**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
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MEMORANDUM

SUBJECT: Section 18 Ecological Risk Assessment for Fipronil Use to Control Cabbage Maggot in Turnip and Rutabaga.

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Attached is the EFED risk assessment for the Section 18 request from the Oregon Department of Agriculture for in-furrow use of fipronil (Regent® 4SC) on rutabaga and turnips. The proposed application of fipronil will be a single, in-furrow, at-plant application rate of 0.13 lbs ai./A (0.1456 kg ai/ha). The total acreage for rutabage and turnips is not expected to exceed 600 acres. Therefore, the total amount of fipronil to be applied should not exceed 78 lbs fipronil for the Section 18. The Section 18 will be limited to Clackamas, Marion, Multnomah, and Umatilla counties in Oregon.

The risk assessment indicates that in-furrow use of fipronil, formulated as REGENT 4SC, is likely to pose acute lethal and reproduction risks to birds from ingestion of fipronil residues in seeds and invertebrates exposed at the time of pesticide application. Moreover, residues accumulated in terrestrial invertebrate food items from treated soil and residues in incidentally consumed soil in treatment areas may also pose acute risks to small birds foraging on treated fields following application of the pesticide. Similar concerns for reproduction effects in insectivorous mammals are also suggested by the results of the risk assessment. Fipronil and its degradates, while not exceeding acute or chronic toxic levels of concern freshwater fish, are of

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concern for acute and chronic effects to freshwater invertebrates. Estuarine and marine species were not evaluated in this risk assessment owing to the proposed locations of use not occurring in proximity to such habitats.

The environmental fate data indicate that fipronil and its degradates have a moderate soil sorption affinity and moderate to high persistence in terrestrial and aquatic environments. Because fipronil residues exhibit a high environmental persistence, there is a high potential for accumulation in terrestrial and aquatic environments. Accumulation of fipronil residues (particularly fipronil degradates) is likely to result in long-term exposure. In-furrow application of fipronil, however, is expected to limit exposure, which is expected to reduce direct exposure to fipronil and to reduce the potential for fipronil movement in runoff waters.

# Fipronil
# Environmental Fate and Ecological Effects Assessment and Characterization for Section 18 Registration of In-Furrow Applications to Rutabaga and Turnips

# I. EXECUTIVE SUMMARY

EFED calculated terrestrial animal and freshwater aquatic animal and plant risk quotients for the proposed in-furrow, at plant use of fipronil on rutabaga and turnips. Estimated fipronil and selected degradate exposures for aquatic invertebrates exceed Agency levels of concern for acute and chronic effects to Federally listed threatened and endangered species (listed species) and non-listed species. No concerns for direct effects to aquatic plants nor freshwater fish are identified by the risk assessment. While no acute effects in mammals are identified as a concern, there is concern for reproduction effects in insectivorous small mammals consuming terrestrial invertebrates directly treated at the time of pesticide application. Concerns for birds extend to acute and chronic effects to listed and non-listed species from consuming pesticide residues in seeds and invertebrates directly treated with the pesticide at the time of application as well as consumption of invertebrates accumulating the pesticide from treated soil in the case of small birds in the 20 g in size category. A shift from upper bound residue assumptions to mean values does not appreciably alter concerns for avian risk. However, exposures to mammals, under the assumption of mean pesticide residues in food items, are below levels triggering concern.

As has been the case for a number of fipronil use scenarios in the past, the environmental fate profile of the chemical and its degradates suggest a concern for the potential accumulation of residues both on the field and in sediments of surface waters receiving these compounds with runoff from treated areas.

# II. PROBLEM FORMULATION

***Nature of the Chemical Stressor***

This Section 18 screening level risk assessment addresses the ecological impacts from at plant, in-furrow uses of fipronil (5-amino-1-(2,6-dichloro-4-(trifluoromethyl)phenyl)-4-((1,R,S)-(trifluoromethyl) sulfinyl)-1-H-pyrazole-3-carbonitrile ) on turnips and rutabagas in Oregon. Fipronil is a phenylpyrazole insecticide (CAS #: 120068-37-3, PC Code: 129121). Under the proposed Section 18, Regent 4SC® will be used as the formulation (40% active ingredient) for in-furrow applications at an application rate of 0.13 lbs ai./A (0.1456 kg/ha). It is applied into seed furrows as a solid stream after dissolving in water and liquid fertilizer. The Section 18 is limited to Clackamas, Marion, Multnomah, and Umatilla counties of Oregon, which are not associated with estaurine areas in the state. The target insect is the cabbage maggot.

