993	3.859	3.734	3.716	3.625
0.774193548387097	4.008	3.972	3.858	3.726	3.694	3.507
0.806451612903226	4	3.952	3.824	3.561	3.488	3.304
0.838709677419355	3.951	3.901	3.76	3.467	3.33	2.89
0.870967741935484	3.442	3.354	3.081	2.829	2.82	2.322
0.903225806451613	2.81	2.707	2.39	2.049	1.932	1.557
0.935483870967742	1.319	1.29	1.194	1.092	1.083	0.9905
0.967741935483871	1.248	1.171	1.047	0.932	0.8196	0.4485
0.1	7.4474	7.3329	7.0394	6.6027	6.5508	6.378

Average of yearly averages:

4.55646666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: FLMSSoyA
Metfile: w03940.dvf
PRZM scenario: MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7	0	days	Half-life	
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.1052	kg/ha	

```
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  01-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    5     days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1052      kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)


stored as FLMSSoyG.out
Chemical: Flubendiamide
PRZM environment: MSsoybeanSTD.txt  modified Tueday, 29 May 2007 at
12:58:06
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w03940.dvf     modified Tueday, 26 August 2008 at 05:14:14
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.083	1.053	0.9786	0.8583	0.7403	0.3826
1962	1.078	1.062	0.9399	0.8944	0.8884	0.8434
1963	2.558	2.457	2.144	1.81	1.696	1.345
1964	3.216	3.124	2.841	2.583	2.575	2.067
1965	4.086	3.961	3.583	3.179	3.039	2.592
1966	3.651	3.603	3.408	3.209	3.136	2.964
1967	3.523	3.493	3.41	3.266	3.26	3.122
1968	3.451	3.43	3.383	3.325	3.298	3.199
1969	3.604	3.518	3.39	3.241	3.204	3.168
1970	4.237	4.171	4.028	3.841	3.772	3.435
1971	4.376	4.322	4.165	3.886	3.855	3.679
1972	4.037	4.016	3.98	3.915	3.888	3.748
1973	4.076	4.039	3.844	3.785	3.754	3.63
1974	4.258	4.224	4.08	3.942	3.932	3.864
1975	5.436	5.364	5.168	4.843	4.744	4.311
1976	4.919	4.871	4.719	4.594	4.601	4.462
1977	5.068	5.017	4.864	4.653	4.566	4.466
1978	5.082	5.02	4.832	4.58	4.558	4.455
1979	7.264	7.129	6.703	6.291	6.159	5.466
1980	5.794	5.782	5.762	5.726	5.701	5.483
1981	6.968	6.879	6.472	6.008	5.862	5.46
1982	6.892	6.804	6.545	6.394	6.319	5.856
1983	6.46	6.392	6.271	6.116	6.074	5.896
1984	6.442	6.398	6.192	6.082	5.961	5.853
1985	6.672	6.584	6.309	6.011	5.956	5.778
1986	5.824	5.795	5.71	5.643	5.599	5.562
1987	6.53	6.443	6.223	5.913	5.798	5.516
1988	5.601	5.556	5.48	5.411	5.397	5.315

1989	6.453	6.363	6.177	5.941	5.805	5.489
1990	5.748	5.726	5.692	5.645	5.606	5.36
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	7.264	7.129	6.703	6.394	6.319	5.896
0.0645161290322581	6.968	6.879	6.545	6.291	6.159	5.856
0.0967741935483871	6.892	6.804	6.472	6.116	6.074	5.853
0.129032258064516	6.672	6.584	6.309	6.082	5.961	5.778
0.161290322580645	6.53	6.443	6.271	6.011	5.956	5.562
0.193548387096774	6.46	6.398	6.223	6.008	5.862	5.516
0.225806451612903	6.453	6.392	6.192	5.941	5.805	5.489
0.258064516129032	6.442	6.363	6.177	5.913	5.798	5.483
0.290322580645161	5.824	5.795	5.762	5.726	5.701	5.466
0.32258064516129	5.794	5.782	5.71	5.645	5.606	5.46
0.354838709677419	5.748	5.726	5.692	5.643	5.599	5.36
0.387096774193548	5.601	5.556	5.48	5.411	5.397	5.315
0.419354838709677	5.436	5.364	5.168	4.843	4.744	4.466
0.451612903225806	5.082	5.02	4.864	4.653	4.601	4.462
0.483870967741936	5.068	5.017	4.832	4.594	4.566	4.455
0.516129032258065	4.919	4.871	4.719	4.58	4.558	4.311
0.548387096774194	4.376	4.322	4.165	3.942	3.932	3.864
0.580645161290323	4.258	4.224	4.08	3.915	3.888	3.748
0.612903225806452	4.237	4.171	4.028	3.886	3.855	3.679
0.645161290322581	4.086	4.039	3.98	3.841	3.772	3.63
0.67741935483871	4.076	4.016	3.844	3.785	3.754	3.435
0.709677419354839	4.037	3.961	3.583	3.325	3.298	3.199
0.741935483870968	3.651	3.603	3.41	3.266	3.26	3.168
0.774193548387097	3.604	3.518	3.408	3.241	3.204	3.122
0.806451612903226	3.523	3.493	3.39	3.209	3.136	2.964
0.838709677419355	3.451	3.43	3.383	3.179	3.039	2.592
0.870967741935484	3.216	3.124	2.841	2.583	2.575	2.067
0.903225806451613	2.558	2.457	2.144	1.81	1.696	1.345
0.935483870967742	1.083	1.062	0.9786	0.8944	0.8884	0.8434
0.967741935483871	1.078	1.053	0.9399	0.8583	0.7403	0.3826
0.1	6.87	6.782	6.4557	6.1126	6.0627	5.8455

Average of yearly averages:

4.09223333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: FLMSSoyG
Metfile: w03940.dvf
PRZM scenario: MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	

```
Photolysis half-life    kdp   11.58 days  Half-life
Aerobic Aquatic Metabolism    kbacw 0     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 1092  days  Halfife
Aerobic Soil Metabolism asm   0     days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.1052      kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  01-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    5     days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1052      kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)


stored as FLORCTA.out
Chemical: Flubendiamide
PRZM environment: ORXmasTreeSTD.txt modified Tueday, 21 February 2006
at 14:39:00
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24232.dvf     modified Tueday, 26 August 2008 at 05:15:54
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.7753	0.7246	0.5694	0.4203	0.3652	0.1976
1962	1.077	1.026	0.8681	0.7169	0.6596	0.511
1963	1.636	1.571	1.372	1.175	1.102	0.8981
1964	1.763	1.712	1.554	1.402	1.342	1.183
1965	2.089	2.038	1.879	1.726	1.665	1.512
1966	2.37	2.319	2.159	2.004	1.941	1.792
1967	2.61	2.559	2.399	2.243	2.179	2.01
1968	2.779	2.728	2.568	2.412	2.348	2.208
1969	2.959	2.907	2.746	2.598	2.55	2.39
1970	3.173	3.121	2.959	2.802	2.735	2.559
1971	3.294	3.242	3.081	2.924	2.859	2.7
1972	3.404	3.352	3.205	3.044	2.975	2.789
1973	3.501	3.448	3.287	3.128	3.06	2.91
1974	3.648	3.596	3.435	3.276	3.207	3.035
1975	3.734	3.681	3.519	3.36	3.292	3.114
1976	3.782	3.73	3.567	3.408	3.34	3.141
1977	3.733	3.681	3.52	3.361	3.292	3.117
1978	3.873	3.835	3.726	3.537	3.458	3.233
1979	3.877	3.824	3.66	3.499	3.428	3.271
1980	3.941	3.889	3.727	3.568	3.499	3.336
1981	4.124	4.071	3.909	3.764	3.696	3.55

1982	4.237	4.184	4.021	3.86	3.788	3.604
1983	4.261	4.208	4.044	3.883	3.812	3.633
1984	4.266	4.211	4.042	3.882	3.809	3.625
1985	4.265	4.212	4.05	3.944	3.879	3.662
1986	4.283	4.23	4.067	3.905	3.832	3.637
1987	4.245	4.193	4.029	3.866	3.814	3.66
1988	4.429	4.377	4.214	4.052	3.979	3.797
1989	4.399	4.347	4.183	4.02	3.948	3.782
1990	4.526	4.474	4.31	4.148	4.075	3.899
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	4.526	4.474	4.31	4.148	4.075	3.899
0.0645161290322581	4.429	4.377	4.214	4.052	3.979	3.797
0.0967741935483871	4.399	4.347	4.183	4.02	3.948	3.782
0.129032258064516	4.283	4.23	4.067	3.944	3.879	3.662
0.161290322580645	4.266	4.212	4.05	3.905	3.832	3.66
0.193548387096774	4.265	4.211	4.044	3.883	3.814	3.637
0.225806451612903	4.261	4.208	4.042	3.882	3.812	3.633
0.258064516129032	4.245	4.193	4.029	3.866	3.809	3.625
0.290322580645161	4.237	4.184	4.021	3.86	3.788	3.604
0.32258064516129	4.124	4.071	3.909	3.764	3.696	3.55
0.354838709677419	3.941	3.889	3.727	3.568	3.499	3.336
0.387096774193548	3.877	3.835	3.726	3.537	3.458	3.271
0.419354838709677	3.873	3.824	3.66	3.499	3.428	3.233
0.451612903225806	3.782	3.73	3.567	3.408	3.34	3.141
0.483870967741936	3.734	3.681	3.52	3.361	3.292	3.117
0.516129032258065	3.733	3.681	3.519	3.36	3.292	3.114
0.548387096774194	3.648	3.596	3.435	3.276	3.207	3.035
0.580645161290323	3.501	3.448	3.287	3.128	3.06	2.91
0.612903225806452	3.404	3.352	3.205	3.044	2.975	2.789
0.645161290322581	3.294	3.242	3.081	2.924	2.859	2.7
0.67741935483871	3.173	3.121	2.959	2.802	2.735	2.559
0.709677419354839	2.959	2.907	2.746	2.598	2.55	2.39
0.741935483870968	2.779	2.728	2.568	2.412	2.348	2.208
0.774193548387097	2.61	2.559	2.399	2.243	2.179	2.01
0.806451612903226	2.37	2.319	2.159	2.004	1.941	1.792
0.838709677419355	2.089	2.038	1.879	1.726	1.665	1.512
0.870967741935484	1.763	1.712	1.554	1.402	1.342	1.183
0.903225806451613	1.636	1.571	1.372	1.175	1.102	0.8981
0.935483870967742	1.077	1.026	0.8681	0.7169	0.6596	0.511
0.967741935483871	0.7753	0.7246	0.5694	0.4203	0.3652	0.1976
0.1	4.3874	4.3353	4.1714	4.0124	3.9411	3.77

Average of yearly averages:

2.75852333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: FLORCTA
Metfile: w24232.dvf
PRZM scenario: ORXmasTreeSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

```
Description Variable Name     Value Units Comments
Molecular weight  mwt    682.4 g/mol
Henry's Law Const.       henry 8.9e-11      atm-m^3/mol
Vapor Pressure    vapr   7.5e-7       torr
Solubility  sol    0.04   mg/L
Kd    Kd           mg/L
Koc   Koc    1954.2       mg/L
Photolysis half-life     kdp    11.58 days   Half-life
Aerobic Aquatic Metabolism     kbacw 0      days  Halfife
Anaerobic Aquatic Metabolism   kbacs 1092   days  Halfife
Aerobic Soil Metabolism asm    0      days  Halfife
Hydrolysis: pH 7  0      days  Half-life
Method:      CAM   2      integer      See PRZM manual
Incorporation Depth:     DEPI  0      cm
Application Rate: TAPP   0.1747       kg/ha
Application Efficiency: APPEFF       0.95  fraction
Spray Drift DRFT  0.05   fraction of application rate applied to pond
Application Date  Date   01-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval     7      days  Set to 0 or delete line for single
app.
app. rate 1 apprate      0.1747       kg/ha
Record 17:  FILTRA
      IPSCND       1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC       0.5
Flag for Index Res. Run IR     EPA Pond
Flag for runoff calc.    RUNOFF       none  none, monthly or
total(average of entire run)


stored as FLORCTG.out
Chemical: Flubendiamide
PRZM environment: ORXmasTreeSTD.txt modified Tueday, 21 February 2006
at 14:39:00
EXAMS environment: pond298.exv       modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24232.dvf      modified Tueday, 26 August 2008 at 05:15:54
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.2206	0.2099	0.1449	0.1004	0.08658	0.04771
1962	0.5001	0.4794	0.4182	0.3249	0.2932	0.1926
1963	0.6986	0.6733	0.6063	0.5527	0.518	0.4304
1964	1.068	1.046	0.8274	0.6758	0.6309	0.5769
1965	1.096	1.077	0.891	0.8647	0.82	0.7828
1966	1.241	1.227	1.163	1.062	1.004	0.9518
1967	1.217	1.206	1.17	1.123	1.094	1.07
1968	1.345	1.336	1.291	1.26	1.256	1.179
1969	1.496	1.484	1.456	1.4	1.354	1.273
1970	1.552	1.477	1.451	1.408	1.39	1.366
1971	1.565	1.551	1.506	1.467	1.458	1.433
1972	1.652	1.635	1.549	1.508	1.489	1.456
1973	1.872	1.842	1.769	1.673	1.593	1.518
1974	1.792	1.775	1.718	1.67	1.618	1.59

1975	1.745	1.734	1.699	1.664	1.645	1.621
1976	1.744	1.733	1.698	1.663	1.645	1.599
1977	1.773	1.755	1.708	1.612	1.566	1.53
1978	1.875	1.853	1.79	1.715	1.685	1.615
1979	1.784	1.767	1.713	1.665	1.656	1.62
1980	2.186	2.149	1.984	1.797	1.722	1.658
1981	2.072	2.046	2.007	1.963	1.944	1.852
1982	2.054	2.038	1.994	1.93	1.91	1.883
1983	2.017	2.006	1.97	1.934	1.918	1.891
1984	2.046	2.027	1.986	1.953	1.902	1.863
1985	2.091	2.075	2.019	1.96	1.942	1.882
1986	1.982	1.971	1.936	1.899	1.879	1.84
1987	2.419	2.376	2.292	2.008	1.931	1.854
1988	2.161	2.146	2.114	2.065	2.039	1.986
1989	2.444	2.404	2.281	2.072	2.008	1.959
1990	2.225	2.212	2.162	2.143	2.12	2.071
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	2.444	2.404	2.292	2.143	2.12	2.071
0.0645161290322581	2.419	2.376	2.281	2.072	2.039	1.986
0.0967741935483871	2.225	2.212	2.162	2.065	2.008	1.959
0.129032258064516	2.186	2.149	2.114	2.008	1.944	1.891
0.161290322580645	2.161	2.146	2.019	1.963	1.942	1.883
0.193548387096774	2.091	2.075	2.007	1.96	1.931	1.882
0.225806451612903	2.072	2.046	1.994	1.953	1.918	1.863
0.258064516129032	2.054	2.038	1.986	1.934	1.91	1.854
0.290322580645161	2.046	2.027	1.984	1.93	1.902	1.852
0.32258064516129	2.017	2.006	1.97	1.899	1.879	1.84
0.354838709677419	1.982	1.971	1.936	1.797	1.722	1.658
0.387096774193548	1.875	1.853	1.79	1.715	1.685	1.621
0.419354838709677	1.872	1.842	1.769	1.673	1.656	1.62
0.451612903225806	1.792	1.775	1.718	1.67	1.645	1.615
0.483870967741936	1.784	1.767	1.713	1.665	1.645	1.599
0.516129032258065	1.773	1.755	1.708	1.664	1.618	1.59
0.548387096774194	1.745	1.734	1.699	1.663	1.593	1.53
0.580645161290323	1.744	1.733	1.698	1.612	1.566	1.518
0.612903225806452	1.652	1.635	1.549	1.508	1.489	1.456
0.645161290322581	1.565	1.551	1.506	1.467	1.458	1.433
0.67741935483871	1.552	1.484	1.456	1.408	1.39	1.366
0.709677419354839	1.496	1.477	1.451	1.4	1.354	1.273
0.741935483870968	1.345	1.336	1.291	1.26	1.256	1.179
0.774193548387097	1.241	1.227	1.17	1.123	1.094	1.07
0.806451612903226	1.217	1.206	1.163	1.062	1.004	0.9518
0.838709677419355	1.096	1.077	0.891	0.8647	0.82	0.7828
0.870967741935484	1.068	1.046	0.8274	0.6758	0.6309	0.5769
0.903225806451613	0.6986	0.6733	0.6063	0.5527	0.518	0.4304
0.935483870967742	0.5001	0.4794	0.4182	0.3249	0.2932	0.1926
0.967741935483871	0.2206	0.2099	0.1449	0.1004	0.08658	0.04771
0.1	2.2211	2.2057	2.1572	2.0593	2.0016	1.9522

Average of yearly averages: 1.419707

Inputs generated by pe5.pl - Novemeber 2006

```
Data used for this run:
Output File: FLORCTG
Metfile:    w24232.dvf
PRZM scenario:    ORXmasTreeSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:    Flubendiamide
Description Variable Name     Value Units Comments
Molecular weight  mwt   682.4 g/mol
Henry's Law Const.      henry 8.9e-11     atm-m^3/mol
Vapor Pressure    vapr  7.5e-7      torr
Solubility  sol   0.04  mg/L
Kd    Kd          mg/L
Koc   Koc   1954.2      mg/L
Photolysis half-life    kdp   11.58 days  Half-life
Aerobic Aquatic Metabolism    kbacw 0     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 1092  days  Halfife
Aerobic Soil Metabolism asm   0     days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.1747      kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  01-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    7     days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1747      kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)


stored as ILBNA.out
Chemical: Flubendiamide
PRZM environment: ILbeansNMC.txt    modified Thuday, 14 June 2007 at
10:16:26
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w14842.dvf     modified Tueday, 26 August 2008 at 05:15:08
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	2.615	2.522	2.168	1.851	1.713	0.6487
1962	2.19	2.141	2.021	1.978	1.947	1.665
1963	3.502	3.42	3.192	2.983	2.905	2.455
1964	3.968	3.92	3.8	3.59	3.583	3.199
1965	6.183	6.117	5.9	5.633	5.477	4.826
1966	6.899	6.791	6.523	6.239	6.201	5.691
1967	7.302	7.22	7.008	6.766	6.727	6.39

1968	7.731	7.655	7.553	7.296	7.236	6.877
1969	8.433	8.373	8.155	7.874	7.759	7.388
1970	9.65	9.527	9.163	8.858	8.728	8.049
1971	9.777	9.668	9.385	9.065	8.938	8.502
1972	9.115	9.078	8.947	8.807	8.824	8.639
1973	9.941	9.851	9.592	9.321	9.312	9.002
1974	9.523	9.474	9.401	9.237	9.178	9.1
1975	10.53	10.41	10.06	9.946	9.822	9.357
1976	10	9.957	9.87	9.788	9.704	9.598
1977	11.02	10.94	10.64	10.35	10.26	9.741
1978	10.82	10.74	10.48	10.19	10.07	9.853
1979	11.03	10.94	10.66	10.39	10.25	9.965
1980	10.86	10.8	10.61	10.51	10.42	10.14
1981	11.91	11.79	11.68	11.4	11.19	10.5
1982	12.45	12.32	11.93	11.69	11.57	11.01
1983	11.62	11.57	11.47	11.43	11.37	11.27
1984	11.48	11.44	11.39	11.24	11.2	11.12
1985	11.51	11.45	11.28	11.16	11.1	11
1986	12.46	12.36	12.06	11.64	11.56	11.15
1987	11.41	11.36	11.29	11.24	11.2	11
1988	10.96	10.94	10.88	10.84	10.8	10.51
1989	10.38	10.36	10.3	10.23	10.21	10.06
1990	11.67	11.55	11.35	11.08	10.92	10.33
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	12.46	12.36	12.06	11.69	11.57	11.27
0.0645161290322581	12.45	12.32	11.93	11.64	11.56	11.15
0.0967741935483871	11.91	11.79	11.68	11.43	11.37	11.12
0.129032258064516	11.67	11.57	11.47	11.4	11.2	11.01
0.161290322580645	11.62	11.55	11.39	11.24	11.2	11
0.193548387096774	11.51	11.45	11.35	11.24	11.19	11
0.225806451612903	11.48	11.44	11.29	11.16	11.1	10.51
0.258064516129032	11.41	11.36	11.28	11.08	10.92	10.5
0.290322580645161	11.03	10.94	10.88	10.84	10.8	10.33
0.32258064516129	11.02	10.94	10.66	10.51	10.42	10.14
0.354838709677419	10.96	10.94	10.64	10.39	10.26	10.06
0.387096774193548	10.86	10.8	10.61	10.35	10.25	9.965
0.419354838709677	10.82	10.74	10.48	10.23	10.21	9.853
0.451612903225806	10.53	10.41	10.3	10.19	10.07	9.741
0.483870967741936	10.38	10.36	10.06	9.946	9.822	9.598
0.516129032258065	10	9.957	9.87	9.788	9.704	9.357
0.548387096774194	9.941	9.851	9.592	9.321	9.312	9.1
0.580645161290323	9.777	9.668	9.401	9.237	9.178	9.002
0.612903225806452	9.65	9.527	9.385	9.065	8.938	8.639
0.645161290322581	9.523	9.474	9.163	8.858	8.824	8.502
0.67741935483871	9.115	9.078	8.947	8.807	8.728	8.049
0.709677419354839	8.433	8.373	8.155	7.874	7.759	7.388
0.741935483870968	7.731	7.655	7.553	7.296	7.236	6.877
0.774193548387097	7.302	7.22	7.008	6.766	6.727	6.39
0.806451612903226	6.899	6.791	6.523	6.239	6.201	5.691
0.838709677419355	6.183	6.117	5.9	5.633	5.477	4.826
0.870967741935484	3.968	3.92	3.8	3.59	3.583	3.199
0.903225806451613	3.502	3.42	3.192	2.983	2.905	2.455

0.935483870967742	2.615	2.522	2.168	1.978	1.947	1.665
0.967741935483871	2.19	2.141	2.021	1.851	1.713	0.6487
0.1	11.886	11.768	11.659	11.427	11.353	11.109

Average of yearly averages: 8.30119

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ILBNA
Metfile: w14842.dvf
PRZM scenario: ILbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7	0	days	Half-life	
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.1052	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	
Application Date	Date	01-07	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	5	days	Set to 0 or delete line for single app.
app. rate 1	apprate	0.1052	kg/ha	

Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

stored as ILBNG.out
Chemical: Flubendiamide
PRZM environment: ILbeansNMC.txt modified Thuday, 14 June 2007 at 10:16:26
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w14842.dvf modified Tueday, 26 August 2008 at 05:15:08
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly

1961	2.602	2.505	2.137	1.808	1.666	0.5998
1962	1.991	1.964	1.882	1.837	1.806	1.548
1963	3.119	3.053	2.874	2.719	2.659	2.272
1964	3.735	3.686	3.561	3.341	3.331	2.958
1965	5.949	5.881	5.657	5.379	5.221	4.572
1966	6.526	6.423	6.173	5.91	5.883	5.401
1967	6.869	6.794	6.605	6.436	6.396	6.063
1968	7.187	7.129	7.003	6.818	6.791	6.509
1969	8.058	7.996	7.771	7.476	7.363	6.987
1970	9.272	9.144	8.768	8.454	8.322	7.627
1971	9.108	9.017	8.785	8.532	8.428	8.056
1972	8.629	8.591	8.46	8.322	8.293	8.162
1973	9.307	9.226	9.002	8.827	8.784	8.503
1974	8.895	8.848	8.773	8.72	8.694	8.574
1975	9.869	9.763	9.434	9.361	9.249	8.811
1976	9.34	9.305	9.239	9.138	9.127	9.039
1977	10.41	10.34	10.04	9.757	9.682	9.164
1978	9.979	9.918	9.722	9.48	9.401	9.26
1979	10.32	10.24	9.982	9.707	9.577	9.357
1980	10.28	10.2	9.966	9.885	9.804	9.525
1981	11.25	11.14	11.02	10.75	10.55	9.891
1982	11.71	11.59	11.23	10.98	10.89	10.41
1983	11.06	11.02	10.92	10.88	10.82	10.67
1984	10.86	10.82	10.75	10.67	10.64	10.51
1985	10.91	10.86	10.68	10.58	10.51	10.38
1986	11.61	11.52	11.25	11.01	10.92	10.52
1987	10.71	10.7	10.68	10.63	10.6	10.36
1988	10.34	10.32	10.26	10.22	10.18	9.857
1989	9.742	9.719	9.658	9.588	9.574	9.377
1990	10.89	10.77	10.6	10.37	10.21	9.657
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	11.71	11.59	11.25	11.01	10.92	10.67
0.0645161290322581	11.61	11.52	11.23	10.98	10.89	10.52
0.0967741935483871	11.25	11.14	11.02	10.88	10.82	10.51
0.129032258064516	11.06	11.02	10.92	10.75	10.64	10.41
0.161290322580645	10.91	10.86	10.75	10.67	10.6	10.38
0.193548387096774	10.89	10.82	10.68	10.63	10.55	10.36
0.225806451612903	10.86	10.77	10.68	10.58	10.51	9.891
0.258064516129032	10.71	10.7	10.6	10.37	10.21	9.857
0.290322580645161	10.41	10.34	10.26	10.22	10.18	9.657
0.32258064516129	10.34	10.32	10.04	9.885	9.804	9.525
0.354838709677419	10.32	10.24	9.982	9.757	9.682	9.377
0.387096774193548	10.28	10.2	9.966	9.707	9.577	9.357
0.419354838709677	9.979	9.918	9.722	9.588	9.574	9.26
0.451612903225806	9.869	9.763	9.658	9.48	9.401	9.164
0.483870967741936	9.742	9.719	9.434	9.361	9.249	9.039
0.516129032258065	9.34	9.305	9.239	9.138	9.127	8.811
0.548387096774194	9.307	9.226	9.002	8.827	8.784	8.574
0.580645161290323	9.272	9.144	8.785	8.72	8.694	8.503
0.612903225806452	9.108	9.017	8.773	8.532	8.428	8.162
0.645161290322581	8.895	8.848	8.768	8.454	8.322	8.056
0.67741935483871	8.629	8.591	8.46	8.322	8.293	7.627

0.709677419354839	8.058	7.996	7.771	7.476	7.363	6.987
0.741935483870968	7.187	7.129	7.003	6.818	6.791	6.509
0.774193548387097	6.869	6.794	6.605	6.436	6.396	6.063
0.806451612903226	6.526	6.423	6.173	5.91	5.883	5.401
0.838709677419355	5.949	5.881	5.657	5.379	5.221	4.572
0.870967741935484	3.735	3.686	3.561	3.341	3.331	2.958
0.903225806451613	3.119	3.053	2.874	2.719	2.659	2.272
0.935483870967742	2.602	2.505	2.137	1.837	1.806	1.548
0.967741935483871	1.991	1.964	1.882	1.808	1.666	0.5998
0.1	11.231	11.128	11.01	10.867	10.802	10.5

Average of yearly averages: 7.82066

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ILBNG
Metfile: w14842.dvf
PRZM scenario: ILbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide
Description Variable Name Value Units Comments
Molecular weight mwt 682.4 g/mol
Henry's Law Const. henry 8.9e-11 atm-m^3/mol
Vapor Pressure vapr 7.5e-7 torr
Solubility sol 0.04 mg/L
Kd Kd mg/L
Koc Koc 1954.2 mg/L
Photolysis half-life kdp 11.58 days Half-life
Aerobic Aquatic Metabolism kbacw 0 days Halfife
Anaerobic Aquatic Metabolism kbacs 1092 days Halfife
Aerobic Soil Metabolism asm 0 days Halfife
Hydrolysis: pH 7 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.1052 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 5 days Set to 0 or delete line for single app.
app. rate 1 apprate 0.1052 kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

stored as MIBNA.out
Chemical: Flubendiamide

PRZM environment: MIbeansSTD.txt modified Tueday, 29 May 2007 at 12:56:44
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w14826.dvf modified Tueday, 26 August 2008 at 05:15:04
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.899	0.8551	0.758	0.6631	0.6293	0.2679
1962	1.204	1.166	1.085	0.9933	0.9627	0.7783
1963	1.488	1.453	1.359	1.303	1.291	1.112
1964	2.515	2.448	2.239	2.054	2.016	1.666
1965	3.087	3.02	2.812	2.665	2.591	2.279
1966	3.069	3.037	2.946	2.838	2.811	2.679
1967	3.619	3.574	3.477	3.431	3.391	3.139
1968	5.603	5.474	5.071	4.641	4.498	3.93
1969	5.385	5.32	5.238	5.047	4.94	4.647
1970	5.797	5.724	5.494	5.37	5.339	5.03
1971	5.905	5.853	5.712	5.568	5.504	5.347
1972	6.78	6.696	6.434	6.221	6.197	5.874
1973	6.809	6.763	6.659	6.511	6.432	6.287
1974	7.029	6.988	6.866	6.751	6.735	6.617
1975	8.805	8.657	8.5	8.021	7.833	7.079
1976	8.003	7.956	7.829	7.654	7.655	7.53
1977	7.866	7.82	7.7	7.565	7.507	7.446
1978	7.667	7.628	7.531	7.408	7.405	7.334
1979	7.797	7.745	7.643	7.498	7.404	7.253
1980	8.33	8.242	8.003	7.822	7.791	7.426
1981	8.622	8.548	8.341	8.129	8.065	7.734
1982	8.164	8.125	8.068	7.943	7.916	7.838
1983	8.192	8.147	8.02	7.938	7.9	7.8
1984	8.171	8.13	8.045	7.97	7.921	7.784
1985	9.511	9.397	9.095	8.768	8.662	8.165
1986	9.876	9.782	9.558	9.226	9.097	8.535
1987	9.255	9.193	9.052	8.858	8.778	8.67
1988	8.869	8.827	8.729	8.675	8.643	8.588
1989	9.301	9.248	9.062	8.904	8.859	8.633
1990	8.992	8.946	8.801	8.728	8.691	8.597
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	9.876	9.782	9.558	9.226	9.097	8.67
0.0645161290322581	9.511	9.397	9.095	8.904	8.859	8.633
0.0967741935483871	9.301	9.248	9.062	8.858	8.778	8.597
0.129032258064516	9.255	9.193	9.052	8.768	8.691	8.588
0.161290322580645	8.992	8.946	8.801	8.728	8.662	8.535
0.193548387096774	8.869	8.827	8.729	8.675	8.643	8.165
0.225806451612903	8.805	8.657	8.5	8.129	8.065	7.838
0.258064516129032	8.622	8.548	8.341	8.021	7.921	7.8
0.290322580645161	8.33	8.242	8.068	7.97	7.916	7.784
0.32258064516129	8.192	8.147	8.045	7.943	7.9	7.734
0.354838709677419	8.171	8.13	8.02	7.938	7.833	7.53
0.387096774193548	8.164	8.125	8.003	7.822	7.791	7.446
0.419354838709677	8.003	7.956	7.829	7.654	7.655	7.426
0.451612903225806	7.866	7.82	7.7	7.565	7.507	7.334

0.483870967741936	7.797	7.745	7.643	7.498	7.405	7.253
0.516129032258065	7.667	7.628	7.531	7.408	7.404	7.079
0.548387096774194	7.029	6.988	6.866	6.751	6.735	6.617
0.580645161290323	6.809	6.763	6.659	6.511	6.432	6.287
0.612903225806452	6.78	6.696	6.434	6.221	6.197	5.874
0.645161290322581	5.905	5.853	5.712	5.568	5.504	5.347
0.67741935483871	5.797	5.724	5.494	5.37	5.339	5.03
0.709677419354839	5.603	5.474	5.238	5.047	4.94	4.647
0.741935483870968	5.385	5.32	5.071	4.641	4.498	3.93
0.774193548387097	3.619	3.574	3.477	3.431	3.391	3.139
0.806451612903226	3.087	3.037	2.946	2.838	2.811	2.679
0.838709677419355	3.069	3.02	2.812	2.665	2.591	2.279
0.870967741935484	2.515	2.448	2.239	2.054	2.016	1.666
0.903225806451613	1.488	1.453	1.359	1.303	1.291	1.112
0.935483870967742	1.204	1.166	1.085	0.9933	0.9627	0.7783
0.967741935483871	0.899	0.8551	0.758	0.6631	0.6293	0.2679
0.1	9.2964	9.2425	9.061	8.849	8.7693	8.5961

Average of yearly averages: 5.86884

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MIBNA
Metfile: w14826.dvf
PRZM scenario: MIbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11		atm-m^3/mol
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7	0	days	Half-life	
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.1052	kg/ha	
Application Efficiency:	APPEFF		0.95	fraction
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	
Application Date	Date	01-07	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	5	days	Set to 0 or delete line for single app.
app. rate 1	apprate	0.1052	kg/ha	

Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond

Flag for runoff calc. RUNOFF none none; monthly or total(average of entire run)

stored as MIBNG.out
Chemical: Flubendiamide
PRZM environment: MIbeansSTD.txt modified Tueday, 29 May 2007 at 12:56:44
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w14826.dvf modified Tueday, 26 August 2008 at 05:15:04
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.7973	0.7534	0.6554	0.5621	0.5304	0.2028
1962	0.8374	0.826	0.7999	0.7675	0.7531	0.6226
1963	1.048	1.033	1.008	0.9897	0.9728	0.8681
1964	1.973	1.924	1.772	1.638	1.631	1.353
1965	2.678	2.611	2.406	2.266	2.194	1.906
1966	2.467	2.449	2.393	2.361	2.322	2.246
1967	3.105	3.083	2.983	2.937	2.893	2.651
1968	5.083	4.952	4.544	4.113	3.97	3.41
1969	4.66	4.615	4.496	4.384	4.304	4.097
1970	5.004	4.963	4.858	4.777	4.748	4.441
1971	5.234	5.192	5.025	4.826	4.796	4.722
1972	5.949	5.878	5.705	5.57	5.536	5.228
1973	6.161	6.113	6.004	5.849	5.764	5.616
1974	6.289	6.256	6.15	6.04	6.028	5.925
1975	8.117	7.966	7.813	7.327	7.138	6.371
1976	7.167	7.134	7.077	6.966	6.937	6.814
1977	6.956	6.921	6.838	6.772	6.75	6.701
1978	6.862	6.836	6.745	6.649	6.626	6.557
1979	6.752	6.72	6.645	6.577	6.542	6.451
1980	7.254	7.202	7.048	6.908	6.907	6.609
1981	7.823	7.747	7.534	7.308	7.247	6.909
1982	7.185	7.157	7.103	7.046	7.03	6.999
1983	7.342	7.295	7.169	7.092	7.057	6.948
1984	7.162	7.131	7.068	7.001	6.967	6.919
1985	8.681	8.565	8.256	7.924	7.814	7.307
1986	9.066	8.969	8.736	8.393	8.257	7.679
1987	8.401	8.338	8.197	7.994	7.922	7.813
1988	8.007	7.965	7.882	7.798	7.786	7.725
1989	8.434	8.379	8.193	8.009	7.958	7.763
1990	8.136	8.089	7.941	7.864	7.823	7.718
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	9.066	8.969	8.736	8.393	8.257	7.813
0.0645161290322581	8.681	8.565	8.256	8.009	7.958	7.763
0.0967741935483871	8.434	8.379	8.197	7.994	7.922	7.725
0.129032258064516	8.401	8.338	8.193	7.924	7.823	7.718
0.161290322580645	8.136	8.089	7.941	7.864	7.814	7.679
0.193548387096774	8.117	7.966	7.882	7.798	7.786	7.307
0.225806451612903	8.007	7.965	7.813	7.327	7.247	6.999
0.258064516129032	7.823	7.747	7.534	7.308	7.138	6.948

0.290322580645161	7.342	7.295	7.169	7.092	7.057	6.919
0.32258064516129	7.254	7.202	7.103	7.046	7.03	6.909
0.354838709677419	7.185	7.157	7.077	7.001	6.967	6.814
0.387096774193548	7.167	7.134	7.068	6.966	6.937	6.701
0.419354838709677	7.162	7.131	7.048	6.908	6.907	6.609
0.451612903225806	6.956	6.921	6.838	6.772	6.75	6.557
0.483870967741936	6.862	6.836	6.745	6.649	6.626	6.451
0.516129032258065	6.752	6.72	6.645	6.577	6.542	6.371
0.548387096774194	6.289	6.256	6.15	6.04	6.028	5.925
0.580645161290323	6.161	6.113	6.004	5.849	5.764	5.616
0.612903225806452	5.949	5.878	5.705	5.57	5.536	5.228
0.645161290322581	5.234	5.192	5.025	4.826	4.796	4.722
0.67741935483871	5.083	4.963	4.858	4.777	4.748	4.441
0.709677419354839	5.004	4.952	4.544	4.384	4.304	4.097
0.741935483870968	4.66	4.615	4.496	4.113	3.97	3.41
0.774193548387097	3.105	3.083	2.983	2.937	2.893	2.651
0.806451612903226	2.678	2.611	2.406	2.361	2.322	2.246
0.838709677419355	2.467	2.449	2.393	2.266	2.194	1.906
0.870967741935484	1.973	1.924	1.772	1.638	1.631	1.353
0.903225806451613	1.048	1.033	1.008	0.9897	0.9728	0.8681
0.935483870967742	0.8374	0.826	0.7999	0.7675	0.7531	0.6226
0.967741935483871	0.7973	0.7534	0.6554	0.5621	0.5304	0.2028
0.1	8.4307	8.3749	8.1966	7.987	7.9121	7.7243

Average of yearly averages: 5.21905

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MIBNG
Metfile: w14826.dvf
PRZM scenario: MIbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11		atm-m^3/mol
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7	0	days	Half-life	
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.1052	kg/ha	
Application Efficiency:	APPEFF	0.99	fraction	
Spray Drift	DRFT	0.01	fraction of application rate applied to pond	
Application Date	Date	01-07	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	5	days	Set to 0 or delete line for single app.
app. rate 1	apprate	0.1052	kg/ha	

```
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)


stored as ORBNA.out
Chemical: Flubendiamide
PRZM environment: ORsnbeansSTD.txt  modified Tueday, 29 May 2007 at
13:01:06
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24232.dvf     modified Tueday, 26 August 2008 at 05:15:54
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.9303	0.8909	0.6981	0.4961	0.4095	0.1599
1962	1.93	1.876	1.768	1.535	1.442	0.8919
1963	2.636	2.597	2.486	2.393	2.245	1.891
1964	4.408	4.326	3.742	3.23	2.981	2.66
1965	4.713	4.671	4.132	4.015	3.833	3.616
1966	5.232	5.189	5.106	4.798	4.587	4.371
1967	5.607	5.573	5.426	5.172	5.061	4.855
1968	6.5	6.456	6.353	6.128	6.028	5.586
1969	7.09	7.043	6.923	6.683	6.588	6.233
1970	7.731	7.52	7.369	7.172	7.038	6.89
1971	7.946	7.905	7.856	7.657	7.573	7.393
1972	8.48	8.422	8.07	7.917	7.873	7.712
1973	9.319	9.244	9.085	8.838	8.457	8
1974	9.387	9.333	9.152	8.96	8.9	8.689
1975	9.331	9.278	9.119	8.997	8.887	8.756
1976	9.205	9.172	9.09	9.014	9.009	8.77
1977	9.734	9.651	9.392	8.884	8.657	8.442
1978	9.39	9.34	9.217	9.075	8.986	8.755
1979	9.316	9.267	9.181	9.074	8.972	8.762
1980	10.29	10.19	9.744	9.329	9.18	9.031
1981	10.4	10.35	10.27	10.02	9.867	9.425
1982	10.38	10.32	10.2	10.07	10.03	9.796
1983	10.35	10.33	10.28	10.2	10.17	9.988
1984	10.6	10.56	10.4	10.31	10.1	9.915
1985	10.18	10.15	10.07	10.02	9.995	9.837
1986	10.3	10.27	10.19	10.03	9.977	9.793
1987	11.12	11.02	10.79	10.12	10.02	9.865
1988	10.76	10.7	10.56	10.36	10.27	10.03
1989	10.68	10.61	10.38	10.13	10.14	9.945
1990	10.69	10.65	10.6	10.48	10.41	10.14
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	11.12	11.02	10.79	10.48	10.41	10.14

0.0645161290322581	10.76	10.7	10.6	10.36	10.27	10.03
0.0967741935483871	10.69	10.65	10.56	10.31	10.17	9.988
0.129032258064516	10.68	10.61	10.4	10.2	10.14	9.945
0.161290322580645	10.6	10.56	10.38	10.13	10.1	9.915
0.193548387096774	10.4	10.35	10.28	10.12	10.03	9.865
0.225806451612903	10.38	10.33	10.27	10.07	10.02	9.837
0.258064516129032	10.35	10.32	10.2	10.03	9.995	9.796
0.290322580645161	10.3	10.27	10.19	10.02	9.977	9.793
0.32258064516129	10.29	10.19	10.07	10.02	9.867	9.425
0.354838709677419	10.18	10.15	9.744	9.329	9.18	9.031
0.387096774193548	9.734	9.651	9.392	9.075	9.009	8.77
0.419354838709677	9.39	9.34	9.217	9.074	8.986	8.762
0.451612903225806	9.387	9.333	9.181	9.014	8.972	8.756
0.483870967741936	9.331	9.278	9.152	8.997	8.9	8.755
0.516129032258065	9.319	9.267	9.119	8.96	8.887	8.689
0.548387096774194	9.316	9.244	9.09	8.884	8.657	8.442
0.580645161290323	9.205	9.172	9.085	8.838	8.457	8
0.612903225806452	8.48	8.422	8.07	7.917	7.873	7.712
0.645161290322581	7.946	7.905	7.856	7.657	7.573	7.393
0.67741935483871	7.731	7.52	7.369	7.172	7.038	6.89
0.709677419354839	7.09	7.043	6.923	6.683	6.588	6.233
0.741935483870968	6.5	6.456	6.353	6.128	6.028	5.586
0.774193548387097	5.607	5.573	5.426	5.172	5.061	4.855
0.806451612903226	5.232	5.189	5.106	4.798	4.587	4.371
0.838709677419355	4.713	4.671	4.132	4.015	3.833	3.616
0.870967741935484	4.408	4.326	3.742	3.23	2.981	2.66
0.903225806451613	2.636	2.597	2.486	2.393	2.245	1.891
0.935483870967742	1.93	1.876	1.768	1.535	1.442	0.8919
0.967741935483871	0.9303	0.8909	0.6981	0.4961	0.4095	0.1599
0.1	10.689	10.646	10.544	10.299	10.167	9.9837

Average of yearly averages:

7.33992666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORBNA
Metfile: w24232.dvf
PRZM scenario: ORsnbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7	0	days	Half-life	
Method:	CAM	2	integer	See PRZM manual

```
Incorporation Depth:    DEPI  0      cm
Application Rate: TAPP  0.1052       kg/ha
Application Efficiency: APPEFF       0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    5      days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1052       kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF       none  none, monthly or
total(average of entire run)


stored as ORBNG.out
Chemical: Flubendiamide
PRZM environment: ORsnbeansSTD.txt  modified Tueday, 29 May 2007 at
13:01:06
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24232.dvf     modified Tueday, 26 August 2008 at 05:15:54
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.8527	0.8117	0.6108	0.3997	0.3087	0.09024
1962	1.787	1.731	1.619	1.375	1.278	0.7416
1963	2.424	2.384	2.268	2.172	2.017	1.681
1964	4.185	4.1	3.491	2.956	2.694	2.39
1965	4.424	4.381	3.816	3.694	3.503	3.303
1966	4.892	4.848	4.761	4.439	4.216	4.014
1967	5.22	5.185	5.033	4.766	4.648	4.452
1968	6.09	6.045	5.939	5.702	5.594	5.153
1969	6.653	6.604	6.479	6.226	6.123	5.769
1970	7.272	7.053	6.894	6.69	6.607	6.403
1971	7.448	7.406	7.353	7.143	7.053	6.877
1972	7.964	7.904	7.573	7.427	7.382	7.166
1973	8.796	8.717	8.552	8.296	7.895	7.427
1974	8.876	8.82	8.633	8.435	8.374	8.11
1975	8.746	8.691	8.526	8.397	8.328	8.148
1976	8.631	8.597	8.512	8.428	8.424	8.132
1977	9.114	9.027	8.758	8.225	7.985	7.763
1978	8.759	8.707	8.58	8.435	8.346	8.067
1979	8.636	8.585	8.497	8.383	8.273	8.053
1980	9.632	9.535	9.066	8.63	8.509	8.315
1981	9.735	9.683	9.595	9.332	9.169	8.708
1982	9.7	9.639	9.51	9.397	9.358	9.079
1983	9.684	9.661	9.606	9.528	9.487	9.266
1984	9.892	9.852	9.691	9.596	9.367	9.178
1985	9.458	9.434	9.355	9.308	9.284	9.084
1986	9.593	9.562	9.479	9.316	9.258	9.028