Fipronil affects the gamma-aminobutyric acid neurotransmission system by interfering with the passage of chloride . In addition, research data indicate that fipronil displays a higher potency in the insect GABA chloride channel than in the vertebrate GABA chloride channel which may indicate selective toxicity (Hainzl and Casida, 1996).

Fipronil is moderately persistent to persistent ($t_{1/2}$= 128 to 300 days) and relatively immobile (mean $K_{oc}$ 727 ml/g) in terrestrial environments. Major routes of dissipation appear to be dependant on photodegradation in water, microbially-mediated degradation, and soil binding.

Fipronil degrades to form MB46136 and RPA 200766 in aerobic soil metabolism studies. MB46513 is a major degradate in photolysis studies however the soil surface photolysis half-life of 149 days suggests that this photodegradate is not rapidly produced in terrestrial systems. MB45950 appears to be predominantly formed under low oxygen conditions from microbial-mediated processes. These degradates appear to be persistent and relatively immobile in terrestrial and aquatic environments. Field dissipation studies confirm the persistence and relative immobility of fipronil and its degradates. Available toxicity data suggest that both parent fipronil and the degradates MB46136, MB46513, and MB45950 are of toxicological concern.

## III. CONCEPTUAL MODEL

### Chemical Stressors Considered in the Risk Assessment

This risk assessment considers parent fipronil and the degradates MB46136, MB46513, and MB45950. However, available exposure tools limit the extent to which degradates are considered in all terrestrial risk assessment scenarios. For example, this screening-level risk assessment does not address the contribution of fipronil degradates when exposure is modeled as residues in seeds and soil invertebrates present on the field at the time of application. However, degradates are considered for terrestrial exposures modeled as mass of applied material per unit area, and in the risk discussion when accumulation in soil invertebrates from soil is considered. In addition, the long soil surface photolytic half-life of fipronil suggests that the photodegradate MB46513 will not readily be produced in terrestrial systems to an extent that terrestrial food items will contain appreciable levels of this degradate.

### Receptors

This screening level risk assessment approaches the analysis for adverse effects through the use of broad plant and animal taxonomic groups including:

- Birds (also used as surrogate for terrestrial-phase amphibians and reptiles),
- Mammals,
- Freshwater fish (also used as a surrogate for aquatic phase amphibians),
- Freshwater invertebrates (including sediment-dwelling species),
- Algae and vascular aquatic plants

Because the Section 18 is limited to non-estuarine counties, the following taxonomic groups are not addressed in this risk assessment:

- Estuarine/marine fish,
- Estuarine/marine invertebrates,

This risk assessment will evaluate effects to Federally listed threatened and endangered (listed species) and non-listed species associated with the above taxonomic groups.

It is important to note that this screening-level risk assessment does not address risks to terrestrial plants. Currently, terrestrial plant testing is not required for pesticides other than herbicides except on a case-by-case basis (*e.g.*, labeling bears phytotoxicity warnings incident data or literature that demonstrate phytotoxicity). This policy has been applied to the data requirements for fipronil and consequently, no terrestrial plant effects data are available to quantify potential risks of any fipronil use on non-target plants. While the in-furrow application of the pesticide is expected to reduce drift to such an extent that off-site transport by this route is inconsequential., there remains the potential for off site transport to terrestrial plants via surface runoff. Though not quantitatively assessed in this document, there is insufficient information available to preclude a potential for risks to terrestrial plants at this time

It is also important to note that this screening level risk assessment does not address risks to non-target beneficial insects. The rationale for exclusion of these insects from the assessment is based on the expectation that pesticide exposure pathways to these insects are incomplete. The pesticide is used at-planting and so will not involve application of the pesticide to crop plant when they would be attractive to beneficial insects. Moreover, the in-furrow application of the pesticide is expected to reduce drift to such an extent that off-site transport by this route is inconsequential.