1987	10.42	10.31	10.07	9.371	9.293	9.097
1988	10.05	9.986	9.838	9.636	9.547	9.259
1989	9.946	9.874	9.633	9.389	9.4	9.167
1990	9.964	9.927	9.878	9.745	9.675	9.367
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	10.42	10.31	10.07	9.745	9.675	9.367
0.0645161290322581	10.05	9.986	9.878	9.636	9.547	9.266
0.0967741935483871	9.964	9.927	9.838	9.596	9.487	9.259
0.129032258064516	9.946	9.874	9.691	9.528	9.4	9.178
0.161290322580645	9.892	9.852	9.633	9.397	9.367	9.167
0.193548387096774	9.735	9.683	9.606	9.389	9.358	9.097
0.225806451612903	9.7	9.661	9.595	9.371	9.293	9.084
0.258064516129032	9.684	9.639	9.51	9.332	9.284	9.079
0.290322580645161	9.632	9.562	9.479	9.316	9.258	9.028
0.32258064516129	9.593	9.535	9.355	9.308	9.169	8.708
0.354838709677419	9.458	9.434	9.066	8.63	8.509	8.315
0.387096774193548	9.114	9.027	8.758	8.435	8.424	8.148
0.419354838709677	8.876	8.82	8.633	8.435	8.374	8.132
0.451612903225806	8.796	8.717	8.58	8.428	8.346	8.11
0.483870967741936	8.759	8.707	8.552	8.397	8.328	8.067
0.516129032258065	8.746	8.691	8.526	8.383	8.273	8.053
0.548387096774194	8.636	8.597	8.512	8.296	7.985	7.763
0.580645161290323	8.631	8.585	8.497	8.225	7.895	7.427
0.612903225806452	7.964	7.904	7.573	7.427	7.382	7.166
0.645161290322581	7.448	7.406	7.353	7.143	7.053	6.877
0.67741935483871	7.272	7.053	6.894	6.69	6.607	6.403
0.709677419354839	6.653	6.604	6.479	6.226	6.123	5.769
0.741935483870968	6.09	6.045	5.939	5.702	5.594	5.153
0.774193548387097	5.22	5.185	5.033	4.766	4.648	4.452
0.806451612903226	4.892	4.848	4.761	4.439	4.216	4.014
0.838709677419355	4.424	4.381	3.816	3.694	3.503	3.303
0.870967741935484	4.185	4.1	3.491	2.956	2.694	2.39
0.903225806451613	2.424	2.384	2.268	2.172	2.017	1.681
0.935483870967742	1.787	1.731	1.619	1.375	1.278	0.7416
0.967741935483871	0.8527	0.8117	0.6108	0.3997	0.3087	0.09024
0.1	9.9622	9.9217	9.8233	9.5892	9.4783	9.2509

Average of yearly averages:

6.77626133333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORBNG
Metfile: w24232.dvf
PRZM scenario: ORsnbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	

```
Kd    Kd          mg/L
Koc   Koc   1954.2      mg/L
Photolysis half-life    kdp   11.58 days  Half-life
Aerobic Aquatic Metabolism    kbacw 0     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 1092  days  Halfife
Aerobic Soil Metabolism asm   0     days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.1052      kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    5     days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1052      kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)


stored as WABNA.out
Chemical: Flubendiamide
PRZM environment: WAbeansNMC.txt    modified Thuday, 14 June 2007 at
10:18:32
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24243.dvf     modified Tueday, 26 August 2008 at 05:15:56
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.4809	0.449	0.3511	0.2551	0.2207	0.09457
1962	0.7283	0.6993	0.6104	0.5169	0.4764	0.3099
1963	0.9034	0.8735	0.7743	0.6751	0.6379	0.5172
1964	1.797	1.734	1.114	0.8095	0.7568	0.6454
1965	1.529	1.492	1.337	1.221	1.181	1.102
1966	1.599	1.566	1.464	1.361	1.32	1.221
1967	1.641	1.608	1.506	1.402	1.359	1.246
1968	1.796	1.769	1.683	1.593	1.586	1.457
1969	1.908	1.875	1.771	1.666	1.623	1.517
1970	1.983	1.95	1.846	1.739	1.695	1.597
1971	2.016	1.983	1.879	1.772	1.732	1.628
1972	2.016	1.983	1.879	1.773	1.729	1.624
1973	2.031	1.998	1.894	1.787	1.743	1.66
1974	2.089	2.056	1.953	1.847	1.802	1.695
1975	2.326	2.285	2.155	2.012	1.977	1.805
1976	2.243	2.21	2.107	2	1.955	1.848
1977	2.225	2.194	2.077	1.97	1.924	1.837
1978	2.304	2.27	2.166	2.059	2.014	1.919
1979	2.295	2.262	2.157	2.049	2.002	1.903

1980	2.269	2.236	2.131	2.024	1.978	1.896
1981	2.338	2.304	2.2	2.092	2.061	1.982
1982	2.411	2.377	2.273	2.165	2.12	2.047
1983	2.517	2.483	2.396	2.28	2.199	2.105
1984	2.57	2.537	2.431	2.322	2.274	2.19
1985	2.574	2.54	2.434	2.323	2.276	2.185
1986	2.685	2.663	2.569	2.457	2.424	2.334
1987	2.842	2.802	2.681	2.46	2.412	2.343
1988	2.806	2.773	2.666	2.555	2.506	2.416
1989	2.753	2.719	2.613	2.503	2.455	2.36
1990	3.773	3.673	3.362	3.028	2.915	2.528
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	3.773	3.673	3.362	3.028	2.915	2.528
0.0645161290322581	2.842	2.802	2.681	2.555	2.506	2.416
0.0967741935483871	2.806	2.773	2.666	2.503	2.455	2.36
0.129032258064516	2.753	2.719	2.613	2.46	2.424	2.343
0.161290322580645	2.685	2.663	2.569	2.457	2.412	2.334
0.193548387096774	2.574	2.54	2.434	2.323	2.276	2.19
0.225806451612903	2.57	2.537	2.431	2.322	2.274	2.185
0.258064516129032	2.517	2.483	2.396	2.28	2.199	2.105
0.290322580645161	2.411	2.377	2.273	2.165	2.12	2.047
0.32258064516129	2.338	2.304	2.2	2.092	2.061	1.982
0.354838709677419	2.326	2.285	2.166	2.059	2.014	1.919
0.387096774193548	2.304	2.27	2.157	2.049	2.002	1.903
0.419354838709677	2.295	2.262	2.155	2.024	1.978	1.896
0.451612903225806	2.269	2.236	2.131	2.012	1.977	1.848
0.483870967741936	2.243	2.21	2.107	2	1.955	1.837
0.516129032258065	2.225	2.194	2.077	1.97	1.924	1.805
0.548387096774194	2.089	2.056	1.953	1.847	1.802	1.695
0.580645161290323	2.031	1.998	1.894	1.787	1.743	1.66
0.612903225806452	2.016	1.983	1.879	1.773	1.732	1.628
0.645161290322581	2.016	1.983	1.879	1.772	1.729	1.624
0.67741935483871	1.983	1.95	1.846	1.739	1.695	1.597
0.709677419354839	1.908	1.875	1.771	1.666	1.623	1.517
0.741935483870968	1.797	1.769	1.683	1.593	1.586	1.457
0.774193548387097	1.796	1.734	1.506	1.402	1.359	1.246
0.806451612903226	1.641	1.608	1.464	1.361	1.32	1.221
0.838709677419355	1.599	1.566	1.337	1.221	1.181	1.102
0.870967741935484	1.529	1.492	1.114	0.8095	0.7568	0.6454
0.903225806451613	0.9034	0.8735	0.7743	0.6751	0.6379	0.5172
0.935483870967742	0.7283	0.6993	0.6104	0.5169	0.4764	0.3099
0.967741935483871	0.4809	0.449	0.3511	0.2551	0.2207	0.09457
0.1	2.8007	2.7676	2.6607	2.4987	2.4519	2.3583

Average of yearly averages: 1.667069

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: WABNA
Metfile: w24243.dvf
PRZM scenario: WAbeansNMC.txt
EXAMS environment file: pond298.exv

```
Chemical Name:    Flubendiamide
Description Variable Name     Value Units Comments
Molecular weight  mwt   682.4 g/mol
Henry's Law Const.      henry 8.9e-11     atm-m^3/mol
Vapor Pressure    vapr  7.5e-7      torr
Solubility  sol   0.04  mg/L
Kd    Kd          mg/L
Koc   Koc   1954.2      mg/L
Photolysis half-life    kdp   11.58 days  Half-life
Aerobic Aquatic Metabolism    kbacw 0     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 1092  days  Halfife
Aerobic Soil Metabolism asm   0     days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.1052      kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    5     days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1052      kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)


stored as WABNG.out
Chemical: Flubendiamide
PRZM environment: WAbeansNMC.txt    modified Thuday, 14 June 2007 at
10:18:32
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24243.dvf     modified Tueday, 26 August 2008 at 05:15:56
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.1849	0.1742	0.1026	0.05397	0.04541	0.0224
1962	0.5317	0.5018	0.4103	0.3144	0.2723	0.1356
1963	0.3241	0.3199	0.2995	0.2782	0.2697	0.2508
1964	1.466	1.4	0.7538	0.4356	0.3792	0.2931
1965	1.187	1.148	0.9871	0.8475	0.7884	0.6838
1966	0.9071	0.8895	0.861	0.7983	0.7747	0.7335
1967	0.7764	0.7694	0.7471	0.7231	0.7113	0.6956
1968	1.156	1.13	1.049	0.9658	0.942	0.8562
1969	0.9375	0.9303	0.9077	0.8827	0.8767	0.8598
1970	1.08	1.07	1.027	0.9647	0.943	0.8949
1971	0.98	0.9717	0.9459	0.9173	0.9083	0.8829
1972	0.9146	0.9075	0.885	0.8604	0.8524	0.8368
1973	1.012	0.9996	0.9666	0.9171	0.8767	0.8367

1974	0.9198	0.9128	0.8904	0.8662	0.8588	0.8404
1975	1.406	1.366	1.244	1.113	1.069	0.925
1976	1.02	1.013	0.9906	0.966	0.9576	0.9398
1977	1.313	1.281	1.159	0.9598	0.9266	0.9008
1978	1.103	1.09	1.065	1.023	1.007	0.9655
1979	1.006	1	0.9822	0.9598	0.9508	0.9274
1980	1.235	1.209	1.132	0.985	0.9429	0.9047
1981	1.264	1.24	1.164	1.09	1.065	0.9798
1982	1.255	1.235	1.175	1.125	1.085	1.03
1983	1.509	1.474	1.386	1.265	1.177	1.076
1984	1.319	1.303	1.256	1.178	1.169	1.149
1985	1.201	1.194	1.174	1.163	1.157	1.126
1986	1.614	1.593	1.501	1.394	1.358	1.268
1987	1.802	1.76	1.634	1.365	1.31	1.269
1988	1.5	1.487	1.455	1.412	1.393	1.337
1989	1.348	1.341	1.318	1.305	1.303	1.269
1990	2.686	2.585	2.274	1.943	1.835	1.439
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	2.686	2.585	2.274	1.943	1.835	1.439
0.0645161290322581	1.802	1.76	1.634	1.412	1.393	1.337
0.0967741935483871	1.614	1.593	1.501	1.394	1.358	1.269
0.129032258064516	1.509	1.487	1.455	1.365	1.31	1.269
0.161290322580645	1.5	1.474	1.386	1.305	1.303	1.268
0.193548387096774	1.466	1.4	1.318	1.265	1.177	1.149
0.225806451612903	1.406	1.366	1.256	1.178	1.169	1.126
0.258064516129032	1.348	1.341	1.244	1.163	1.157	1.076
0.290322580645161	1.319	1.303	1.175	1.125	1.085	1.03
0.32258064516129	1.313	1.281	1.174	1.113	1.069	0.9798
0.354838709677419	1.264	1.24	1.164	1.09	1.065	0.9655
0.387096774193548	1.255	1.235	1.159	1.023	1.007	0.9398
0.419354838709677	1.235	1.209	1.132	0.985	0.9576	0.9274
0.451612903225806	1.201	1.194	1.065	0.966	0.9508	0.925
0.483870967741936	1.187	1.148	1.049	0.9658	0.943	0.9047
0.516129032258065	1.156	1.13	1.027	0.9647	0.9429	0.9008
0.548387096774194	1.103	1.09	0.9906	0.9598	0.942	0.8949
0.580645161290323	1.08	1.07	0.9871	0.9598	0.9266	0.8829
0.612903225806452	1.02	1.013	0.9822	0.9173	0.9083	0.8598
0.645161290322581	1.012	1	0.9666	0.9171	0.8767	0.8562
0.67741935483871	1.006	0.9996	0.9459	0.8827	0.8767	0.8404
0.709677419354839	0.98	0.9717	0.9077	0.8662	0.8588	0.8368
0.741935483870968	0.9375	0.9303	0.8904	0.8604	0.8524	0.8367
0.774193548387097	0.9198	0.9128	0.885	0.8475	0.7884	0.7335
0.806451612903226	0.9146	0.9075	0.861	0.7983	0.7747	0.6956
0.838709677419355	0.9071	0.8895	0.7538	0.7231	0.7113	0.6838
0.870967741935484	0.7764	0.7694	0.7471	0.4356	0.3792	0.2931
0.903225806451613	0.5317	0.5018	0.4103	0.3144	0.2723	0.2508
0.935483870967742	0.3241	0.3199	0.2995	0.2782	0.2697	0.1356
0.967741935483871	0.1849	0.1742	0.1026	0.05397	0.04541	0.0224
0.1	1.6035	1.5824	1.4964	1.3911	1.3532	1.269

Average of yearly averages:

0.877616666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: WABNG
Metfile: w24243.dvf
PRZM scenario: WAbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide
Description Variable Name Value Units Comments
Molecular weight mwt 682.4 g/mol
Henry's Law Const. henry 8.9e-11 atm-m^3/mol
Vapor Pressure vapr 7.5e-7 torr
Solubility sol 0.04 mg/L
Kd Kd mg/L
Koc Koc 1954.2 mg/L
Photolysis half-life kdp 11.58 days Half-life
Aerobic Aquatic Metabolism kbacw 0 days Halfife
Anaerobic Aquatic Metabolism kbacs 1092 days Halfife
Aerobic Soil Metabolism asm 0 days Halfife
Hydrolysis: pH 7 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.1052 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 5 days Set to 0 or delete line for single app.
app. rate 1 apprate 0.1052 kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

stored as ILBNAben.out
Chemical: Flubendiamide
PRZM environment: ILbeansNMC.txt modified Thuday, 14 June 2007 at 10:16:26
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w14842.dvf modified Tueday, 26 August 2008 at 05:15:08
Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.298	1.297	1.293	1.265	1.208	0.4068
1962	1.818	1.818	1.818	1.806	1.78	1.517
1963	2.671	2.671	2.665	2.636	2.625	2.232
1964	3.39	3.389	3.367	3.29	3.254	2.945
1965	5.014	5.01	4.99	4.988	4.972	4.349
1966	5.843	5.842	5.823	5.78	5.762	5.355

1967	6.448	6.448	6.444	6.426	6.386	6.067
1968	6.815	6.812	6.8	6.777	6.776	6.577
1969	7.424	7.424	7.423	7.415	7.371	7.038
1970	8.198	8.198	8.197	8.189	8.148	7.622
1971	8.38	8.38	8.377	8.361	8.354	8.196
1972	8.42	8.42	8.419	8.413	8.401	8.319
1973	8.884	8.883	8.876	8.859	8.832	8.596
1974	8.919	8.919	8.919	8.916	8.908	8.791
1975	9.275	9.275	9.262	9.242	9.226	8.94
1976	9.309	9.309	9.308	9.295	9.295	9.263
1977	9.645	9.645	9.644	9.638	9.618	9.305
1978	9.651	9.651	9.647	9.62	9.604	9.542
1979	9.783	9.783	9.779	9.756	9.73	9.588
1980	9.889	9.889	9.887	9.88	9.877	9.715
1981	10.45	10.45	10.45	10.43	10.42	10.07
1982	10.95	10.95	10.91	10.84	10.82	10.52
1983	10.98	10.98	10.98	10.97	10.96	10.85
1984	10.87	10.87	10.87	10.86	10.86	10.74
1985	10.78	10.78	10.77	10.76	10.75	10.6
1986	11.03	11.03	11.02	11.01	10.98	10.69
1987	11.02	11.02	11.02	11	10.98	10.68
1988	10.52	10.52	10.52	10.52	10.51	10.2
1989	9.981	9.981	9.979	9.97	9.962	9.772
1990	10.33	10.33	10.31	10.24	10.22	9.825
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	11.03	11.03	11.02	11.01	10.98	10.85
0.0645161290322581	11.02	11.02	11.02	11	10.98	10.74
0.0967741935483871	10.98	10.98	10.98	10.97	10.96	10.69
0.129032258064516	10.95	10.95	10.91	10.86	10.86	10.68
0.161290322580645	10.87	10.87	10.87	10.84	10.82	10.6
0.193548387096774	10.78	10.78	10.77	10.76	10.75	10.52
0.225806451612903	10.52	10.52	10.52	10.52	10.51	10.2
0.258064516129032	10.45	10.45	10.45	10.43	10.42	10.07
0.290322580645161	10.33	10.33	10.31	10.24	10.22	9.825
0.32258064516129	9.981	9.981	9.979	9.97	9.962	9.772
0.354838709677419	9.889	9.889	9.887	9.88	9.877	9.715
0.387096774193548	9.783	9.783	9.779	9.756	9.73	9.588
0.419354838709677	9.651	9.651	9.647	9.638	9.618	9.542
0.451612903225806	9.645	9.645	9.644	9.62	9.604	9.305
0.483870967741936	9.309	9.309	9.308	9.295	9.295	9.263
0.516129032258065	9.275	9.275	9.262	9.242	9.226	8.94
0.548387096774194	8.919	8.919	8.919	8.916	8.908	8.791
0.580645161290323	8.884	8.883	8.876	8.859	8.832	8.596
0.612903225806452	8.42	8.42	8.419	8.413	8.401	8.319
0.645161290322581	8.38	8.38	8.377	8.361	8.354	8.196
0.67741935483871	8.198	8.198	8.197	8.189	8.148	7.622
0.709677419354839	7.424	7.424	7.423	7.415	7.371	7.038
0.741935483870968	6.815	6.812	6.8	6.777	6.776	6.577
0.774193548387097	6.448	6.448	6.444	6.426	6.386	6.067
0.806451612903226	5.843	5.842	5.823	5.78	5.762	5.355
0.838709677419355	5.014	5.01	4.99	4.988	4.972	4.349
0.870967741935484	3.39	3.389	3.367	3.29	3.254	2.945

0.903225806451613	2.671	2.671	2.665	2.636	2.625	2.232
0.935483870967742	1.818	1.818	1.818	1.806	1.78	1.517
0.967741935483871	1.298	1.297	1.293	1.265	1.208	0.4068
0.1	10.977	10.977	10.973	10.959	10.95	10.689

Average of yearly averages:

7.94369333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ILBNA
Metfile: w14842.dvf
PRZM scenario: ILbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide
Description Variable Name Value Units Comments
Molecular weight mwt 682.4 g/mol
Henry's Law Const. henry 8.9e-11 atm-m^3/mol
Vapor Pressure vapr 7.5e-7 torr
Solubility sol 0.04 mg/L
Kd Kd mg/L
Koc Koc 1954.2 mg/L
Photolysis half-life kdp 11.58 days Half-life
Aerobic Aquatic Metabolism kbacw 0 days Halfife
Anaerobic Aquatic Metabolism kbacs 1092 days Halfife
Aerobic Soil Metabolism asm 0 days Halfife
Hydrolysis: pH 7 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.1052 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 5 days Set to 0 or delete line for single app.
app. rate 1 apprate 0.1052 kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)
stored as ILBNGben.out
Chemical: Flubendiamide
PRZM environment: ILbeansNMC.txt modified Thuday, 14 June 2007 at 10:16:26
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w14842.dvf modified Tueday, 26 August 2008 at 05:15:08
Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly

1961	1.238	1.238	1.233	1.203	1.144	0.3724
1962	1.678	1.678	1.677	1.664	1.637	1.421
1963	2.475	2.475	2.469	2.437	2.424	2.068
1964	3.142	3.14	3.117	3.036	2.997	2.724
1965	4.758	4.754	4.732	4.729	4.711	4.107
1966	5.555	5.553	5.533	5.487	5.467	5.084
1967	6.12	6.12	6.115	6.094	6.051	5.76
1968	6.448	6.444	6.431	6.405	6.402	6.231
1969	7.028	7.028	7.027	7.019	6.971	6.659
1970	7.791	7.791	7.79	7.781	7.736	7.219
1971	7.926	7.926	7.923	7.908	7.903	7.776
1972	7.946	7.946	7.945	7.938	7.923	7.867
1973	8.401	8.4	8.392	8.371	8.341	8.119
1974	8.444	8.444	8.444	8.44	8.432	8.292
1975	8.75	8.75	8.735	8.712	8.692	8.417
1976	8.8	8.8	8.798	8.788	8.789	8.731
1977	9.087	9.087	9.085	9.08	9.058	8.751
1978	9.084	9.084	9.081	9.068	9.055	8.979
1979	9.173	9.173	9.169	9.148	9.123	9.006
1980	9.291	9.291	9.285	9.281	9.275	9.122
1981	9.849	9.849	9.845	9.83	9.814	9.479
1982	10.37	10.37	10.34	10.25	10.23	9.937
1983	10.44	10.44	10.43	10.42	10.4	10.27
1984	10.31	10.31	10.31	10.3	10.29	10.15
1985	10.2	10.2	10.2	10.18	10.16	10
1986	10.43	10.43	10.42	10.41	10.37	10.09
1987	10.43	10.43	10.42	10.41	10.39	10.08
1988	9.912	9.912	9.911	9.904	9.897	9.569
1989	9.345	9.345	9.344	9.336	9.329	9.124
1990	9.696	9.695	9.675	9.597	9.57	9.174
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	10.44	10.44	10.43	10.42	10.4	10.27
0.0645161290322581	10.43	10.43	10.42	10.41	10.39	10.15
0.0967741935483871	10.43	10.43	10.42	10.41	10.37	10.09
0.129032258064516	10.37	10.37	10.34	10.3	10.29	10.08
0.161290322580645	10.31	10.31	10.31	10.25	10.23	10
0.193548387096774	10.2	10.2	10.2	10.18	10.16	9.937
0.225806451612903	9.912	9.912	9.911	9.904	9.897	9.569
0.258064516129032	9.849	9.849	9.845	9.83	9.814	9.479
0.290322580645161	9.696	9.695	9.675	9.597	9.57	9.174
0.32258064516129	9.345	9.345	9.344	9.336	9.329	9.124
0.354838709677419	9.291	9.291	9.285	9.281	9.275	9.122
0.387096774193548	9.173	9.173	9.169	9.148	9.123	9.006
0.419354838709677	9.087	9.087	9.085	9.08	9.058	8.979
0.451612903225806	9.084	9.084	9.081	9.068	9.055	8.751
0.483870967741936	8.8	8.8	8.798	8.788	8.789	8.731
0.516129032258065	8.75	8.75	8.735	8.712	8.692	8.417
0.548387096774194	8.444	8.444	8.444	8.44	8.432	8.292
0.580645161290323	8.401	8.4	8.392	8.371	8.341	8.119
0.612903225806452	7.946	7.946	7.945	7.938	7.923	7.867
0.645161290322581	7.926	7.926	7.923	7.908	7.903	7.776
0.67741935483871	7.791	7.791	7.79	7.781	7.736	7.219

0.709677419354839	7.028	7.028	7.027	7.019	6.971	6.659
0.741935483870968	6.448	6.444	6.431	6.405	6.402	6.231
0.774193548387097	6.12	6.12	6.115	6.094	6.051	5.76
0.806451612903226	5.555	5.553	5.533	5.487	5.467	5.084
0.838709677419355	4.758	4.754	4.732	4.729	4.711	4.107
0.870967741935484	3.142	3.14	3.117	3.036	2.997	2.724
0.903225806451613	2.475	2.475	2.469	2.437	2.424	2.068
0.935483870967742	1.678	1.678	1.677	1.664	1.637	1.421
0.967741935483871	1.238	1.238	1.233	1.203	1.144	0.3724
0.1	10.424	10.424	10.412	10.399	10.362	10.089

Average of yearly averages:

7.48594666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ILBNG
Metfile: w14842.dvf
PRZM scenario: ILbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide
Description Variable Name Value Units Comments
Molecular weight mwt 682.4 g/mol
Henry's Law Const. henry 8.9e-11 atm-m^3/mol
Vapor Pressure vapr 7.5e-7 torr
Solubility sol 0.04 mg/L
Kd Kd mg/L
Koc Koc 1954.2 mg/L
Photolysis half-life kdp 11.58 days Half-life
Aerobic Aquatic Metabolism kbacw 0 days Halfife
Anaerobic Aquatic Metabolism kbacs 1092 days Halfife
Aerobic Soil Metabolism asm 0 days Halfife
Hydrolysis: pH 7 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.1052 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 5 days Set to 0 or delete line for single app.
app. rate 1 apprate 0.1052 kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)
stored as MIBNAben.out
Chemical: Flubendiamide
PRZM environment: MIbeansSTD.txt modified Tueday, 29 May 2007 at 12:56:44

EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w14826.dvf modified Tueday, 26 August 2008 at 05:15:04
Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.5073	0.5071	0.5052	0.492	0.4751	0.1699
1962	0.8863	0.8863	0.8862	0.8823	0.8708	0.6811
1963	1.188	1.188	1.187	1.178	1.174	1.017
1964	1.846	1.846	1.836	1.822	1.816	1.493
1965	2.417	2.415	2.4	2.373	2.363	2.094
1966	2.687	2.687	2.681	2.657	2.645	2.537
1967	3.25	3.248	3.227	3.198	3.166	2.927
1968	4.172	4.171	4.159	4.115	4.1	3.629
1969	4.625	4.625	4.624	4.608	4.597	4.409
1970	5.092	5.092	5.091	5.079	5.049	4.776
1971	5.263	5.26	5.226	5.202	5.195	5.132
1972	5.93	5.927	5.927	5.915	5.882	5.558
1973	6.207	6.204	6.179	6.101	6.066	6.01
1974	6.415	6.414	6.413	6.405	6.404	6.357
1975	7.224	7.223	7.207	7.191	7.182	6.672
1976	7.317	7.317	7.314	7.295	7.289	7.258
1977	7.258	7.257	7.253	7.24	7.234	7.192
1978	7.193	7.192	7.189	7.178	7.171	7.102
1979	7.088	7.088	7.087	7.08	7.079	7.021
1980	7.35	7.35	7.349	7.342	7.338	7.11
1981	7.679	7.679	7.678	7.673	7.649	7.408
1982	7.667	7.665	7.661	7.648	7.642	7.576
1983	7.592	7.592	7.587	7.575	7.565	7.521
1984	7.575	7.574	7.569	7.557	7.551	7.524
1985	8.129	8.129	8.128	8.124	8.106	7.763
1986	8.55	8.55	8.549	8.546	8.517	8.159
1987	8.542	8.54	8.535	8.521	8.507	8.377
1988	8.434	8.434	8.433	8.425	8.417	8.3
1989	8.438	8.438	8.436	8.431	8.428	8.321
1990	8.413	8.413	8.412	8.403	8.4	8.302
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	8.55	8.55	8.549	8.546	8.517	8.377
0.0645161290322581	8.542	8.54	8.535	8.521	8.507	8.321
0.0967741935483871	8.438	8.438	8.436	8.431	8.428	8.302
0.129032258064516	8.434	8.434	8.433	8.425	8.417	8.3
0.161290322580645	8.413	8.413	8.412	8.403	8.4	8.159
0.193548387096774	8.129	8.129	8.128	8.124	8.106	7.763
0.225806451612903	7.679	7.679	7.678	7.673	7.649	7.576
0.258064516129032	7.667	7.665	7.661	7.648	7.642	7.524
0.290322580645161	7.592	7.592	7.587	7.575	7.565	7.521
0.32258064516129	7.575	7.574	7.569	7.557	7.551	7.408
0.354838709677419	7.35	7.35	7.349	7.342	7.338	7.258
0.387096774193548	7.317	7.317	7.314	7.295	7.289	7.192
0.419354838709677	7.258	7.257	7.253	7.24	7.234	7.11
0.451612903225806	7.224	7.223	7.207	7.191	7.182	7.102
0.483870967741936	7.193	7.192	7.189	7.178	7.171	7.021

0.516129032258065	7.088	7.088	7.087	7.08	7.079	6.672
0.548387096774194	6.415	6.414	6.413	6.405	6.404	6.357
0.580645161290323	6.207	6.204	6.179	6.101	6.066	6.01
0.612903225806452	5.93	5.927	5.927	5.915	5.882	5.558
0.645161290322581	5.263	5.26	5.226	5.202	5.195	5.132
0.67741935483871	5.092	5.092	5.091	5.079	5.049	4.776
0.709677419354839	4.625	4.625	4.624	4.608	4.597	4.409
0.741935483870968	4.172	4.171	4.159	4.115	4.1	3.629
0.774193548387097	3.25	3.248	3.227	3.198	3.166	2.927
0.806451612903226	2.687	2.687	2.681	2.657	2.645	2.537
0.838709677419355	2.417	2.415	2.4	2.373	2.363	2.094
0.870967741935484	1.846	1.846	1.836	1.822	1.816	1.493
0.903225806451613	1.188	1.188	1.187	1.178	1.174	1.017
0.935483870967742	0.8863	0.8863	0.8862	0.8823	0.8708	0.6811
0.967741935483871	0.5073	0.5071	0.5052	0.492	0.4751	0.1699
0.1	8.4376	8.4376	8.4357	8.4304	8.4269	8.3018

Average of yearly averages: 5.6132

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MIBNA
Metfile: w14826.dvf
PRZM scenario: MIbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7	0	days	Half-life	
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.1052	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	
Application Date	Date	01-07	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	5	days	Set to 0 or delete line for single app.
app. rate 1	apprate	0.1052	kg/ha	

Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond

Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)
stored as MIBNGben.out
Chemical: Flubendiamide
PRZM environment: MIbeansSTD.txt modified Tueday, 29 May 2007 at 12:56:44
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w14826.dvf modified Tueday, 26 August 2008 at 05:15:04
Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.4141	0.4139	0.4118	0.3978	0.38	0.1254
1962	0.7038	0.7038	0.7036	0.699	0.6865	0.5481
1963	0.9231	0.923	0.9217	0.9119	0.9069	0.7973
1964	1.523	1.522	1.511	1.496	1.489	1.203
1965	2.037	2.035	2.019	1.99	1.978	1.746
1966	2.245	2.245	2.238	2.212	2.198	2.131
1967	2.763	2.76	2.737	2.706	2.671	2.465
1968	3.663	3.662	3.649	3.602	3.584	3.132
1969	4.078	4.078	4.077	4.058	4.045	3.886
1970	4.515	4.515	4.513	4.498	4.464	4.215
1971	4.648	4.645	4.609	4.581	4.571	4.537
1972	5.299	5.296	5.295	5.28	5.243	4.938
1973	5.553	5.549	5.522	5.439	5.401	5.369
1974	5.79	5.79	5.788	5.774	5.766	5.695
1975	6.547	6.545	6.528	6.508	6.495	5.989
1976	6.669	6.669	6.665	6.646	6.632	6.573
1977	6.555	6.555	6.551	6.54	6.536	6.478
1978	6.464	6.464	6.462	6.452	6.446	6.36
1979	6.341	6.341	6.34	6.334	6.33	6.252
1980	6.549	6.549	6.548	6.543	6.539	6.323
1981	6.878	6.878	6.877	6.871	6.843	6.614
1982	6.869	6.868	6.865	6.854	6.849	6.771
1983	6.778	6.778	6.774	6.765	6.756	6.703
1984	6.752	6.751	6.747	6.738	6.733	6.694
1985	7.3	7.3	7.3	7.294	7.273	6.933
1986	7.727	7.727	7.726	7.722	7.689	7.333
1987	7.723	7.722	7.717	7.705	7.693	7.553
1988	7.609	7.609	7.608	7.603	7.597	7.47
1989	7.582	7.582	7.581	7.579	7.578	7.484
1990	7.573	7.573	7.572	7.566	7.566	7.457
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	7.727	7.727	7.726	7.722	7.693	7.553
0.0645161290322581	7.723	7.722	7.717	7.705	7.689	7.484
0.0967741935483871	7.609	7.609	7.608	7.603	7.597	7.47
0.129032258064516	7.582	7.582	7.581	7.579	7.578	7.457
0.161290322580645	7.573	7.573	7.572	7.566	7.566	7.333
0.193548387096774	7.3	7.3	7.3	7.294	7.273	6.933
0.225806451612903	6.878	6.878	6.877	6.871	6.849	6.771
0.258064516129032	6.869	6.868	6.865	6.854	6.843	6.703
0.290322580645161	6.778	6.778	6.774	6.765	6.756	6.694
0.32258064516129	6.752	6.751	6.747	6.738	6.733	6.614

0.354838709677419	6.669	6.669	6.665	6.646	6.632	6.573
0.387096774193548	6.555	6.555	6.551	6.543	6.539	6.478
0.419354838709677	6.549	6.549	6.548	6.54	6.536	6.36
0.451612903225806	6.547	6.545	6.528	6.508	6.495	6.323
0.483870967741936	6.464	6.464	6.462	6.452	6.446	6.252
0.516129032258065	6.341	6.341	6.34	6.334	6.33	5.989
0.548387096774194	5.79	5.79	5.788	5.774	5.766	5.695
0.580645161290323	5.553	5.549	5.522	5.439	5.401	5.369
0.612903225806452	5.299	5.296	5.295	5.28	5.243	4.938
0.645161290322581	4.648	4.645	4.609	4.581	4.571	4.537
0.67741935483871	4.515	4.515	4.513	4.498	4.464	4.215
0.709677419354839	4.078	4.078	4.077	4.058	4.045	3.886
0.741935483870968	3.663	3.662	3.649	3.602	3.584	3.132
0.774193548387097	2.763	2.76	2.737	2.706	2.671	2.465
0.806451612903226	2.245	2.245	2.238	2.212	2.198	2.131
0.838709677419355	2.037	2.035	2.019	1.99	1.978	1.746
0.870967741935484	1.523	1.522	1.511	1.496	1.489	1.203
0.903225806451613	0.9231	0.923	0.9217	0.9119	0.9069	0.7973
0.935483870967742	0.7038	0.7038	0.7036	0.699	0.6865	0.5481
0.967741935483871	0.4141	0.4139	0.4118	0.3978	0.38	0.1254
0.1	7.6063	7.6063	7.6053	7.6006	7.5951	7.4687

Average of yearly averages:

4.99249333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MIBNG
Metfile: w14826.dvf
PRZM scenario: MIbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7	0	days	Half-life	
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.1052	kg/ha	
Application Efficiency:	APPEFF	0.99	fraction	
Spray Drift	DRFT	0.01	fraction of application rate applied to pond	
Application Date	Date	01-07	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	5	days	Set to 0 or delete line for single app.
app. rate 1	apprate	0.1052	kg/ha	

Record 17: FILTRA
IPSCND 1

UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)
stored as MSSoyAben.out
Chemical: Flubendiamide
PRZM environment: MSsoybeanSTD.txt modified Tueday, 29 May 2007 at 12:58:06
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w03940.dvf modified Tueday, 26 August 2008 at 05:14:14
Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.7716	0.7688	0.7358	0.661	0.6305	0.2868
1962	1.002	0.9992	0.9941	0.9885	0.9857	0.9004
1963	1.74	1.737	1.709	1.645	1.634	1.353
1964	2.543	2.541	2.52	2.459	2.403	2.063
1965	2.966	2.965	2.956	2.955	2.943	2.679
1966	3.229	3.228	3.228	3.223	3.223	3.109
1967	3.478	3.476	3.447	3.429	3.425	3.318
1968	3.539	3.539	3.538	3.534	3.528	3.469
1969	3.533	3.529	3.506	3.471	3.468	3.446
1970	3.922	3.922	3.921	3.901	3.842	3.663
1971	4.145	4.143	4.115	4.055	4.043	3.942
1972	4.194	4.194	4.193	4.189	4.183	4.079
1973	4.091	4.091	4.09	4.084	4.076	3.975
1974	4.281	4.278	4.252	4.225	4.218	4.151
1975	4.883	4.883	4.882	4.875	4.845	4.518
1976	4.877	4.877	4.873	4.855	4.837	4.798
1977	4.9	4.899	4.878	4.836	4.829	4.774
1978	4.935	4.935	4.934	4.927	4.922	4.801
1979	6.058	6.058	6.053	6.022	6.014	5.519
1980	6.058	6.058	6.056	6.053	6.04	5.821
1981	5.883	5.883	5.88	5.865	5.852	5.691
1982	6.38	6.378	6.353	6.294	6.275	5.996
1983	6.408	6.408	6.407	6.4	6.386	6.178
1984	6.211	6.211	6.209	6.203	6.197	6.103
1985	6.171	6.171	6.17	6.164	6.157	6.056
1986	6.058	6.057	6.049	6.024	6.002	5.868
1987	5.957	5.957	5.954	5.937	5.917	5.825
1988	5.78	5.78	5.779	5.769	5.758	5.635
1989	5.932	5.932	5.929	5.907	5.886	5.751
1990	5.933	5.933	5.932	5.924	5.916	5.712
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	6.408	6.408	6.407	6.4	6.386	6.178
0.0645161290322581	6.38	6.378	6.353	6.294	6.275	6.103
0.0967741935483871	6.211	6.211	6.209	6.203	6.197	6.056
0.129032258064516	6.171	6.171	6.17	6.164	6.157	5.996
0.161290322580645	6.058	6.058	6.056	6.053	6.04	5.868

0.193548387096774	6.058	6.058	6.053	6.024	6.014	5.825
0.225806451612903	6.058	6.057	6.049	6.022	6.002	5.821
0.258064516129032	5.957	5.957	5.954	5.937	5.917	5.751
0.290322580645161	5.933	5.933	5.932	5.924	5.916	5.712
0.32258064516129	5.932	5.932	5.929	5.907	5.886	5.691
0.354838709677419	5.883	5.883	5.88	5.865	5.852	5.635
0.387096774193548	5.78	5.78	5.779	5.769	5.758	5.519
0.419354838709677	4.935	4.935	4.934	4.927	4.922	4.801
0.451612903225806	4.9	4.899	4.882	4.875	4.845	4.798
0.483870967741936	4.883	4.883	4.878	4.855	4.837	4.774
0.516129032258065	4.877	4.877	4.873	4.836	4.829	4.518
0.548387096774194	4.281	4.278	4.252	4.225	4.218	4.151
0.580645161290323	4.194	4.194	4.193	4.189	4.183	4.079
0.612903225806452	4.145	4.143	4.115	4.084	4.076	3.975
0.645161290322581	4.091	4.091	4.09	4.055	4.043	3.942
0.67741935483871	3.922	3.922	3.921	3.901	3.842	3.663
0.709677419354839	3.539	3.539	3.538	3.534	3.528	3.469
0.741935483870968	3.533	3.529	3.506	3.471	3.468	3.446
0.774193548387097	3.478	3.476	3.447	3.429	3.425	3.318
0.806451612903226	3.229	3.228	3.228	3.223	3.223	3.109
0.838709677419355	2.966	2.965	2.956	2.955	2.943	2.679
0.870967741935484	2.543	2.541	2.52	2.459	2.403	2.063
0.903225806451613	1.74	1.737	1.709	1.645	1.634	1.353
0.935483870967742	1.002	0.9992	0.9941	0.9885	0.9857	0.9004
0.967741935483871	0.7716	0.7688	0.7358	0.661	0.6305	0.2868
0.1	6.207	6.207	6.2051	6.1991	6.193	6.05

Average of yearly averages:

4.31600666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MSSoyA
Metfile: w03940.dvf
PRZM scenario: MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7	0	days	Half-life	
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.1052	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	

Application Date Date 01-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 5 days Set to 0 or delete line for single app.
app. rate 1 apprate 0.1052 kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)
stored as MSSoyGben.out
Chemical: Flubendiamide
PRZM environment: MSsoybeanSTD.txt modified Tueday, 29 May 2007 at 12:58:06
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w03940.dvf modified Tueday, 26 August 2008 at 05:14:14
Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.6938	0.6908	0.6562	0.5777	0.5455	0.239
1962	0.8403	0.8376	0.8318	0.8251	0.8213	0.7765
1963	1.529	1.526	1.496	1.429	1.416	1.161
1964	2.297	2.295	2.272	2.207	2.146	1.827
1965	2.676	2.675	2.665	2.661	2.647	2.403
1966	2.894	2.893	2.892	2.885	2.883	2.792
1967	3.105	3.102	3.07	3.05	3.044	2.959
1968	3.173	3.173	3.172	3.168	3.163	3.07
1969	3.089	3.085	3.059	3.035	3.032	3.01
1970	3.466	3.466	3.465	3.441	3.377	3.206
1971	3.678	3.675	3.645	3.578	3.563	3.471
1972	3.736	3.736	3.735	3.731	3.726	3.595
1973	3.612	3.612	3.611	3.604	3.598	3.47
1974	3.77	3.766	3.738	3.706	3.697	3.64
1975	4.378	4.378	4.378	4.369	4.334	4.005
1976	4.376	4.376	4.373	4.358	4.342	4.283
1977	4.379	4.377	4.354	4.323	4.317	4.245
1978	4.422	4.422	4.421	4.415	4.409	4.265
1979	5.565	5.565	5.558	5.522	5.511	5.005
1980	5.568	5.568	5.567	5.564	5.554	5.312
1981	5.341	5.341	5.338	5.326	5.316	5.176
1982	5.893	5.891	5.863	5.797	5.774	5.489
1983	5.927	5.927	5.926	5.919	5.908	5.674
1984	5.714	5.714	5.712	5.707	5.702	5.59
1985	5.666	5.666	5.665	5.662	5.657	5.537
1986	5.543	5.542	5.535	5.513	5.493	5.341
1987	5.394	5.393	5.391	5.376	5.359	5.295
1988	5.253	5.253	5.252	5.245	5.237	5.095
1989	5.368	5.368	5.362	5.34	5.321	5.213
1990	5.415	5.415	5.413	5.405	5.397	5.171
Sorted results						

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	5.927	5.927	5.926	5.919	5.908	5.674
0.0645161290322581	5.893	5.891	5.863	5.797	5.774	5.59
0.0967741935483871	5.714	5.714	5.712	5.707	5.702	5.537
0.129032258064516	5.666	5.666	5.665	5.662	5.657	5.489
0.161290322580645	5.568	5.568	5.567	5.564	5.554	5.341
0.193548387096774	5.565	5.565	5.558	5.522	5.511	5.312
0.225806451612903	5.543	5.542	5.535	5.513	5.493	5.295
0.258064516129032	5.415	5.415	5.413	5.405	5.397	5.213
0.290322580645161	5.394	5.393	5.391	5.376	5.359	5.176
0.32258064516129	5.368	5.368	5.362	5.34	5.321	5.171
0.354838709677419	5.341	5.341	5.338	5.326	5.316	5.095
0.387096774193548	5.253	5.253	5.252	5.245	5.237	5.005
0.419354838709677	4.422	4.422	4.421	4.415	4.409	4.283
0.451612903225806	4.379	4.378	4.378	4.369	4.342	4.265
0.483870967741936	4.378	4.377	4.373	4.358	4.334	4.245
0.516129032258065	4.376	4.376	4.354	4.323	4.317	4.005
0.548387096774194	3.77	3.766	3.738	3.731	3.726	3.64
0.580645161290323	3.736	3.736	3.735	3.706	3.697	3.595
0.612903225806452	3.678	3.675	3.645	3.604	3.598	3.471
0.645161290322581	3.612	3.612	3.611	3.578	3.563	3.47
0.67741935483871	3.466	3.466	3.465	3.441	3.377	3.206
0.709677419354839	3.173	3.173	3.172	3.168	3.163	3.07
0.741935483870968	3.105	3.102	3.07	3.05	3.044	3.01
0.774193548387097	3.089	3.085	3.059	3.035	3.032	2.959
0.806451612903226	2.894	2.893	2.892	2.885	2.883	2.792
0.838709677419355	2.676	2.675	2.665	2.661	2.647	2.403
0.870967741935484	2.297	2.295	2.272	2.207	2.146	1.827
0.903225806451613	1.529	1.526	1.496	1.429	1.416	1.161
0.935483870967742	0.8403	0.8376	0.8318	0.8251	0.8213	0.7765
0.967741935483871	0.6938	0.6908	0.6562	0.5777	0.5455	0.239
0.1	5.7092	5.7092	5.7073	5.7025	5.6975	5.5322