**Exposure Pathways Considered for Terrestrial Animals**

For the purposes of this risk assessment, terrestrial non-target animals are assumed to occupy the treated field and areas immediately adjacent to treated fields. These organisms are assumed to obtain their diet exclusively from treated areas. A number of exposure pathways extending from the point of pesticide release to non-target terrestrial animals are possible and include the following (note: bulleted items with * are quantitatively considered as individual pathways in this risk assessment):

- Direct impingement of pesticide spray on wildlife dietary items and subsequent consumption of these food items by wildlife*;
- Spray contamination of surface soil and subsequent consumption of soil incidental to feeding/preening activities*;
- Spray contamination of surface soil and subsequent dermal contact with soil by wildlife;
- Spray contamination of surface soil, bioaccumulation of pesticide from soil in vegetative or animal matter and subsequent ingestion of these items by feeding wildlife*;
- Spray contamination of surface soil and vegetation, volatilization of the pesticide from these surfaces, and subsequent inhalation by wildlife;
- Inhalation of applied pesticide spray droplets at the time of application;
- Direct application of spray droplets to wildlife skin;
- Incidental contact of wildlife skin with dislodgeable residues from directly sprayed soil and vegetative surfaces as well as pesticide in contaminated water sources
- Wildlife ingestion of pesticide contaminated drinking water from directly sprayed puddles, puddles in contact with treated soil, or dew formed on treated surfaces.

From this list it is evident that a number potentially complete pathways are not addresses on a specific quantitative manner in this risk assessment. However, the risk assessment does include a more general exposure approach that assesses risk on the basis of total potential availability of the pesticide from all possible exposure pathways (i.e., an exposure based on pesticide mass applied to a square foot of treated field).

**Exposure Pathways Considered for Aquatic Organisms**

In this risk assessment, aquatic organisms (animal and plant) are assumed to occupy surface water bodies immediately adjacent to treated fields. A number of pathways from the application of the pesticide to surface water bodies are possible and include the following (note: bulleted items with * are quantitatively considered as individual pathways in this risk assessment:

- Deposition of drifted spray application the surface water body
- Partitioning of pesticide from treated soil to runoff water emptying into the surface water body
- Erosion of treated soil particles with runoff emptying into the surface water body.

Once a pesticide is released to the surface water body, aquatic organisms may be exposed via the following routes (note: bulleted items with * are quantitatively considered as individual pathways in this risk assessment):

- uptake of the pesticide dissolved in surface water across the gill surface, body integument, or plant membranes*;
- uptake of the pesticide dissolved in sediment pore water across the gill surface and body integument*;
- uptake of the pesticide associated with sediment solids across the gut*;
- uptake of the pesticide concentrated in food items (plant and animal) across the gut of animal consumers

**Assessment Endpoints**

Assessment endpoints for this screening-level pesticide ecological risk assessments are reduced survival and reproductive impairment for both aquatic and terrestrial animal species from both direct acute and direct chronic exposures. These assessment endpoints, while measured at the individual level, provide insight about risks at higher levels of biological organization (e.g., populations). It is assumed that toxicant do not affect populations or communities except through the impact on the individuals comprising the population or community and the demographics of birth, growth, and death that govern population dynamics. The number of individuals within a population change (intrinsic rate of increase) primarily because of births (fecundity) and deaths (survival) and secondarily from migration in and out of a specific area. If effects on the survival and reproduction of individuals are limited, it is assumed that risks at the population level from such effects will be of minor consequence. However, as the risk of reductions in survival and/or reproduction rates increase, the greater the potential risk to populations.

For aquatic plants, this risk assessment is concerned with the maintenance and growth of standing crop or biomass. Measurement endpoints for this assessment focus on algal growth rates and biomass measurements as well as similar measurements for vascular plants.

**Measures of Effects and Exposure**

Because this screening-level risk assessment is conducted on a broad taxonomic basis, measurement endpoints for both exposure and effects are generically derived and applied across those taxonomic groups.

***Exposure Measures***

Exposures estimated in the screening-level risk assessment for non-target organisms are likewise not specific to a given species. Aquatic organism (plant and animals) exposures are based on a set of standardized water body assumptions (water body size, watershed size, proximity to field, etc.) that result in high-end estimates of exposure. The measurement endpoints for this risk assessment are the single day peak, 21-day, and 60-day average water concentrations with a 1 in 10 year return frequency.

Estimates of exposure for terrestrial birds and mammals assume that animals are in the treatment area, and exposure estimates involve grouping taxa based on food preferences (e.g., obligate insectivores, herbivores, granivores) and generic weight classes. Because the risk assessment involves an in-furrow application of the pesticide at planting, direct deposition of the pesticide to seeds and invertebrates at the time of application, is used as an exposure measurement endpoint for the dietary route for birds and mammals feeding on recently treated fields. In addition, the mass of pesticide applied per square foot of treatment area was also used as an overall exposure measure of available pesticide for potential wildlife exposure. Finally, the risk description section describes the potential for pesticide in soil to accumulate in terrestrial invertebrates as a wildlife dietary source and as an incidental soil infgestion source. In both cases an instantaneous at time of application concentration in soil serves as the measure of exposure.

***Effects Measures***

This screening-level risk assessment relies on a suite of toxicity studies performed on a limited number of organisms in the following broad groupings (organisms in parentheses capture the available tested species in the data set for fipronil and its degradates considered in this risk assessment):

- Birds (mallard duck, bobwhite quail, pigeon, red-legged partridge, ringed-neck pheasant, and house sparrow) used as surrogate for terrestrial-phase amphibians and reptiles,
- Mammals (laboratory rat),
- Freshwater fish (bluegill sunfish, rainbow trout, and channel catfish) used as a surrogate

for aquatic phase amphibians,

- Freshwater invertebrates (*Daphnia magna, Chironomus tentans, C. teperi, Procambarus clarkii*),
- Estuarine/marine fish (sheepshead minnow),
- Estuarine/marine invertebrates (*Crassostrea virginica* and *Mysidopsis bahia*),
- Algae and aquatic plants (*Navicula pellicosaLemna gibba, Skeletonema costatum, Anabaena flos-aquae, and Selenastrum capricornutum*)

Within each of these very broad taxonomic groups, an acute and a chronic endpoint have been selected from the available test data. Short-term exposure measurements of growth, mobility, and lethality and longer term exposures and measures of growth, development, and reproduction are considered. The selection of appropriate endpoints is made from the most sensitive species tested within a given taxonomic group. The contributing data and the final selection of effects endpoints are summarized in the effects characterization portion of the Analysis section of this document

**Risk Hypothesis**

The risk hypothesis for this screening-level risk assessment is that fipronil, used in accordance with the proposed Section 18 label, results in adverse effects upon survival and reproduction of non-target terrestrial and freshwater aquatic animals; and survival and growth of aquatic, semi-aquatic, and terrestrial plants.

## IV. ANALYSIS

**Environmental Fate and Transport Assessment**

Fipronil dissipation appears to be dependent on photodegradation in water, microbially mediated degradation, and soil binding. Data indicate that fipronil is relatively persistent and immobile in terrestrial environments. In aquatic environments, a determination of the environmental behavior of fipronil is more tentative because soil and aquatic metabolism studies provide contradictory data on fipronil persistence to microbially mediated degradative processes. Photolysis is expected to be a major factor in controlling fipronil dissipation in aquatic environments. Fipronil degrades to form persistent and immobile degradates. These degradates are considered in the HED dietary tolerance expression for fipronil. Since fipronil and its degradates have a moderate to high sorption affinity to organic carbon, it is likely sorption on soil organic matter will limit fipronil residue movement into ground and surface waters. However, fipronil residue may have the potential to move in very vulnerable soils (e.g., coarse-textured soils with low organic matter content). In-furrow fipronil applications are expected to limit runoff potential.