Average of yearly averages:

3.87718333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MSSoyG
Metfile: w03940.dvf
PRZM scenario: MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11		atm-m^3/mol
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife

```
Hydrolysis: pH 7  0      days  Half-life
Method:      CAM   2      integer      See PRZM manual
Incorporation Depth:     DEPI  0      cm
Application Rate: TAPP  0.1052       kg/ha
Application Efficiency: APPEFF       0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  01-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    5      days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1052       kg/ha
Record 17:  FILTRA
      IPSCND       1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC       0.5
Flag for Index Res. Run IR     EPA Pond
Flag for runoff calc.   RUNOFF       none  none, monthly or
total(average of entire run)
stored as ORBNAben.out
Chemical: Flubendiamide
PRZM environment: ORsnbeansSTD.txt  modified Tueday, 29 May 2007 at
13:01:06
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24232.dvf     modified Tueday, 26 August 2008 at 05:15:54
Benthic segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.3829	0.3776	0.3264	0.2597	0.2264	0.08496
1962	1.267	1.263	1.232	1.105	1.02	0.7001
1963	2.112	2.11	2.087	2.002	1.927	1.67
1964	2.903	2.887	2.755	2.6	2.543	2.422
1965	3.683	3.67	3.621	3.527	3.465	3.349
1966	4.433	4.429	4.377	4.223	4.164	4.081
1967	4.865	4.862	4.823	4.718	4.662	4.605
1968	5.74	5.735	5.682	5.56	5.485	5.231
1969	6.309	6.302	6.241	6.157	6.092	5.922
1970	6.796	6.788	6.741	6.665	6.655	6.563
1971	7.314	7.31	7.266	7.18	7.141	7.05
1972	7.54	7.54	7.539	7.534	7.527	7.418
1973	8.123	8.115	8.026	7.789	7.68	7.604
1974	8.479	8.479	8.477	8.471	8.463	8.33
1975	8.569	8.569	8.568	8.565	8.559	8.441
1976	8.696	8.696	8.694	8.687	8.674	8.524
1977	8.4	8.392	8.298	8.248	8.239	8.127
1978	8.622	8.622	8.62	8.608	8.595	8.448
1979	8.635	8.631	8.596	8.515	8.501	8.413
1980	8.871	8.858	8.821	8.817	8.81	8.679
1981	9.445	9.439	9.376	9.204	9.111	9.001
1982	9.653	9.653	9.651	9.641	9.629	9.451
1983	9.761	9.761	9.759	9.748	9.735	9.603
1984	9.736	9.734	9.712	9.686	9.682	9.561
1985	9.753	9.753	9.752	9.745	9.738	9.548
1986	9.632	9.631	9.63	9.619	9.604	9.452

1987	9.675	9.669	9.655	9.647	9.633	9.486
1988	9.89	9.89	9.888	9.876	9.864	9.679
1989	9.795	9.795	9.792	9.781	9.775	9.608
1990	9.964	9.964	9.962	9.95	9.932	9.753
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	9.964	9.964	9.962	9.95	9.932	9.753
0.0645161290322581	9.89	9.89	9.888	9.876	9.864	9.679
0.0967741935483871	9.795	9.795	9.792	9.781	9.775	9.608
0.129032258064516	9.761	9.761	9.759	9.748	9.738	9.603
0.161290322580645	9.753	9.753	9.752	9.745	9.735	9.561
0.193548387096774	9.736	9.734	9.712	9.686	9.682	9.548
0.225806451612903	9.675	9.669	9.655	9.647	9.633	9.486
0.258064516129032	9.653	9.653	9.651	9.641	9.629	9.452
0.290322580645161	9.632	9.631	9.63	9.619	9.604	9.451
0.32258064516129	9.445	9.439	9.376	9.204	9.111	9.001
0.354838709677419	8.871	8.858	8.821	8.817	8.81	8.679
0.387096774193548	8.696	8.696	8.694	8.687	8.674	8.524
0.419354838709677	8.635	8.631	8.62	8.608	8.595	8.448
0.451612903225806	8.622	8.622	8.596	8.565	8.559	8.441
0.483870967741936	8.569	8.569	8.568	8.515	8.501	8.413
0.516129032258065	8.479	8.479	8.477	8.471	8.463	8.33
0.548387096774194	8.4	8.392	8.298	8.248	8.239	8.127
0.580645161290323	8.123	8.115	8.026	7.789	7.68	7.604
0.612903225806452	7.54	7.54	7.539	7.534	7.527	7.418
0.645161290322581	7.314	7.31	7.266	7.18	7.141	7.05
0.67741935483871	6.796	6.788	6.741	6.665	6.655	6.563
0.709677419354839	6.309	6.302	6.241	6.157	6.092	5.922
0.741935483870968	5.74	5.735	5.682	5.56	5.485	5.231
0.774193548387097	4.865	4.862	4.823	4.718	4.662	4.605
0.806451612903226	4.433	4.429	4.377	4.223	4.164	4.081
0.838709677419355	3.683	3.67	3.621	3.527	3.465	3.349
0.870967741935484	2.903	2.887	2.755	2.6	2.543	2.422
0.903225806451613	2.112	2.11	2.087	2.002	1.927	1.67
0.935483870967742	1.267	1.263	1.232	1.105	1.02	0.7001
0.967741935483871	0.3829	0.3776	0.3264	0.2597	0.2264	0.08496
0.1	9.7916	9.7916	9.7887	9.7777	9.7713	9.6075

Average of yearly averages: 7.026802

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORBNA
Metfile: w24232.dvf
PRZM scenario: ORsnbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	

```
Koc   Koc   1954.2      mg/L
Photolysis half-life    kdp   11.58 days  Half-life
Aerobic Aquatic Metabolism    kbacw 0     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 1092  days  Halfife
Aerobic Soil Metabolism asm   0     days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.1052      kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    5     days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1052      kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)
stored as ORBNGben.out
Chemical: Flubendiamide
PRZM environment: ORsnbeansSTD.txt  modified Tueday, 29 May 2007 at
13:01:06
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24232.dvf     modified Tueday, 26 August 2008 at 05:15:54
Benthic segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.2845	0.279	0.2254	0.1556	0.1206	0.03685
1962	1.102	1.097	1.065	0.9311	0.8421	0.5682
1963	1.887	1.884	1.861	1.771	1.691	1.48
1964	2.624	2.607	2.469	2.306	2.246	2.172
1965	3.359	3.346	3.294	3.195	3.128	3.055
1966	4.072	4.067	4.012	3.849	3.805	3.744
1967	4.46	4.457	4.415	4.304	4.295	4.225
1968	5.312	5.307	5.25	5.122	5.041	4.817
1969	5.851	5.844	5.779	5.689	5.62	5.481
1970	6.311	6.302	6.252	6.236	6.226	6.098
1971	6.804	6.8	6.753	6.66	6.618	6.557
1972	7.053	7.053	7.052	7.049	7.04	6.898
1973	7.571	7.562	7.468	7.218	7.157	7.053
1974	7.959	7.959	7.957	7.95	7.941	7.775
1975	8.02	8.02	8.018	8.014	8.008	7.86
1976	8.122	8.122	8.12	8.112	8.1	7.916
1977	7.743	7.735	7.637	7.614	7.608	7.476
1978	7.985	7.985	7.983	7.973	7.96	7.788
1979	7.949	7.945	7.907	7.857	7.844	7.731
1980	8.177	8.163	8.156	8.153	8.148	7.991
1981	8.758	8.752	8.684	8.501	8.401	8.309
1982	8.989	8.989	8.988	8.979	8.968	8.762

1983	9.097	9.097	9.095	9.083	9.069	8.908
1984	9.021	9.018	8.999	8.993	8.989	8.851
1985	9.043	9.043	9.041	9.038	9.032	8.825
1986	8.922	8.922	8.92	8.91	8.896	8.716
1987	8.936	8.936	8.935	8.927	8.914	8.746
1988	9.17	9.17	9.168	9.157	9.147	8.94
1989	9.073	9.073	9.07	9.057	9.049	8.86
1990	9.24	9.24	9.238	9.225	9.209	9.005
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	9.24	9.24	9.238	9.225	9.209	9.005
0.0645161290322581	9.17	9.17	9.168	9.157	9.147	8.94
0.0967741935483871	9.097	9.097	9.095	9.083	9.069	8.908
0.129032258064516	9.073	9.073	9.07	9.057	9.049	8.86
0.161290322580645	9.043	9.043	9.041	9.038	9.032	8.851
0.193548387096774	9.021	9.018	8.999	8.993	8.989	8.825
0.225806451612903	8.989	8.989	8.988	8.979	8.968	8.762
0.258064516129032	8.936	8.936	8.935	8.927	8.914	8.746
0.290322580645161	8.922	8.922	8.92	8.91	8.896	8.716
0.32258064516129	8.758	8.752	8.684	8.501	8.401	8.309
0.354838709677419	8.177	8.163	8.156	8.153	8.148	7.991
0.387096774193548	8.122	8.122	8.12	8.112	8.1	7.916
0.419354838709677	8.02	8.02	8.018	8.014	8.008	7.86
0.451612903225806	7.985	7.985	7.983	7.973	7.96	7.788
0.483870967741936	7.959	7.959	7.957	7.95	7.941	7.775
0.516129032258065	7.949	7.945	7.907	7.857	7.844	7.731
0.548387096774194	7.743	7.735	7.637	7.614	7.608	7.476
0.580645161290323	7.571	7.562	7.468	7.218	7.157	7.053
0.612903225806452	7.053	7.053	7.052	7.049	7.04	6.898
0.645161290322581	6.804	6.8	6.753	6.66	6.618	6.557
0.67741935483871	6.311	6.302	6.252	6.236	6.226	6.098
0.709677419354839	5.851	5.844	5.779	5.689	5.62	5.481
0.741935483870968	5.312	5.307	5.25	5.122	5.041	4.817
0.774193548387097	4.46	4.457	4.415	4.304	4.295	4.225
0.806451612903226	4.072	4.067	4.012	3.849	3.805	3.744
0.838709677419355	3.359	3.346	3.294	3.195	3.128	3.055
0.870967741935484	2.624	2.607	2.469	2.306	2.246	2.172
0.903225806451613	1.887	1.884	1.861	1.771	1.691	1.48
0.935483870967742	1.102	1.097	1.065	0.9311	0.8421	0.5682
0.967741935483871	0.2845	0.279	0.2254	0.1556	0.1206	0.03685
0.1	9.0946	9.0946	9.0925	9.0804	9.067	8.9032

Average of yearly averages: 6.488135

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORBNG
Metfile: w24232.dvf
PRZM scenario: ORsnbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide
Description Variable Name Value Units Comments
Molecular weight mwt 682.4 g/mol

```
Henry's Law Const.      henry 8.9e-11     atm-m^3/mol
Vapor Pressure    vapr  7.5e-7      torr
Solubility  sol   0.04  mg/L
Kd    Kd          mg/L
Koc   Koc   1954.2     mg/L
Photolysis half-life    kdp   11.58 days  Half-life
Aerobic Aquatic Metabolism    kbacw 0     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 1092  days  Halfife
Aerobic Soil Metabolism asm   0     days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.1052      kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    5     days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1052      kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)
stored as ORCTAben.out
Chemical: Flubendiamide
PRZM environment: ORXmasTreeSTD.txt modified Tueday, 21 February 2006
at 14:39:00
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24232.dvf     modified Tueday, 26 August 2008 at 05:15:54
Benthic segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.2568	0.2555	0.245	0.2368	0.2333	0.1409
1962	0.5953	0.5947	0.5872	0.5557	0.5414	0.4283
1963	0.9516	0.9515	0.9505	0.9385	0.9233	0.7989
1964	1.219	1.215	1.181	1.173	1.17	1.09
1965	1.504	1.501	1.491	1.487	1.482	1.404
1966	1.787	1.786	1.774	1.756	1.751	1.675
1967	1.993	1.993	1.992	1.987	1.98	1.903
1968	2.19	2.19	2.186	2.175	2.165	2.087
1969	2.376	2.375	2.362	2.341	2.331	2.27
1970	2.537	2.537	2.536	2.529	2.521	2.449
1971	2.66	2.66	2.659	2.652	2.644	2.581
1972	2.77	2.77	2.769	2.762	2.752	2.677
1973	2.865	2.865	2.856	2.849	2.84	2.776
1974	3.001	3.001	3	2.993	2.984	2.913
1975	3.085	3.085	3.084	3.076	3.067	2.994
1976	3.134	3.134	3.133	3.125	3.116	3.038
1977	3.084	3.084	3.083	3.076	3.066	2.998
1978	3.215	3.215	3.214	3.205	3.195	3.105

1979	3.217	3.217	3.216	3.207	3.197	3.142
1980	3.288	3.288	3.287	3.279	3.269	3.198
1981	3.472	3.472	3.471	3.462	3.452	3.39
1982	3.57	3.57	3.568	3.56	3.549	3.477
1983	3.592	3.592	3.591	3.583	3.573	3.502
1984	3.583	3.583	3.582	3.573	3.562	3.491
1985	3.635	3.635	3.632	3.621	3.61	3.534
1986	3.612	3.612	3.611	3.603	3.592	3.516
1987	3.599	3.597	3.573	3.566	3.564	3.505
1988	3.759	3.759	3.758	3.748	3.736	3.657
1989	3.725	3.725	3.724	3.715	3.704	3.637
1990	3.85	3.85	3.849	3.839	3.826	3.749
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	3.85	3.85	3.849	3.839	3.826	3.749
0.0645161290322581	3.759	3.759	3.758	3.748	3.736	3.657
0.0967741935483871	3.725	3.725	3.724	3.715	3.704	3.637
0.129032258064516	3.635	3.635	3.632	3.621	3.61	3.534
0.161290322580645	3.612	3.612	3.611	3.603	3.592	3.516
0.193548387096774	3.599	3.597	3.591	3.583	3.573	3.505
0.225806451612903	3.592	3.592	3.582	3.573	3.564	3.502
0.258064516129032	3.583	3.583	3.573	3.566	3.562	3.491
0.290322580645161	3.57	3.57	3.568	3.56	3.549	3.477
0.32258064516129	3.472	3.472	3.471	3.462	3.452	3.39
0.354838709677419	3.288	3.288	3.287	3.279	3.269	3.198
0.387096774193548	3.217	3.217	3.216	3.207	3.197	3.142
0.419354838709677	3.215	3.215	3.214	3.205	3.195	3.105
0.451612903225806	3.134	3.134	3.133	3.125	3.116	3.038
0.483870967741936	3.085	3.085	3.084	3.076	3.067	2.998
0.516129032258065	3.084	3.084	3.083	3.076	3.066	2.994
0.548387096774194	3.001	3.001	3	2.993	2.984	2.913
0.580645161290323	2.865	2.865	2.856	2.849	2.84	2.776
0.612903225806452	2.77	2.77	2.769	2.762	2.752	2.677
0.645161290322581	2.66	2.66	2.659	2.652	2.644	2.581
0.67741935483871	2.537	2.537	2.536	2.529	2.521	2.449
0.709677419354839	2.376	2.375	2.362	2.341	2.331	2.27
0.741935483870968	2.19	2.19	2.186	2.175	2.165	2.087
0.774193548387097	1.993	1.993	1.992	1.987	1.98	1.903
0.806451612903226	1.787	1.786	1.774	1.756	1.751	1.675
0.838709677419355	1.504	1.501	1.491	1.487	1.482	1.404
0.870967741935484	1.219	1.215	1.181	1.173	1.17	1.09
0.903225806451613	0.9516	0.9515	0.9505	0.9385	0.9233	0.7989
0.935483870967742	0.5953	0.5947	0.5872	0.5557	0.5414	0.4283
0.967741935483871	0.2568	0.2555	0.245	0.2368	0.2333	0.1409
0.1	3.716	3.716	3.7148	3.7056	3.6946	3.6267

Average of yearly averages:

2.63753666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORCTA
Metfile: w24232.dvf

```
PRZM scenario:    ORXmasTreeSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:    Flubendiamide
Description Variable Name     Value Units Comments
Molecular weight  mwt   682.4 g/mol
Henry's Law Const.      henry 8.9e-11     atm-m^3/mol
Vapor Pressure    vapr  7.5e-7      torr
Solubility  sol   0.04  mg/L
Kd    Kd          mg/L
Koc   Koc   1954.2      mg/L
Photolysis half-life    kdp   11.58 days  Half-life
Aerobic Aquatic Metabolism    kbacw 0     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 1092  days  Halfife
Aerobic Soil Metabolism asm   0     days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.1747      kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  01-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    7     days  Set to 0 or delete line for single
app.
app. rate 1 apprate     0.1747      kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)
stored as ORCTGben.out
Chemical: Flubendiamide
PRZM environment: ORXmasTreeSTD.txt modified Tueday, 21 February 2006
at 14:39:00
EXAMS environment: pond298.exv      modified Tueday, 26 August 2008 at
05:14:08
Metfile: w24232.dvf     modified Tueday, 26 August 2008 at 05:15:54
Benthic segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.08103	0.07972	0.06846	0.05924	0.05503	0.03024
1962	0.2634	0.2627	0.2543	0.2202	0.2042	0.1511
1963	0.4796	0.4795	0.4776	0.4634	0.446	0.3746
1964	0.6167	0.6121	0.5762	0.5499	0.5457	0.5301
1965	0.7873	0.7835	0.7702	0.75	0.739	0.7228
1966	0.9683	0.9672	0.9534	0.9111	0.8994	0.8839
1967	1.054	1.053	1.047	1.036	1.032	1.015
1968	1.192	1.192	1.186	1.171	1.158	1.111
1969	1.298	1.297	1.282	1.256	1.241	1.209
1970	1.337	1.337	1.337	1.333	1.329	1.312
1971	1.397	1.396	1.394	1.39	1.386	1.371
1972	1.429	1.428	1.428	1.425	1.42	1.402
1973	1.53	1.529	1.517	1.47	1.451	1.443

1974	1.561	1.56	1.555	1.546	1.543	1.528
1975	1.588	1.588	1.588	1.584	1.58	1.563
1976	1.588	1.588	1.587	1.584	1.58	1.558
1977	1.519	1.517	1.502	1.497	1.493	1.473
1978	1.591	1.591	1.591	1.587	1.581	1.55
1979	1.592	1.592	1.589	1.578	1.571	1.555
1980	1.676	1.671	1.633	1.602	1.6	1.584
1981	1.849	1.848	1.838	1.805	1.786	1.756
1982	1.858	1.858	1.858	1.856	1.853	1.821
1983	1.852	1.852	1.851	1.849	1.847	1.826
1984	1.829	1.829	1.826	1.812	1.808	1.794
1985	1.849	1.849	1.848	1.843	1.837	1.819
1986	1.82	1.82	1.818	1.814	1.813	1.786
1987	1.883	1.88	1.848	1.778	1.767	1.764
1988	1.95	1.95	1.949	1.947	1.943	1.913
1989	1.948	1.946	1.924	1.907	1.905	1.881
1990	2.024	2.024	2.023	2.02	2.016	1.988
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	2.024	2.024	2.023	2.02	2.016	1.988
0.0645161290322581	1.95	1.95	1.949	1.947	1.943	1.913
0.0967741935483871	1.948	1.946	1.924	1.907	1.905	1.881
0.129032258064516	1.883	1.88	1.858	1.856	1.853	1.826
0.161290322580645	1.858	1.858	1.851	1.849	1.847	1.821
0.193548387096774	1.852	1.852	1.848	1.843	1.837	1.819
0.225806451612903	1.849	1.849	1.848	1.814	1.813	1.794
0.258064516129032	1.849	1.848	1.838	1.812	1.808	1.786
0.290322580645161	1.829	1.829	1.826	1.805	1.786	1.764
0.32258064516129	1.82	1.82	1.818	1.778	1.767	1.756
0.354838709677419	1.676	1.671	1.633	1.602	1.6	1.584
0.387096774193548	1.592	1.592	1.591	1.587	1.581	1.563
0.419354838709677	1.591	1.591	1.589	1.584	1.58	1.558
0.451612903225806	1.588	1.588	1.588	1.584	1.58	1.555
0.483870967741936	1.588	1.588	1.587	1.578	1.571	1.55
0.516129032258065	1.561	1.56	1.555	1.546	1.543	1.528
0.548387096774194	1.53	1.529	1.517	1.497	1.493	1.473
0.580645161290323	1.519	1.517	1.502	1.47	1.451	1.443
0.612903225806452	1.429	1.428	1.428	1.425	1.42	1.402
0.645161290322581	1.397	1.396	1.394	1.39	1.386	1.371
0.67741935483871	1.337	1.337	1.337	1.333	1.329	1.312
0.709677419354839	1.298	1.297	1.282	1.256	1.241	1.209
0.741935483870968	1.192	1.192	1.186	1.171	1.158	1.111
0.774193548387097	1.054	1.053	1.047	1.036	1.032	1.015
0.806451612903226	0.9683	0.9672	0.9534	0.9111	0.8994	0.8839
0.838709677419355	0.7873	0.7835	0.7702	0.75	0.739	0.7228
0.870967741935484	0.6167	0.6121	0.5762	0.5499	0.5457	0.5301
0.903225806451613	0.4796	0.4795	0.4776	0.4634	0.446	0.3746
0.935483870967742	0.2634	0.2627	0.2543	0.2202	0.2042	0.1511
0.967741935483871	0.08103	0.07972	0.06846	0.05924	0.05503	0.03024
0.1	1.9415	1.9394	1.9174	1.9019	1.8998	1.8755

Average of yearly averages: 1.357158

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORCTG
Metfile: w24232.dvf
PRZM scenario: ORXmasTreeSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide
Description Variable Name Value Units Comments
Molecular weight mwt 682.4 g/mol
Henry's Law Const. henry 8.9e-11 atm-m^3/mol
Vapor Pressure vapr 7.5e-7 torr
Solubility sol 0.04 mg/L
Kd Kd mg/L
Koc Koc 1954.2 mg/L
Photolysis half-life kdp 11.58 days Half-life
Aerobic Aquatic Metabolism kbacw 0 days Halfife
Anaerobic Aquatic Metabolism kbacs 1092 days Halfife
Aerobic Soil Metabolism asm 0 days Halfife
Hydrolysis: pH 7 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.1747 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 01-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 7 days Set to 0 or delete line for single app.
app. rate 1 apprate 0.1747 kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)
stored as WABNAben.out
Chemical: Flubendiamide
PRZM environment: WAbeansNMC.txt modified Thuday, 14 June 2007 at 10:18:32
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w24243.dvf modified Tueday, 26 August 2008 at 05:15:56
Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.1535	0.1523	0.1419	0.1383	0.1378	0.06148
1962	0.4098	0.4098	0.4091	0.4016	0.3788	0.2503
1963	0.5419	0.5419	0.5417	0.5387	0.5378	0.4733
1964	0.7477	0.7364	0.6636	0.6448	0.6427	0.582
1965	1.066	1.066	1.066	1.065	1.063	1.004
1966	1.202	1.202	1.201	1.199	1.196	1.152
1967	1.238	1.238	1.238	1.235	1.232	1.196
1968	1.464	1.464	1.463	1.463	1.461	1.358

1969	1.499	1.499	1.498	1.495	1.492	1.46
1970	1.567	1.567	1.566	1.563	1.56	1.525
1971	1.599	1.599	1.598	1.596	1.594	1.563
1972	1.601	1.601	1.601	1.598	1.594	1.566
1973	1.645	1.645	1.645	1.631	1.619	1.586
1974	1.674	1.674	1.673	1.669	1.665	1.637
1975	1.822	1.822	1.822	1.82	1.818	1.708
1976	1.824	1.824	1.824	1.82	1.815	1.788
1977	1.82	1.818	1.79	1.786	1.782	1.762
1978	1.88	1.88	1.879	1.875	1.871	1.846
1979	1.868	1.868	1.867	1.863	1.858	1.835
1980	1.883	1.882	1.868	1.842	1.837	1.817
1981	1.961	1.961	1.961	1.958	1.946	1.896
1982	2.023	2.022	2.019	2.009	1.994	1.963
1983	2.12	2.12	2.112	2.067	2.045	2.011
1984	2.136	2.136	2.136	2.131	2.126	2.11
1985	2.138	2.138	2.138	2.136	2.134	2.114
1986	2.297	2.297	2.296	2.294	2.291	2.214
1987	2.323	2.32	2.289	2.279	2.275	2.25
1988	2.364	2.364	2.363	2.359	2.355	2.335
1989	2.314	2.314	2.313	2.308	2.302	2.285
1990	2.615	2.615	2.614	2.612	2.608	2.373
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	2.615	2.615	2.614	2.612	2.608	2.373
0.0645161290322581	2.364	2.364	2.363	2.359	2.355	2.335
0.0967741935483871	2.323	2.32	2.313	2.308	2.302	2.285
0.129032258064516	2.314	2.314	2.296	2.294	2.291	2.25
0.161290322580645	2.297	2.297	2.289	2.279	2.275	2.214
0.193548387096774	2.138	2.138	2.138	2.136	2.134	2.114
0.225806451612903	2.136	2.136	2.136	2.131	2.126	2.11
0.258064516129032	2.12	2.12	2.112	2.067	2.045	2.011
0.290322580645161	2.023	2.022	2.019	2.009	1.994	1.963
0.32258064516129	1.961	1.961	1.961	1.958	1.946	1.896
0.354838709677419	1.883	1.882	1.879	1.875	1.871	1.846
0.387096774193548	1.88	1.88	1.868	1.863	1.858	1.835
0.419354838709677	1.868	1.868	1.867	1.842	1.837	1.817
0.451612903225806	1.824	1.824	1.824	1.82	1.818	1.788
0.483870967741936	1.822	1.822	1.822	1.82	1.815	1.762
0.516129032258065	1.82	1.818	1.79	1.786	1.782	1.708
0.548387096774194	1.674	1.674	1.673	1.669	1.665	1.637
0.580645161290323	1.645	1.645	1.645	1.631	1.619	1.586
0.612903225806452	1.601	1.601	1.601	1.598	1.594	1.566
0.645161290322581	1.599	1.599	1.598	1.596	1.594	1.563
0.67741935483871	1.567	1.567	1.566	1.563	1.56	1.525
0.709677419354839	1.499	1.499	1.498	1.495	1.492	1.46
0.741935483870968	1.464	1.464	1.463	1.463	1.461	1.358
0.774193548387097	1.238	1.238	1.238	1.235	1.232	1.196
0.806451612903226	1.202	1.202	1.201	1.199	1.196	1.152
0.838709677419355	1.066	1.066	1.066	1.065	1.063	1.004
0.870967741935484	0.7477	0.7364	0.6636	0.6448	0.6427	0.582
0.903225806451613	0.5419	0.5419	0.5417	0.5387	0.5378	0.4733
0.935483870967742	0.4098	0.4098	0.4091	0.4016	0.3788	0.2503

0.967741935483871	0.1535	0.1523	0.1419	0.1383	0.1378	0.06148
0.1	2.3221	2.3194	2.3113	2.3066	2.3009	2.2815

Average of yearly averages:

1.59070266666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: WABNA
Metfile: w24243.dvf
PRZM scenario: WAbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide
Description Variable Name Value Units Comments
Molecular weight mwt 682.4 g/mol
Henry's Law Const. henry 8.9e-11 atm-m^3/mol
Vapor Pressure vapr 7.5e-7 torr
Solubility sol 0.04 mg/L
Kd Kd mg/L
Koc Koc 1954.2 mg/L
Photolysis half-life kdp 11.58 days Half-life
Aerobic Aquatic Metabolism kbacw 0 days Halfife
Anaerobic Aquatic Metabolism kbacs 1092 days Halfife
Aerobic Soil Metabolism asm 0 days Halfife
Hydrolysis: pH 7 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.1052 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 01-07 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 5 days Set to 0 or delete line for single app.
app. rate 1 apprate 0.1052 kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)
stored as WABNGben.out
Chemical: Flubendiamide
PRZM environment: WAbeansNMC.txt modified Thuday, 14 June 2007 at 10:18:32
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w24243.dvf modified Tueday, 26 August 2008 at 05:15:56
Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.04576	0.04444	0.03352	0.02946	0.02875	0.01259
1962	0.2089	0.2088	0.2078	0.1992	0.1751	0.1

1963	0.2526	0.2525	0.2519	0.2479	0.2463	0.2335
1964	0.38	0.3681	0.2919	0.2712	0.268	0.2567
1965	0.633	0.633	0.6328	0.6317	0.6302	0.6136
1966	0.7084	0.7084	0.7083	0.7072	0.7057	0.6936
1967	0.6985	0.6985	0.6982	0.6965	0.6947	0.6777
1968	0.8595	0.8595	0.8594	0.8585	0.8558	0.7875
1969	0.8593	0.8593	0.8591	0.8581	0.8572	0.8369
1970	0.8802	0.8802	0.88	0.8787	0.8769	0.8565
1971	0.872	0.872	0.8718	0.8708	0.8694	0.8529
1972	0.8375	0.8375	0.8374	0.8365	0.8348	0.8145
1973	0.8384	0.8383	0.8364	0.819	0.8077	0.7983
1974	0.8404	0.8403	0.8402	0.8396	0.8384	0.8189
1975	0.952	0.952	0.9519	0.9511	0.9499	0.8637
1976	0.9454	0.9451	0.9441	0.942	0.9402	0.9177
1977	0.909	0.9064	0.8878	0.8857	0.8839	0.8637
1978	0.9549	0.9549	0.9547	0.9533	0.9516	0.9314
1979	0.9211	0.9211	0.921	0.9196	0.9177	0.8992
1980	0.9191	0.9177	0.9019	0.8805	0.8794	0.8641
1981	0.9876	0.9875	0.9856	0.9794	0.9644	0.9316
1982	1.033	1.033	1.029	1.014	0.9966	0.9849
1983	1.123	1.122	1.113	1.063	1.037	1.02
1984	1.136	1.136	1.136	1.135	1.133	1.109
1985	1.128	1.128	1.128	1.127	1.126	1.097
1986	1.256	1.256	1.255	1.254	1.25	1.187
1987	1.284	1.281	1.251	1.25	1.248	1.216
1988	1.332	1.332	1.331	1.33	1.327	1.296
1989	1.264	1.264	1.263	1.261	1.26	1.235
1990	1.559	1.559	1.558	1.557	1.554	1.322
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	1.559	1.559	1.558	1.557	1.554	1.322
0.0645161290322581	1.332	1.332	1.331	1.33	1.327	1.296
0.0967741935483871	1.284	1.281	1.263	1.261	1.26	1.235
0.129032258064516	1.264	1.264	1.255	1.254	1.25	1.216
0.161290322580645	1.256	1.256	1.251	1.25	1.248	1.187
0.193548387096774	1.136	1.136	1.136	1.135	1.133	1.109
0.225806451612903	1.128	1.128	1.128	1.127	1.126	1.097
0.258064516129032	1.123	1.122	1.113	1.063	1.037	1.02
0.290322580645161	1.033	1.033	1.029	1.014	0.9966	0.9849
0.32258064516129	0.9876	0.9875	0.9856	0.9794	0.9644	0.9316
0.354838709677419	0.9549	0.9549	0.9547	0.9533	0.9516	0.9314
0.387096774193548	0.952	0.952	0.9519	0.9511	0.9499	0.9177
0.419354838709677	0.9454	0.9451	0.9441	0.942	0.9402	0.8992
0.451612903225806	0.9211	0.9211	0.921	0.9196	0.9177	0.8641
0.483870967741936	0.9191	0.9177	0.9019	0.8857	0.8839	0.8637
0.516129032258065	0.909	0.9064	0.8878	0.8805	0.8794	0.8637
0.548387096774194	0.8802	0.8802	0.88	0.8787	0.8769	0.8565
0.580645161290323	0.872	0.872	0.8718	0.8708	0.8694	0.8529
0.612903225806452	0.8595	0.8595	0.8594	0.8585	0.8572	0.8369
0.645161290322581	0.8593	0.8593	0.8591	0.8581	0.8558	0.8189
0.67741935483871	0.8404	0.8403	0.8402	0.8396	0.8384	0.8145
0.709677419354839	0.8384	0.8383	0.8374	0.8365	0.8348	0.7983
0.741935483870968	0.8375	0.8375	0.8364	0.819	0.8077	0.7875

0.774193548387097	0.7084	0.7084	0.7083	0.7072	0.7057	0.6936
0.806451612903226	0.6985	0.6985	0.6982	0.6965	0.6947	0.6777
0.838709677419355	0.633	0.633	0.6328	0.6317	0.6302	0.6136
0.870967741935484	0.38	0.3681	0.2919	0.2712	0.268	0.2567
0.903225806451613	0.2526	0.2525	0.2519	0.2479	0.2463	0.2335
0.935483870967742	0.2089	0.2088	0.2078	0.1992	0.1751	0.1
0.967741935483871	0.04576	0.04444	0.03352	0.02946	0.02875	0.01259
0.1	1.282	1.2793	1.2622	1.2603	1.259	1.2331

Average of yearly averages: 0.836383

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: WABNG
Metfile: w24243.dvf
PRZM scenario: WAbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Flubendiamide

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	682.4	g/mol	
Henry's Law Const.	henry	8.9e-11	atm-m^3/mol	
Vapor Pressure	vapr	7.5e-7	torr	
Solubility	sol	0.04	mg/L	
Kd	Kd		mg/L	
Koc	Koc	1954.2	mg/L	
Photolysis half-life	kdp	11.58	days	Half-life
Aerobic Aquatic Metabolism	kbacw	0	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1092	days	Halfife
Aerobic Soil Metabolism	asm	0	days	Halfife
Hydrolysis: pH 7		0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.1052	kg/ha	
Application Efficiency:	APPEFF		0.99	fraction
Spray Drift	DRFT	0.01	fraction of application rate applied to pond	
Application Date	Date	01-07	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	5	days	Set to 0 or delete line for single app.
app. rate 1	apprate	0.1052	kg/ha	

Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

APPENDIX D: Ecological Toxicity Tables

Comment [ap2]: Necessary? Can't we reference past assessments for this information?

Table 1: Acute Toxicity of Flubendiamide to Freshwater Fish

Species	% a.i.	96-hr LC_{50}, µg/L (confid. int.)	NOAEC (µg/L)	Study Properties[a]	Toxicity Classification	MRID/Acc #, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Rainbow trout	97	>65.1	65.1	M, S	Not toxic at limit of solubility	468169-40, Dorgerloh, 2003	Acceptable
Carp	96.7	>84.8	84.8	M, Static Renewal	Not toxic at limit of solubility	468169-41, Yamakazi, 2003	Acceptable
Bluegill sunfish	97	>67.7	67.7	M, S	Not toxic at limit of solubility	468169-39, Dorgerloh, 2003	Acceptable
Fathead Minnow	96.6	>66.5	66.5	M, S	Not toxic at limit of solubility	468169-37, Kern, 2004	Acceptable
Flubendiamide Formulation 480 SC							
Rainbow trout	40	>91.1	91.1	M, S	Not toxic at limit of solubility	468169-43, Dorgerloh, 2003	Acceptable
Bluegill sunfish	40	>80.2	80.2	M, S	Not toxic at limit of solubility	468169-42, Dorgerloh, 2003	Acceptable

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static.

Table 2: Acute Toxicity of Flubendiamide to Freshwater Invertebrates							
Species	% a.i.	48-hr EC_{50}, µg/L (confid. int.)	NOAEC (µg/L)	Study Properties[a]	Toxicity Classification	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Daphnia magna	97	>54.8	54.8	M, S	Not toxic at limit of solubility	469189-30, Dorgerloh, 2003	Acceptable
Flubendiamide Formulation – 24 WG							
Daphnia magna	24	1.5 (0.97 – 2.3) Slope = 1.84 +/- 0.255	<1.21 based on sublethal effects	M, S	Very Highly Toxic	468169-32, Dorgerloh, 2005	Acceptable
Flubendiamide Formulation – 480 SC							
Daphnia magna	494.8 g/L	2.6 (2.0 – 3.3) Slope = 2.11	0.45 based on sublethal effects	M, S	Very Highly Toxic	468169-31, Dorgerloh, 2005	Acceptable
Daphnia magna	482.16 g/L	Unfed- 4.3	<1.25	M, S	Very Highly Toxic	468169-34, Dorgerloh, 2005	Supplemental
		10^2 cells/mL- 6.44	1.25				
		10^4 cells/mL- 7.5	<1.25				
		10^6 cells/mL- >12.2	12.2				
Flubendiamide degradate – des-iodo							
Daphnia magna	99.3	> 881	881	M, S	Not toxic at limit of solubility	468169-33 Dorgerloh, 2004	Acceptable

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static

Table 3: Acute Toxicity of Flubendiamide to Estuarine/Marine Invertebrates							
Species	% a.i.	96-hr EC_{50}, µg/L (confid. int.)	NOAEC (µg/L)	Study Properties[a]	Toxicity Classification	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Mysidopsis bahia Mysid Shrimp	96.28	>28	28	M, S	Not toxic at limit of solubility	468169-36 Dionne, 2004	Acceptable
EPA PC Code: 027602- Flubendiamide Technical							
Crassostrea virginica Eastern Oyster	97	>49	49	M, S	Not toxic at limit of solubility	468169-35 Dionne, 2004	Acceptable

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static

Table 4: Acute Toxicity of Flubendiamide to Estuarine Fish							
Species	% a.i.	96-hr LC_{50} µg/L (confid. int.)	NOAEC (µg/L)	Study Properties[a]	Toxicity Classification	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Sheepshead minnow	97.3	>29.8	29.8	M,S	Not toxic at limit of solubility	468169-38 Banman, 2004	Acceptable

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static

Table 5: Chronic (Early-life) Toxicity of Flubendiamide to Fish							
Species	% a.i.	NOAEC (µg/L)	LOAEC (µg/L)	Study Properties[a]	Most sensitive parameter	MRID , Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Fathead minnow	97.3	60.5	> 60.5	M, F-T	No treatment related effects	468169-47, Kern, 2004	Acceptable

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static.

Table 6: Chronic (Full Life Cycle) Toxicity of Flubendiamide to Fish							
Species	% a.i.	NOAEC (µg/L)	LOAEC (µg/L)	Study Properties[a]	Most sensitive parameter	MRID , Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Fathead minnow	97.1	<4.3	4.3	M, F-T	Growth (length and weight)	468169-48, Kern, 2004	Unacceptable (Significant reproductive effects in solvent control compared to neg. control)

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static.

Table 7: Chronic (Life-cycle) Toxicity of Flubendiamide to Aquatic Invertebrates							
Species	% ai	NOAEC (µg a.i./L)	LOAEC (µg ai/L)	Study Properties[a]	Most sensitive parameter	MRID, Author, Year	Status
EPA PC Code: 122101 - Flubendiamide Technical							
Daphnia magna	97	41.1	68.5	M, Static Renewal	Number of eggs aborted, number of dead neonate	468169-44, Dorgerloh 2003	Supplemental, uncertainties regarding analytical stability
Mysid-opsis bahia	98.1	> 20	>20	M, F-T	No treatment effects	468169-46. Putt, 2005	Acceptable
Flubendiamide Formulation 480 SC							
Daphnia magna	494.8 g ai/L	0.38	1.18	M, Static Renewal	Parental mortality, sublethal effects, time to first brood	468169-45, Dorgerloh 2003	Acceptable

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static

Table 8: Acute Toxicity of Flubendiamide to Aquatic Plants							
Species	%a.i.	EC_{50} (µg ai/L)	NOAEC /EC_{05} (µg/L) a.i.	Most sensitive parameter	Initial/mean measured concentrations	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Vascular Plant Duckweed (*Lemna gibba*) Tier II	96.6	7-day test > 54.6	54.6	Frond number	mean	468170-39 Kern, 2004	Acceptable
Non-Vascular Plant Green algae (*Selenastrum capricornutum*) Tier I	96.7	96-hr test >69.3 (2% inhibition)	69.3	Cell density, growth rate, area under the growth curve	mean	468170-41 Yamazaki, 2003	Acceptable
Flubendiamide Formulation 480 SC							
Non-Vascular Plant Green algae (*Pseudokirchneriella subcapitata*) Tier II	489.54 g/L	72- hour test > 50,500	50,500	Cell density, growth rate	mean	468170-40 Dorgerloh, 2005	Acceptable OECD 3-day studies accepted for review as Tier I screen only

Table 8: Acute Toxicity of Flubendiamide to Benthic Organisms						
Species	%a.i.	EC_{50} (µg ai/L)	NOAEC/ (µg/L) a.i.	Most sensitive parameter	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical						
Chironomid (*Chironomus riparius*)	97.4	28-day test	NOAEC= 40 µg a.i./L (nominal) LOAEC= 80 µg a.i./L (nominal, 69 µg a.i./L 1-hr initial water column measured)	Percent emergence	468170-22 Dorgerloh, 2003	Supplemental Sediment not analyzed for a.i. Emergence success sign. Lower in solvent control
Flubendiamide Formulation 24 WG						
Chironomid (*Chironomus riparius*)	24	48- hr test 130 (95- 178) Slope = 2.05	36	Mortality	468170-14 Dorgerloh, 2005	Acceptable
Flubendiamide Formulation 480 SC						
Chironomid (*Chironomus riparius*)	24	48- hr test 1650 (1180- 2310) Slope = 1.64	380	Mortality	468170-13 Dorgerloh, 2005	Acceptable
Flubendiamide Degradate, des-iodo						
Chironomid (*Chironomus riparius*)	99.3% des-iodo	28-day test	NOAEC= 3.2 µg a.i./L (initial measured) LOAEC= 8.0 µg a.i./L (nominal)	Reduction in percent emergence and male and female development rates	468170-23	Supplemental

Table 9: Mesocosm Study						
Species	%a.i.	LC_{50}, (µg ai/L)	NOAEC/ EC_{05} (µg/L) a.i.	Most sensitive parameter	MRID, Author, Year	Status
Flubendiamide Formulation 480 SC						
Zooplankton, phytoplankton, benthos,	478.5 g/L	Not determined Concentration tested 0.4, 1.0, 2.3, 5.3 ppb (two ponds per level) 12 ppb – one pond per level		Daphnia was the most sensitive species	468170-02 Heimbach *et al* 2006	Supplemental (insufficient number of replicate ponds were tested for each level, finfish not included)

Table 10: Acute Toxicity to Flubendiamide to Birds (oral administration)							
Species	Purity	LD_{50}, mg/kg-bw (conf. interval)	NOAEL, mg/kg-bw	Effects	Toxicity Classification (based on a.i.)	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Bobwhite quail	97%	>2000	2000	One mortality in 250 mg/kg group	Slightly toxic	468170-03 Barfkne	Acceptable
Flubendiamide Formulation 480 SC							
Bobwhite quail	489.54 g/L	> 2000	1000	Enlarged gall bladder, whitish pancreas, no mortality	Practically non-toxic	468170-04 Barfkne cht2004	Acceptable

Table 11: Acute Toxicity to Flubendiamide to Birds (dietary administration)							
Species	% a.i.	LC_{50}, mg/kg-diet	NOAEC, mg/kg-diet	Effects	Toxicity Classification	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical							
Bobwhite quail	97	>5199	5199	No treatment effects	Practically non-toxic	468170-06 Barfknecht, 2003	Acceptable
Mallard duck	96.62	>4535	4535	No treatment effects	Practically non-toxic	468170-05 Bowers, 2005	Acceptable

Table 12: Avian Developmental and Chronic Toxicity to Flubendiamide						
Test Type	% a.i.	NOAEC (mg ai/kg-diet)	LOAEC (mg ai/kg-diet)	Effects	MRID #, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical						
One-generation reproductive Mallard duck	97.3	98	298	The ratio of viable embryos to eggs set was significantly reduced (6%) from control at the lowest treatment level, dose-dependent response for hatchling survival of number hatched. Percent reductions in this endpoint were slight (1, 3, and 7%, respectively) with increasing test levels, but did follow a dose-dependent pattern. Survivor weights were adversely affected at the 289 mg ai/kg diet level and numerous reproductive parameters, including eggs set of eggs laid, viable embryos, live embryos, hatchling survivors, and egg shell quality (strength and thickness) were adversely affected at the 960 mg ai/kg diet level.	468170-07, Sabbert, 2006	Supplemental (statistically significant effects observed at the lowest test level)
One-generation reproductive - Bobwhite quail	97	1059	>1059	No treatment related effects were observed at any test level	468170-08, Bowers, 2005	Acceptable

Table 13: Mammalian Acute Oral Toxicity to Flubendiamide					
Species	% a.i.	LD_{50} (mg a.i./kg-bw)	Toxicity Classification	MRID #, Author, Year	Status[a]
EPA PC Code: 027602- Flubendiamide Technical					
laboratory mouse	N/A	>2000 Combined sexes	Practically non-toxic	468171-42	Acceptable
laboratory rat *(Rattus norvegicus)*	N/A	>5000 Combined sexes	Practically non-toxic	468171-43	Acceptable

N/A: Not Available

Table 14: Mammalian Developmental and Chronic Toxicity to Flubendiamide						
Test Type	% a.i.	NOAEL (mg ai/kg-diet)	LOAEL (mg ai/kg-diet)	Effects	MRID #	Status[a]
EPA PC Code: 027602- Flubendiamide Technical						
2-generation reproduction study (rats)	N/A	Parental 50	2000	Effects on liver, thyroid, and kidneys	468172-16	Acceptable
		Offspring 50	2000	Effects on liver and thyroid		
		Reproduction 20,000	>20,000	No reproductive effects observed		
		Eye Effect 50	2000	Eyeball enlargement and liver hypertrophy		
1-generation reproduction study (rats)	N/A	200 ppm – parental	2000 ppm	Effects on liver, thyroid, and kidneys At 20,000 ppm, F1 pup body weights were decreased by an estimated 9% in both sexes compared to controls on PND 21. Absolute and relative (to body weight) anogenital distances were increased by in the ≥2000 ppm male pups on PND 4. These parameters were comparable to controls in the treated females. Sexual maturation was significantly delayed in both sexes.	468172-39	Supplemental
		200 ppm – offspring	2000 ppm	At ≥2000 ppm, absolute and relative liver weights were increased ($p \leq 0.001$) in both males and females. At necropsy, incidences of dark-colored livers were increased at ≥2000 ppm (25.7-42.8%) compared to 0 controls.		
		20,000 ppm - reproductive	>20,000 ppm	no evidence of any-treatment-related effects or signs of reproductive impairment in males or females		
		Eye Effect 200	2000	Microscopic effects on the eyes		

N/A: Not Available
[a] Status (acceptability) based on HEDs guidelines.