***Abiotic Degradation***

The chemical degradation of fipronil appears to be dependent predominately on photodegradation in water and, to a lesser extent, on alkaline-catalyzed hydrolysis. Fipronil is stable ($t_{1/2}$ > 30 days) in pH 5 and pH 7 buffer solution and hydrolyzes slowly ($t_{1/2}$=28 days) in pH 9 buffer solution. The major hydrolysis degradate is RPA 200766 (5-amino-3-carbamoyl-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoro-methanesulfinyl pyrazole. Photodegradation of fipronil is a major route of degradation (photodegradation in water half-life=3.63 hours) in aquatic environment. In contrast, fipronil photodegradation on soil surfaces (dark control corrected half-life=149 days) does not appear to a major degradation pathway. Major photolysis products of fipronil are MB 46513 (5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoro-methylpyrazole 350, and RPA 104615 (5-amino-3-cyano-1-(2,6-dichloro-4-trifluoro methyl phenyl) pyrazole-4-sulfonic acid).

### *Biotic Degradation*

Fipronil degradation in terrestrial and aquatic systems appears to be controlled by slow microbially-mediated processes. In aerobic mineral soil, fipronil is moderately persistent to persistent ($t_{1/2}$= 128 to 300 days). Major aerobic soil degradates (>10% of applied of fipronil) are RPA 200766 and MB 46136 (5-amino-1-(2,6-dichloro-4-trifluoro methylphenyl)-3-cyano-4-trifluoromethyl-sulphonyl-pyrazole). Minor degradates (<10% of applied fipronil) are MB 45950 (5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoro-methyl-thio-pyrazole) and MB46513. These degradation products are not unique soil metabolism degradation products. Fipronil degraded ($t_{1/2}$=14.5 days to 35 days) under stratified redox aquatic/sediment systems. Fipronil also is moderately persistent (anaerobic aquatic $t_{1/2}$ = 116-130 days) in anoxic aquatic environments. Major anaerobic aquatic degradates are MB 45950 and RPA 200766. Supplemental aerobic aquatic metabolism data indicate that fipronil degradation ($t_{1/2}$=14 days) is rapid in aquatic environments with stratified redox potentials. These data contradict the longer fipronil persistence reported in anaerobic aquatic and aerobic soil studies.

### *Mobility*

Fipronil has a moderate sorption affinity ($K_f$=4.19 to 20.69 ml/g; 1/n= 0.938 to 0.969; $K_{oc}$= 427 to 1248 ml/g) on five non-United States soils. Fipronil sorption appears to be lower ($K_f$< 5 ml/g) on coarse-textured soils with low organic matter contents. Desorption coefficients for fipronil ranged from 7.25 to 21.51 ml/g. These data suggest that fipronil sorption on soil is not a completely reversible process. Since the fipronil sorption affinity correlates with soil organic matter content, fipronil mobility may be adequately described using a $K_{oc}$ partitioning model. Soil column leaching studies confirm the immobility of fipronil.

### *Environmental Fate of Fipronil Degradates*

Conclusions regarding the environmental fate of fipronil degradates, except MB 46513, are more tentative because they are based on a preliminary review of interim data, not a formal evaluation of a fully documented study report. Since discernable decline patterns for the fipronil degradates were not observed in metabolism studies, the degradates are assumed to be persistent ($t_{1/2}$≈700 days) to microbially mediated degradation in terrestrial and aquatic environments. However, the fipronil degradate, MB46136, rapidly photodegrades ($t_{1/2}$=7 days) in water. Radiolabelled MB

46513, applied at 0.1 μg/g, had an extrapolated half-life of 630 or 693 days in loamy sand soils when incubated aerobically in the dark at 25°C. The major metabolite of MB 46513 was RPA 105048 (5-amino-3-carbamoyl-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulfonyl pyrazone).

Fipronil degradation products have relatively low potential mobility because of a moderate to high sorption affinity to soil organic matter. Organic carbon partitioning coefficients for fipronil degradates can range from 1150 to 1498 ml/g for MB 46513, 1619 to 3521 ml/g for MB 45950, and 1448 to 6745 ml/g for MB 46136. The high sorption affinity of fipronil degradates is expected to limit movement into ground and surface water.