Table 15: Toxicity of Flubendiamide to Terrestrial Plants (Seedling Emergence - Tier 1)						
Species	% a.i.	EC_{25}, (lbs ai/acre)	$NOAEC/EC_{05}$ (lbs ai/acre)	Most sensitive parameter, % Inhibition	MRID, Author, Year	Status
Flubendiamide Formulation 24 WG						
Monocots:	24%				468170-34 Nguyen, 2005	Acceptable
Oat		>0.158	0.158	N/A		
Corn		>0.158	0.158	N/A		
Dicots:						
Soybean		>0.158	0.158	N/A		
Oilseed rape		>0.158	0.158	N/A		
Cucumber		>0.158	0.158	Survival- 19%		
Sunflower		<0.158	<0.158	Percent Emergence- 33%		
Flubendiamide Formulation 480 SC						
Monocots:						
Oat	40.5%	>0.393	0.393	N/A		
Corn		>0.393	0.393	N/A		
Ryegrass		>0.393	0.393	N/A		Acceptable
Dicots:						
Soybean		>0.393	0.393	N/A	468170-36(a) Nguyen, 2005	
Cabbage		>0.393	0.393	Dry Weight, 14%		
Cucumber		>0.393	0.393	Dry Weight, 14%		
Tomato		>0.393	0.393	N/A		
Lettuce		>0.393	0.393	N/A		
Turnip		>0.393	0.393	N/A		

Table 16: Toxicity of Flubendiamide to Terrestrial Plants Vegetative Vigor - Tier 1						
Species	% a.i.	EC_{25}, (lbs ai/acre)	NOAEC/EC_{05} (lbs ai/acre)	Most sensitive parameter % Inhibition	MRID, Author, Year	Status
Flubendiamide Formulation 24 WG						
Monocots	24				468170-37 Nguyen, 2005	Supplemental (non-GLP lab, low number of reps)
Onion, corn, oat		>0.158	0.158	N/A		
Dicots						
Soybean		>0.158	<0.158	Dry Weight, 22%		
Oilseed rape, lettuce, cucumber, sunflower		>0.158	0.158	N/A		
Flubendiamide Formulation 480 SC						
Monocots					468170-36(b) Christ, 2005	Acceptable
Onion, corn, oat, ryegrass		>4.26	4.26	N/A		
Dicots						
Cabbage, cucumber, lettuce soybean, tomato, turnip		>4.26	4.26	N/A		

Table 17: Toxicity of Flubendiamide to Terrestrial Plants (Seedling Emergence - Tier 2)						
Species	% a.i.	EC_{25}, (lbs ai/acre)	NOAEC/EC_{05} (lbs ai/acre)	Most sensitive parameter	MRID, Author, Year	Status
Flubendiamide Formulation WG24						
Dicot: Sunflower	23.33	>0.16	0.16	n/a	468170-38 Christ 2006	Acceptable

Measured application rates tested – 0, 0.0098, 0.017, 0.037, 0.0881, and 0.16 lb a.i./A

Table 18: Herbicidal Toxicity of Flubendiamide to Terrestrial Plants (Seedling Emergence - Tier 2)					
Species	% a.i.	Pre-Emergence Treatment 21-day	Post Emergence Treatment 17-day	MRID, Author, Year	Status
Flubendiamide Formulation 480 SC					
5 monocots 6 dicots	494.8 g/L	No phytotoxic effects up to 0.22 lb ai.A	No phytotoxic effects up to 0.22 lb ai.A	468170-35 Lechelt-Kunze 2002	Supplemental (non-guideline)

Table 19: Acute Toxicity of Flubendiamide to Earthworms						
Species	% a.i.	LC_{50}	NOAEC	Most sensitive parameter	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical						
Earthworm (*Eisenia fetida*) 14-day test	97%	> 1000 mg a.i./kg	> 1000 mg a.i./kg	No effects on mortality or percent weight change	468170-28, Lechelt Kunze, 2002	Supplemental (non-guideline)
Flubendiamide Formulation 480 SC						
Earthworm (*Eisenia fetida*) 14-day test	480 g/L	> 1000 mg a.i./kg	> 1000 mg a.i./kg	No effects on mortality or percent weight change	468170-29, Lechelt Kunze, 2004	Supplemental (non-guideline)
Flubendiamide Degradate, des-iodo						
Earthworm (*Eisenia fetida*) 14-day test	99.3%	> 1000 mg a.i./kg	> 1000 mg a.i./kg	No effects on mortality or percent weight change	468170-30, Lechelt Kunze, 2004	Supplemental (non-guideline)

Table 20: Chronic Toxicity of Flubendiamide to Earthworms and Collembola species.						
Species	% a.i.	EC_{25}, (lbs ai/acre)	NOAEC/EC_{05} (lbs ai/acre)	Most sensitive parameter	MRID, Author, Year	Status
Flubendiamide Formulation 480 SC						
Earthworm (*Eisenia fetida*) 28-day test	494.8 g/L	> 1000 mg a.i./kg	> 1000 mg a.i./kg	No effects on mortality or percent weight change	468170-31, Luhrs, 2002	Supplemental (significant guideline deviations)
White springtail soil arthropod *(Folsomia candida)*	482.16 g/L	--	NOAEC = 31.6 mg a.s./kg (dw) LOAEC= 31.6 mg a.s./kg (dw)	Number of juveniles produced	468170-27 Frommholz, 2005	Supplemental
Flubendiamide Formulation 24 WG						
Earthworm (*Eisenia fetida*) 28-day test	494.8 g/L	> 1000 mg a.i./kg	562 mg a.i./kg	No effects on mortality or body weight, Significant reduction of number of juveniles produced	468170-32, Lechelt Kunze, 2005	Supplemental

Table 21: Acute Toxicity of Flubendiamide to Bees						
Species	% a.i.	EC_{25}	NOAEC/EC_{05}	Most sensitive parameter	MRID, Author, Year	Status
EPA PC Code: 027602- Flubendiamide Technical						
Acute Contact 48-hrs Honey bee (*Apis mellifera*)	97%	> 200 µg ai/bee	200 µg ai/bee	Mortality, same results for oral and contact tests	468170-09, Barth, 2002	Acceptable
Flubendiamide Formulation 480 SC						
Acute Contact 48-hrs Honey bee (*Apis mellifera*)	480 g/L	> 200 µg ai/bee	200 µg ai/bee	Mortality, same results for oral and contact tests	468170-10, Barth, 2002	Acceptable

Table 21: Acute Toxicity of Flubendiamide to Bees						
Species	% a.i.	EC_{25}	$NOAEC/EC_{05}$	Most sensitive parameter	MRID, Author, Year	Status
Side Effects 15-days Honey bee (*Apis mellifera*)	39.2%	Not determined, some brood development effects at 0.16 lb ai./A but showed recovery		No adverse effects on mortality, flight intensity, and behavior	468170-11, Schur, 2006	Acceptable
Flubendiamide Formulation WG24						
Bumblebee (*Bombus terrestris*) 27 day test Greenhouse test	24%	Not determined		No adverse effects on pollination activity, flight frequency, or final hive evaluation data	468170-12, Nguyen, 2005	Supplemental Non-guideline

Table 22: Acute Toxicity of Flubendiamide to Non-target Arthropods						
Species	% a.i.	LD_{50}	NOAEC	Most sensitive parameter	MRID, Author, Year	Status
Flubendiamide Formulation WG24						
Parasitoid Wasp (*Aphidius rhopalosiphi*) 15-day test	24.2 %	> 0.55 lb a.i./A	0.17 lb a.i./A	Survival and reproduction were adversely affected	468170-20, Waltersdorfer, 2005	Supplemental non-guideline
Predatory mite (*Typhlodromas pyri*) 14-day test	485.9 g/L	> 0.55 lb a.i./A	0.31 lb ai/A	Mortality (14%), Reproduction (24%)	468170-19, Waltersdorfer, 2005	Supplemental non-guideline
Flubendiamide Formulation 480 SC						
45-day test Ladybird beetle (*Coccinella septempunctata*) Coleoptera	485.9 g/L	LD50= 0.089 lb a.i./A	0.04 lb a.i./A	Adult survival, no effect on larval survival or reproduction	468170-15, Waltersdorfer, 2004	Supplemental non-guideline
Extended laboratory study aged residue test Ladybird beetle (*Coccinella septempunctata*)	482.2 g/L	LD50 > 0.17 lb a.i./A	0.17 lb a.i./A	No reduction of survival or reproduction	468170-16, Moll, 2005	Supplemental non-guideline
Life cycle Test 47 days Ladybird beetle (*Coccinella septempunctata*)	494.8 g/L	LD50 = 0.41 lb a.i./A	0.24 lb a.i./A	Larval survival	468170-17, Maus, 2002	Supplemental non-guideline
Rate-response test 14-days Parasitic wasp (*Aphidius rhopalosiphi*) Side Effects Test	494.8 g/L	Test 1: LD50 = 0.423 lb a.i./A	< 0.2 lb a.i./A	Survival	468170-21 Fussell, 2002	Supplemental non-guideline
		Test 2: LD50 > 0.6 lb a.i./A	0.39 lb a.i./A			
Green lacewing (*Chrysoperla carnea*)	478.5 3 g/L	LD50 > 0.16 lb a.i./A	--	Measured mortality and reproduction	468170-18 Waltersdorfer, 2004	Supplemental

APPENDIX E: ECOTOX Papers

Acceptable for ECOTOX and OPP

1. Dhawan, A.K., Singh,K., Singh R., and Kumar, T. (2006). Field Evaluation of Flubendiamide (NNI 0001 480 SC) Against Bollworms Complex on Upland Cotton. J. *Cotton Res.Dev.* 20:232-235.

   EcoReference No.: 92630
   Chemical of Concern: FDB,ES; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(FBD).

2. Narayana, S.L. and Rajasri, M. (2006). Flubendiamide 20 WDG (RIL-038) – a new Molecule for the Management of the American Bollworm Helicoverpa armigera on Cottor. *Pestology* 30: 16-18

   EcoReference No.: 92813
   Chemical of Concern: SS,IDC,FBD; Habitat: T; Effect Codes: POP,GRO; Rejection Code: LITE EVAL CODED(FBD).

3. Tomar, S.P.S, Choudhary, R.K., and Shrivastava, V.K (2005). Evaluation of Bioefficacy of Flubendiamide 20 WDG (Ril 038) Against Bollworms on Cotton. J. *Cotton Res.Dev.* 19: 231-233.

   EcoReference No.: 92816
   Chemical of Concern: LCYT,SS,IDC,FBD; Habitat: T; Effect Codes: POP;GRO Rejection Code: LITE EVAL CODED(FBD).

Acceptable for ECOTOX, but not OPP

1. Tohnishi, M., Nakao, H. Furuya, T., Seo, A., Kodama, H., Tsubata, K., Fujioka,S., A., Kodama, H., Hirooka, T., and Nishimatsu, T. (2005). Flubendiamide, a Novel Insecticide Highly Active Against Lepidopterous Insect Pests. *J.Pesitic.Sci.* 30:354-360.

   EcoReference No.: 92541
   Chemical of Concern: FBD,MOM,CYH,EMMBCFP; Habitat: T; Effect Codes: PHY,MOR; Rejection Code: NO ENDPOINT(FBD,MOM).

FLUBENDIAMIDE
Papers that Were Excluded from ECOTOX

1. Ebbinghaus-Kintscher, Ulrich, Luemmen, Peter, Lobitz, Nicole, Schulte, Thomas, Funke, Christian, Fischer, Rudiger, Masaki, Takao, Yasokawa, Noriaki, and Tohnishi, Masanori (2006). Phthalic acid diamides activate ryanodine-sensitive Ca2+ release channels in insects. *Cell Calcium* 39: 21-33.

   Chemical of Concern: FBD; Habitat: T

2. Javaregowda and Naik, L. K. (2005). Bio-efficacy of Flubendiamide 20 WDG (RIL-038) Against Paddy Pests and Their Natural Enemies. *Pestology* 29: 58-60.

   Chemical of Concern: FBD; Habitat: T; Rejection Code: NO SOURCE(FBD).

3. Luemmen, Peter, Ebbinghaus-Kintscher, Ulrich, Funke, Christian, Fischer, Ruediger, Masaki, Takao, Yasokawa, Noriaki, and Tohnishi, Masanori (2007). Phthalic acid diamides activate insect ryanodine receptors. *ACS Symposium Series, Synthesis and Chemistry of Agrochemicals VII* 948: 235-248.

   Chemical of Concern: FBD; Habitat: T

4. Lummen, Peter, Ebbinghaus-Kintscher, Ulrich, Lobitz, Nicole, Schulte, Thomas, Funke, Christian, and Fischer, Rudiger (2005). Phthalic acid diamides activate ryanodine-sensitive calcium release channels in insects. *Abstracts of Papers, 230th ACS National Meeting, Washington, DC, United States, Aug. 28-Sept. 1, 2005* AGRO-025.

   Chemical of Concern: FBD; Habitat: T

5. Masaki, T., Yasokawa, N., Tohnishi, M., Nishimatsu, T., Tsubata, K., Inoue, K., Motoba, K., and Hirooka, T. (2006). Flubendiamide, a Novel Ca2+ Channel Modulator, Reveals Evidence for Functional Cooperation Between Ca2+ Pumps and Ca2+ Release. *Mol.Pharmacol.* 69: 1733-1739.

   Chemical of Concern: FBD; Habitat: T; Rejection Code: NO IN VITRO(FBD).

6. Masaki, Takao, Yasokawa, Noriaki, Tohnishi, Masanori, Nishimatsu, Tetsuyoshi, Tsubata, Kenji, Inoue, Kazuyoshi, Motoba, Kazuhiko, and Hirooka, Takashi (2006). Flubendiamide, a novel Ca2+ channel modulator, reveals evidence for functional cooperation between Ca2+ pumps and Ca2+ release. *Molecular Pharmacology* 69: 1733-1739.

   Chemical of Concern: FBD; Habitat: T

7. Nauen, R. (2006). Insecticide Mode of Action: Return of the Ryanodine Receptor. *Pest Manag.Sci.* 62: 690-692.

   Chemical of Concern: FBD; Habitat: T; Rejection Code: NO REVIEW(FBD).

8. Nishimatsu, T., Hirooka, T., Kodama, H., Tohnishi, M., and Seo, A (2005). Flubendiamide - a new insecticide for controlling lepidopterous pests. *BCPC International Congress: Crop Science & Technology, Congress Proceedings, Glasgow, United Kingdom, Oct. 31-Nov. 2, 2005* 1: 57-64.

   Chemical of Concern: FBD; Habitat: T

9. Tohnishi, Masanori, Nakao, Hayami, Furuya, Takashi, Seo, Akira, Kodama, Hiroki, Tsubata, Kenji, Fujioka, Shinsuke, Kodama, Hiroshi, Hirooka, Takashi, and Nishimatsu, Tetsuyoshi (2005). Novel class insecticide, flubendiamide: Synthesis and biological activity. *Abstracts of Papers, 230th ACS National Meeting, Washington, DC, United States, Aug. 28-Sept. 1, 2005* AGRO-009.

Chemical of Concern: FBD; Habitat: T

APPENDIX F: Environmental Fate and Transport DER Summaries

Comment [ap3]: Do we really need to include these? Can't we reference previous assessments?

Hydrolysis

[^{14}C]Flubendiamide was stable at pH 4, 5 and 7; half-lives were not calculated. Overall recoveries of [^{14}C] residues averaged 99.4 ± 2.0% of the applied (range 95.6-102.9%) from the pH 4 buffer solution, 99.6 ± 2.9% (range 95.5-106.3%) from the pH 5 buffer solution, 98.7 ± 2.3% of the applied (range 93.1-103.6%) from the pH 7 buffer solution and 99.6 ± 1.6% (range 97.7-102.5%) from the pH 9 buffer solution. There was no pattern of loss of material over time from any of the buffer solutions.

This study was conducted in accordance with JMAFF Test Guidelines for supporting registration of chemical pesticides (12 Nousan No. 8147; November 2000), OECD Guidelines for the testing of chemicals "111, Hydrolysis as function of pH" (1981), EU European Communities Directive 91/414/EEC (1991) as amended by directive 94/37/EC (1994) and EPA Pesticide Assessment Guidelines, Subdivision N, Chemistry: Environmental Fate, Section 161-1 (1982; p. 13). No significant deviations from the objectives of subdivision N guidelines were noted (MRID 46816907).

Photodegradation in Water

Based on a first-order linear regression analysis [^{14}C] flubendiamide (combined radiolabels) degraded with a half-lives of 5.79, 4,20, and 6.44 days in distilled water, natural water, and distilled water containing 1% acetone, respectively. Because flubendiamide was stable in dark controls, the actual **phototransformation half-lives** were doubled to the half-lives observed of the continuously irradiated samples to be based on a 12 hour light/dark cycle. The **phototransformation half-lives** of [^{14}]C flubendiamide (combined radiolabels) are 11.58, 8.40, and 12.88 days based on a 12 hour light/dark cycle in distilled water, natural water, and distilled water containing 1% acetone respectively. The **phototransformation half-lives** of [phthalic-U-^{14}C]flubendiamide are 7.0, 4.2 and 5.9 days based on the continuous irradiation used in the study, or 14.0, 8.4 and 11.8 days based on a 12-hour light/12-hour dark cycle in distilled water, natural water and distilled water containing 1% acetone, respectively. The **phototransformation half-lives** of [aniline-U-^{14}C]flubendiamide are 4.9 and 7.1 based on the continuous irradiation used in the study, or 9.8 and 14.2 days based on a 12-hour light/12-hour dark cycle in distilled water and distilled water containing 1% acetone, respectively (MRID 46816908).

Photodegradation on Soil

Based on first-order linear regression analysis [^{14}C]flubendiamide (combined radiolabels), flubendiamide degraded with a half-life of 11.25 days in the irradiated samples. Since flubendiamide was stable in the dark controls, the phototransformation half-life is equivalent to the half-life observed in the irradiated samples. The phototransformation half-lives of [phthalic-U-^{14}C] and [aniline-U-^{14}C]flubendiamide are 11.49 days and 11.04 days, respectively, based on the continuous irradiation used in the

study, or 22.98 days and 22.08 days based on a 12-hour light/12-hour dark cycle, respectively. Based on solar intensity representative of average conditions in the 48 contiguous states in the United States for all seasons, 1 day of artificial light was reported to be equivalent to 3.07 solar days. Therefore, the predicted environmental photolytic half-lives for [phthalic-U-^{14}C] and [aniline-U-^{14}C]flubendiamide were 35.3 and 33.9 days, respectively (MRID 46816909).

Aerobic Soil Metabolism

No major transformation products were isolated from any soils [^{14}C]Flubendiamide was relatively stable in the treated soils, decreasing by <3% of the applied in the sandy loam, silt loam, silt, and [aniline ring -^{14}C]flubendiamide-treated loamy sand soil during 120 days of incubation. In the [phthalic ring-^{14}C]flubendiamide-treated loamy sand soil, [^{14}C]flubendiamide averaged 87.7% of the applied at time 0, 82.6% at 120 days posttreatment, and 83.4% at 371 days, a decrease of 4.3% over the course of the experiment. In all soils, the measured concentrations were variable over time. Reviewer-calculated first-order linear half-lives were >5 years and are of uncertain value since they are extrapolated well beyond the duration of the study and assume that the pattern of degradation remains linear, and because the r^2 values are very low (MRID 46816910).

No major transformation products were isolated from any soils. Four minor transformation products were identified:

- Des-iodo [A-1; N^2-(1,1-dimethyl-2-methylsulfonylethyl)-N^1-{2-methyl-4-[1,2,2,2-tetrafluoro-1-(trifluoro-methyl)ethyl]phenyl} phthalamide],
- NNI-0001-3-OH [A-2; N^2-(1,1-dimethyl-2-methylsulfonylethyl)-3-hydroxy-N^1-{2-methyl-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl] phenyl}phthalamide],
- NNI-0001-benzoic acid [A-18; 2-[[2-{[(1,1-dimethyl-2-methylsulfonylethyl)amino]carbonyl}-3-iodophenyl)carbonyl]amino}-5-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl] benzonic acid], and
- Des-iodo-alkylphthalimide[A-27; N-(1,1-dimethyl-2-methylsulfonylethyl)phthalimide].

In the sandy loam soil (120-day experiment), A-1 and A-18 averaged maximums of 2.7% and 0.9% of the applied. In addition, a discrete area of radioactivity (ROI 1) averaged a maximum of 0.8% of the applied; this region did not correspond to any reference standards and was not analyzed further. Unidentified [^{14}C]residues averaged a maximum of 3.6% of the applied. In the silt loam soil (120-day experiment), A-1 and A-18 averaged maximums of 1.5% and 0.7% of the applied. The unknown ROI 1 averaged a maximum of 1.1% of the applied, and unidentified [^{14}C]residues averaged 3.5%. In the silt soil (120-day experiment), A-1 and A-18 averaged maximums of 7.2% and 1.6% of the applied. The unknown ROI 1 averaged a maximum of 0.6% of the applied, and unidentified [^{14}C] residues averaged 3.6%.

In the loamy sand soil treated with [phthalic acid ring-UL-^{14}C]flubendiamide (371-day experiment), A-1, A-2, A-18, and A-27 and A-18 each averaged maximums of ≤1.8% of

the applied. The unknown ROI 1 averaged a maximum of 1.8% of the applied, and unidentified [^{14}C]residues averaged 2.8%. In the loamy sand soil treated with [aniline ring-UL-^{14}C]flubendiamide (120-day experiment), A-1 and A-2 averaged maximums of 1.7% and 0.8% of the applied. The unknown ROI 1 averaged a maximum of 1.0% of the applied, and unidentified [^{14}C]residues averaged 4.4%.

Concentrations of extractable and nonextractable [^{14}C]residues varied over time in the four soils, with no clear pattern of either decline or formation. Extractable [^{14}C]residues ranged from 84.4-96.5% of the applied, and nonextractable [^{14}C]residues ranged from 3.5-7.1%. The duration of the experiment (120 vs 371 days) did not affect the minimum and maximum observed concentrations of extractable and nonextractable residues. In the four soils at study termination, $^{14}CO_2$ totaled ≤0.4% of the applied and volatile [^{14}C] organics were <0.1%.

The study author provided a transformation pathway for flubendiamide. Flubendiamide is ultimately degraded to CO_2 and bound residues via three pathways. Flubendiamide degrades to Des-iodo (A-1), which is further degraded to Des-iodo-alkylphtalimide (A-27) by loss of the aniline ring. Flubendiamide degrades to NNI-0001-benzylalcohol (A-16; a postulated intermediate not detected in this study), which is further degraded to NNI-0001-benzoic acid (A-18) as the aniline methyl ortho-substituent is oxidized. Flubendiamide degrades to NNI-0001-3-OH (A-2) with the replacement of the iodine atom with a hydroxyl substituent.

Anaerobic Soil Metabolism

Flubendiamide was primarily stable under the conditions of this study, with some gradual formation of bound soil residues. Regression half-lives were not calculated due to lack of flubendiamide degradation. No major nonvolatile transformation products were detected and no consistent formation of any minor nonvolatile products was apparent. Total unidentified [^{14}C]residues were ≤5.1% of the applied at any interval. At study termination, extractable soil plus water layer [^{14}C]residues comprised 82.2-91.6% of the applied, while nonextractable [^{14}C]residues totaled 11.7-12.2%. Formation of $^{14}CO_2$ and volatile [^{14}C]organic compounds was not significant totaling ≤0.3% of the applied at any sampling interval.

For both labels, overall recovery of material balance averaged 97.3 ± 4.5% (range 86.6-103.6%) of the applied, with no consistent pattern of decline in recoveries for either label. Low recoveries of 86.6-87.8% of the applied at 56-days post-flooding appear to have been due to procedural errors, with recoveries at all other sampling intervals ≥93.9%. Partitioning of [^{14}C] residues between the soil and water layer could not be determined because water layers were combined with the soil extracts prior to analysis. There was no apparent degradation of flubendiamide during the 120-day post-flood incubation; however, any possible dissipation of flubendiamide from the treated soil to the water layer could not be assessed.

The study was considered supplemental because the soil extracts were combined with the water layers prior to LSC and TLC analysis. Therefore, the possible movement of flubendiamide from the soil layer into the water was not addressed (MRID 46816912).

Anaerobic Aquatic Metabolism

Given the rapid partitioning of parent flubendiamide from the water phase to the sediment, the day 0 water results were assigned the interval of 2 hours post treatment (sample processing time) for the purposes of determining a secondary dissipation half-life (*i.e.*, regression analysis intervals 2 hours to 365 days) of flubendiamide in the water layer, with the initial dissipation half-life then an observed DT_{50} of <2 hours.

Observed DT50 values of flubendiamide were 2 hours in the water layer, ca. ≥ 365 days in the sediment and 269-365 days in the total system. In the water, sediment and total system, calculated linear half-lives (r2 = 0.8293-0.9743) were 127 (secondary dissipation), 364 and 292 days, respectively, with nonlinear half-lives (r^2 = 0.8489-0.9775) of 57 (secondary dissipation), 385 and 289 days, respectively. One major transformation product,

- N-[1,1-dimethyl-2-(methylsulfonyl)ethyl]-N'-[2-methyl-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]phenyl]-1,2-benzenedicarboxamide (desiodo-NNI-0001),

averaged maximums of 22.0%, 36.9% and 58.8% of the applied in the water, sediment and total system, respectively, at study termination. No minor products were detected (MRID 46816914).

Aerobic Aquatic Metabolism

Calculated dissipation half-lives for flubendiamide in the both sediments and the total sand system were not determined due to variable data and insufficient degradation; the linear half-life for flubendiamide in the total pond water-loam system was 533 days (r^2 = 0.8389). For both systems, observed DT50 values were *ca.* 2 hours-3 days in the water layers and >125 days in the sediments and total systems. No major transformation products were detected (MRID 4681913).

Mobility Studies

Leaching Adsorption/Desorption

After 24 hours of equilibration, 45.1-48.0%, 41.9-47.5%, 50.6-57.0%, 33.9-39.9%, and 54.0-59.6% of the applied [^{14}C]flubendiamide was adsorbed to the Hoefchen silt, Laacher Hof AXXa sandy loam, Stanley silty clay, Ephrata loamy sand, and Saskatoon loam soils, respectively. Registrant-calculated Freundlich adsorption K values were 18.3, 23.5, 30.0, 17.3, and 24.8 for the Hoefchen silt, Laacher Hof AXXa sandy loam, Stanley silty clay, Ephrata loamy sand, and Saskatoon loam soils, respectively; corresponding Freundlich

K_{oc} values were 1172, 1596, 2609, 3318, and 1076. Registrant-calculated adsorption K and K_{oc} values were not reported. At the end of the first desorption step (three desorption steps for high dose; one desorption step for all other doses), 45.6-53.0%, 44.7-66.3%, 40.1-46.5%, 51.6-72.2%, and 39.2-42.8% of the applied [^{14}C]flubendiamide desorbed from the Hoefchen silt, Laacher Hof AXXa sandy loam, Stanley silty clay, Ephrata loamy sand, and Saskatoon loam soils, respectively. Following the third desorption step (high dose soils only), the percent of [^{14}C]flubendiamide desorbed from the test soils, as percent of the radioactivity adsorbed, was 32.5% for the Hoefchen silt, 38.6% for the Laacher Hof AXXa sandy loam, 34.7% for the Stanley silty clay, 33.3% for the Ephrata loamy sand, and 31.7% for the Saskatoon loam soils. Registrant-calculated Freundlich desorption K values were 44.3, 76.1, 51.8, 68.4, and 47.4 for the Hoefchen silt, Laacher Hof AXXa sandy loam, Stanley silty clay, Ephrata loamy sand, and Saskatoon loam soils, respectively; corresponding Freundlich desorption K_{oc} values were 2838, 5176, 4502, 13154, and 2061. Registrant-calculated desorption K and K_{oc} values were not reported.

Dissipation Studies

Terrestrial Field Dissipation

In three separate dissipation reports, the major route of dissipation of NNI-0001 480SC under field conditions was transformation. In the first study, MRID 46816915, NNI-0001 480SC was applied to bare sandy loam in Fresno, California. The flubendiamide had a reviewer-calculated half-life of 770.2 days in soil (r^2 = 0.5183; based on all available replicate data, using linear regression and the equation $t_{½}$ = ln 2/k, where k is the rate constant). Based on nonlinear regression analysis (SigmaPlot vers. 9.0), the half-life was 693.1 days (r^2 = 0.9802). However, these half-lives extend beyond the scope of the study and are of limited value. The observed half-life of flubendiamide was >538 days (MRID 46816915).

In the second study, MRID 4681916, flubendiamide was applied under field conditions in Leland, Mississippi in bare silt loam soil. Flubendiamide had a reviewer-calculated half-life of 693.1 days in soil (r^2 = 0.351; based on all available replicate data, using linear regression and the equation $t_{½}$ = *ln* 2/k, where k is the rate constant). Based on nonlinear regression analysis (SigmaPlot vers. 9.0), the half-life was 495.1 days (r^2 = 0.937). The observed half-life of flubendiamide was 15-547 days.

In the final study (MRID 46816917), NNI-0001 480SC was applied to bare loamy sand in Ephrata, Washington. Under field conditions in the bare loamy sand soil, flubendiamide had a reviewer-calculated half-life of 210 days in soil (r^2 = 0.699; based on all available replicate data, using linear regression and the equation $t_{½}$ = *ln* 2/k, where k is the rate constant). Based on nonlinear regression analysis (SigmaPlot vers. 9.0), the half-life was 315.1 days (r^2 = 0.9570). The observed half-life of flubendiamide was 272-366 days.

Accumulation Studies

Bioaccumulation in Fish

In the fish tissue samples, [^{14}C]flubendiamide residues reached steady state at 10-28 days of exposure (mean whole body concentrations of 52 µg/kg and 47.1 µg/kg at nominal concentrations of 0.5 µg/L and 5.0 µg/L, respectively, according to the study authors). For the low-dose study, maximum mean [^{14}C]flubendiamide residues were 57.5 µg/kg in whole fish, 107.1 µg/kg in viscera, and 28.5 µg/kg in edible tissue, each on exposure day 28. Reviewer-calculated maximum mean BCF values were 119.0 for whole fish, 58.9 for edible tissue, and 221.8 for inedible tissue (28 days exposure). In edible and inedible tissue samples, [^{14}C]flubendiamide residues ranged from 22.5-28.5 µg/kg and 76.5-107.1 µg/kg at 10-28 days, respectively. For the high-dose study, maximum mean [^{14}C]flubendiamide residues were 521.3 µg/kg in whole fish, 978.4 µg/kg in viscera, and 270.3 µg/kg in edible tissue, each on exposure day 14. Reviewer-calculated maximum mean BCF values were 109.9 for whole fish, 57.0 for edible tissue, and 206.3 for inedible tissue (14 days exposure). In edible and inedible tissue samples, [^{14}C]flubendiamide residues ranged from 234.9-270.3 µg/kg and 749.0-978.4 µg/kg at 10-28 days, respectively. The mean lipid content in the whole fish was 6.63%. The lipid-normalized BCF for total [^{14}C]flubendiamide residues in whole fish was 66.

Following 14 days of depuration, [^{14}C]flubendiamide residues in the whole fish decreased by a mean of 83% (low dose) and 86% (high dose). The residues depurated with a half-life of 4.6 and 4.8 days, from the low- and high-dose studies, respectively. Mean lipid content in the whole fish after 14 days of depuration was 80.9 g/kg. The depuration rate constant (K_2), based on the predicted curve from the Origin™ non-linear kinetic modeling program, was calculated to be 0.150 ± 0 day^{-1} for the low-dose study and 0.146 ± 0.01 day^{-1} for the high-dose study. The kinetic bioconcentration factor (BCF_K) was calculated as 108 for the low-dose (0.5 µg/L) study and 99.4 for the high-dose (5.0 µg/L flubendiamide) study (46816949).

For the des-iodo degradate, the octanol-water partition coefficient is log Kow 3.40 and the calculated mean BCF values, based on total radioactive residues, of 12.6, 20.4, and 7.7 for whole fish, viscera, and edible tissues, respectively.

Non Subdivision N Guideline Studies

Quantum Yield in Water

The UV-VIS absorption spectra of flubendiamide per litre buffered aqueous solution pH 4, pH 7, and pH 9/acetonitrile (1:1, v:v) showed comparable absorption properties. Based on these results, the study author concluded that the absorption properties of flubendiamide indicated the possibility of direct interactions between flubendiamide in aqueous solution with sunlight in the troposphere.

This study is classified as supplemental. It provides supplemental information on the phototransformation of flubendiamide (NNI-0001) in water. The study was considered supplemental because the sterility check and pH measurements were not preformed and the mass balances were not determined. This study does not follow the EPA Subdivision N Guidelines (MRID 46816919).

NNI-0001-Desi-iodo (transformation product of flubendiamide)

Degradation Studies

Aerobic Soil Metabolism

[^{14}C]Des-iodo was relatively stable in the treated soils, decreasing by ≤2% in the sand, sandy loam and silt soils and by 6-8% in the loamy sand soil during 212 days of incubation. In all soils, the measured concentrations were variable over time. Reviewer-calculated first-order linear half-lives were >6 years and are of uncertain value since they are extrapolated well beyond the duration of the study and assume that the pattern of degradation remains linear, and because the r^2 values are very low (MRID 46816911).

Metabolism Studies

Leaching Adsorption/Desorption

Mass balances for soils at the end of the adsorption phase were not reported. Mean mass balances for soils at the end of the desorption phase were 98.4 ± 4.3% (range 93.2-120.6%), 98.5 ± 5.4% (range 90.5-105.1%), 97.8 ± 2.7% (range 94.6-100.1%), 94.8 ± 2.9% (range 90.6-97.7%), and 96.5 ± 4.5% (range 90.1-100.7%) of the applied for the Höfchen silt loam, Laacher Hof AXXa sandy loam, Laacher Hof AIIIa silt loam, Ephrata loamy sand, and Stanley clay loam soils, respectively.

After 24 hours of equilibration, 52.6-57.1%, 43.5-50.4%, 36.6-44.9%, 22.8-31.2%, and 46.9-55.1% of the applied [^{14}C]Des-iodo was adsorbed to the Höfchen silt loam, Laacher Hof AXXa sandy loam, Laacher Hof AIIIa silt loam, Ephrata loamy sand, and Stanley clay loam soils, respectively. Registrant-calculated adsorption K and K_{oc} values were not reported. Registrant-calculated Freundlich adsorption K values were 8.365, 3.514, 2.574, 1.379, and 6.400 for the Höfchen silt loam, Laacher Hof AXXa sandy loam, Laacher Hof AIIIa silt loam, Ephrata loamy sand, and Stanley clay loam soils, respectively; corresponding Freundlich K_{oc} values were 319, 270, 234, 265, and 581. Following the first desorption step (three desorption steps for high-dose; one desorption step for lower doses), the percent of [^{14}C]Des-iodo desorbed from the test soils, as percent of the

radioactivity adsorbed, was 62.2-71.3%, 55.2-66.3%, 51.2-63.6%, 42.7-68.0%, and 61.5-70.5% for the Höfchen silt loam, Laacher Hof AXXa sandy loam, Laacher Hof AIIIa silt loam, Ephrata loamy sand, and Stanley clay loam soils, respectively. For the high-dose soils, at the end of the third desorption step, 66.8%, 66.3%, 64.7%, 63.2%, and 77.7% of the applied [^{14}C]Des-iodo desorbed from the Höfchen silt loam, Laacher Hof AXXa sandy loam, Laacher Hof AIIIa silt loam, Ephrata loamy sand, and Stanley clay loam soils, respectively. Registrant-calculated desorption K and K_{oc} values were not reported. Registrant-calculated Freundlich desorption K values were 9.548, 4.356, 3.237, 1.254, and 8.495 for the Höfchen silt loam, Laacher Hof AXXa sandy loam, Laacher Hof AIIIa silt loam, Ephrata loamy sand, and Stanley clay loam soils, respectively; corresponding Freundlich desorption K_{oc} values were 364, 335, 294, 241, and 771.

This study is classified as supplemental. No significant deviations from good scientific practices were noted. However, the study was conducted using a transformation product of flubendiamide, rather than the parent compound. Furthermore, it could not be determined if the German test soils were comparable to soils found in typical use areas in the United States (MRID 46816906).

Non Subdivision N Guideline Studies

Quantum Yield in Water

Based on the data obtained from the arithmetic models, it was determined that environmental direct phototransformation half-lives of Des-iodo were more than 1 year for all seasons and locations assessed. It was also determined that direct phototransformation in water does not contribute to elimination of Des-iodo in the environment. However, this assessment does not consider any indirect mechanisms which may enhance the photodegradation in natural water.

This study is classified as scientifically valid. No significant deviations from good scientific practices were noted, however it does not follow the EPA Subdivision N Guidelines (MRID 46816920).

APPENDIX G: Terrestrial Animal RQ Calculations for TREX

TREX Christmas Tree Upper Bound Ken. Res. For RQ Calcs

Acute and Chronic RQs are based on the Upper Kenaga Residues.

The maximum single day residue estimation is used for both the acute and reproduction RQs.

RQs reported as "0.00" in the RQ tables below are <0.01 in your assessment. This is due to rounding figure issues in Excel.

Endpoints

	70.03
	32.10
	39.39
	4.38

Avian Results

	78.76	45.48	20.36
	36.56	20.85	9.33
	44.87	25.58	11.45
	4.59	2.84	1.27

	#DIV/0!	#DIV/0!	#DIV/0!
	#DIV/0!	#DIV/0!	#DIV/0!
	#DIV/0!	#DIV/0!	#DIV/0!
	#DIV/0!	#DIV/0!	#DIV/0!

	RQ	
	Acute	Chronic
	#DIV/0!	1.62
	#DIV/0!	0.70
	#DIV/0!	0.85
	#DIV/0!	0.10

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

Flubendiamide Christmas tree Upper bound Kenaga Residues

Mammalian Results

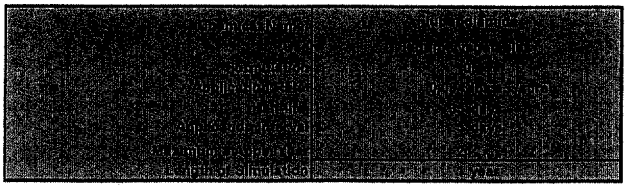
	53.77	45.16	10.70			
	30.58	21.15	4.90			
	37.56	25.96	6.02			
	4.17	2.88	0.67	0.93	0.64	0.15

	Acute	Chronic	Acute	Chronic	Acute	Chronic
	#DIV/0!	3.04	#DIV/0!	2.60	#DIV/0!	1.39
	#DIV/0!	1.39	#DIV/0!	1.15	#DIV/0!	0.64
	#DIV/0!	1.71	#DIV/0!	1.46	#DIV/0!	0.78
	#DIV/0!	0.19	#DIV/0!	0.16	#DIV/0!	0.09
	#DIV/0!	0.04	#DIV/0!	0.04	#DIV/0!	0.02

	Mammalian RQs	
	Acute	Chronic
	#DIV/0!	0.35
	#DIV/0!	0.16
	#DIV/0!	0.20
	#DIV/0!	0.02

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

Legume Vegetables Upper Bound Ken. Res. For RQ Calc.

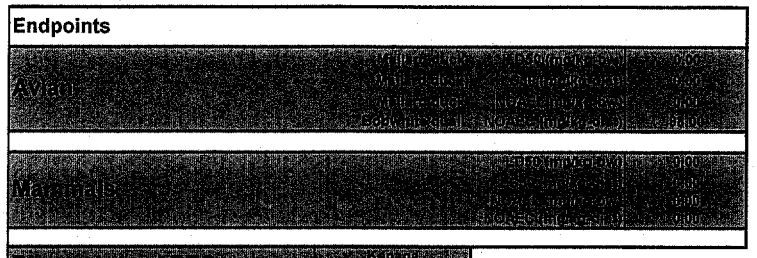


Acute and Chron
Kenaga Residue

The maximum si
both the acute ar

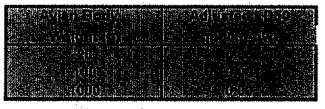
**RQs reported as
<0.01 in your as
figure issues in**

Endpoints



Dietary-based EECs (ppm)	Acute Value
Short grass	42.99
Tall grass	19.71
Broadleaf plants/small insects	24.18
Fruit/pod/seed/large insect	2.69

Avian Results



Dose-based RQs (Dietary-based EECs / Adjusted Toxicity Value)	Acute	Acute Restricted	Acute Endangered
	LD50		
Short grass	48.96	27.92	12.50
Tall grass	22.44	12.80	5.73
Broadleaf plants/small insects	27.54	15.71	7.03
Fruit/pod/seed/large insect	3.06	1.75	0.78

Dose-based RQs (Dose-based EECs / Adjusted Toxicity Value)	Chronic	Chronic Restricted	Chronic Endangered
	NOAEL		
Short grass	#DIV/0!	#DIV/0!	#DIV/0!
Tall grass	#DIV/0!	#DIV/0!	#DIV/0!
Broadleaf plants/small insects	#DIV/0!	#DIV/0!	#DIV/0!
Fruit/pod/seed/large insect	#DIV/0!	#DIV/0!	#DIV/0!

Dietary-based RQs (Dietary-based EECs / Adjusted Toxicity Value)	Acute	Chronic
	NOAEC	
Short grass	#DIV/0!	0.44
Tall grass	#DIV/0!	0.20
Broadleaf plants/small insects	#DIV/0!	0.25
Fruit/pod/seed/large insect	#DIV/0!	0.03

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available