***Soil Field Dissipation***

Terrestrial field studies confirm observations of the relative persistence and immobility of fipronil residues in laboratory studies. Fipronil, formulated as a 1% granular, had half-lives of 1.1 to 1.5 months on bare ground in North Carolina (NC) and Florida (FL), 0.4 to 0.5 months on turf in NC and FL, and 3.4 to 7.3 months for in-furrow applications on field corn in California (CA), Nebraska (NE), NC, and Washington (WA). Fipronil, formulated as 80WG and applied foliar spray at 0.3 lbs ai/A, had a field dissipation half-life of 159 days on a cotton site in California, 30.2 days on cotton site in Washington, and 192 days on a potato site in Washington.

The fipronil degradates MB 46136, MB45950, and RPA 200766 were detected in the field studies for in-furrow and turf uses. The degradate MB46513 was detected during field trails with the foliar spray. Fipronil residues were predominately detected in the 0 to 15 cm soil depth at all test sites. However, there was detection of fipronil, MB 45950, MB 46136 and RPA 200766 at a depth of 15 to 45 cm for in-furrow treatments on coarse sandy loam soil in Ephrata, Washington. Although the field dissipation half-life of individual residues was not reported, the half-life of combined fipronil residues (including fipronil, MB 46136, MB 46513, MB 45950, and RPA 200766) ranged from 9 to 16 months.

The bioconcentration factor for radiolabelled fipronil was 321X in whole fish, 164X in edible tissues, and 575X in non-edible tissues. Accumulated fipronil residues were eliminated (>96%) after a 14-day depuration period. Because fipronil exhibited a high depuration rate, fipronil is not expected to accumulate under flowing water conditions.

**Aquatic Exposure Assessment** (*see Appendix A for model output information*)

Tier II PRZM (version PRZM 3.12 beta) /EXAM (version 2.97.5) modeling using PE4V01.pl (August 13, 2003) was conducted using the Oregon sweet corn scenario as surrogate runoff assessment. This scenario was selected because it is located in Marion County, OR, which is one of the counties listed in the Section 18 applications. Uncertainties in the surface water modeling are predominately associated with persistence of fipronil degradates in terrestrial and aquatic environments. Other uncertainties are associated with the formation efficiency of fipronil degradation products. Formation efficiencies were modeled according to the maximum percent formation observed in aerobic soil metabolism studies. Although higher degradate formation efficiencies were observed for MB46513 and MB45950 in other laboratory studies (photodegradation in water and anaerobic aquatic), these degradation pathways are not expected to be important in the soil furrow

***Modeling Parameters***

The dissipation of fipronil in surface water should be dependent on photodegradation in water and, to a lesser extent, microbial-mediated. Since photolysis is a major route of degradation for fipronil, its dissipation is expected to be dependent on physical components of the water (*i.e.* sediment loading) which affect sunlight penetration. For example, fipronil is expected to degrade faster in clear, shallow water bodies than in murky and/or deeper waters. Since fipronil and its transformation products have moderate soil-water partitioning coefficients, binding to sediments may also be a route of dissipation.

The following data were used as input for the PRZM/EXAMS modeling of fipronil:

| Parameter | Value | Source |
|---|---|---|
| Application rate | 0.1456 kg/ha | REGENT 4SC |
| Soil $K_{oc}$ | 727 ml/g[1] | MRID 44039003 |
| Aerobic soil half-life | 128 days | MRID 42918663 |
| Plotolysis Half-life | 0.16 days | MRID 42918661 |
| Hydrolysis pH 7 | Stable | MRID 42194701 |
| Aerobic Aquatic Half-life | 33.7 days[2] | MRID 44661301, 44261909 |
| Anaerobic Aquatic Half-life | 33.7 days[2] | MRID 44661301, 44261909 |
| Water solubility | 2.4 mg/L | EFGWB one-liner |

1- Mean Koc value

2-Represents the 90$^{th}$ percentile of the mean Aerobic aquatic and anaerobic aquatic metabolism half-lives were derived from redox-stratified, aerobic aquatic metabolism studies. Because redox potentials were stratified in the aerobic aquatic studies, the total system half-lives were used to represent the extent of fipronil degradation in both aqueous and sediment phases

EFED also conducted surface water modeling for the individual degradates including MB 46513, MB 46136 and MB45950. Environmental fate properties of the fipronil degradates are shown in the following table. The modeling was conducted assuming the maximum daily conversion efficiency for the compound was represented by the maximum percentage formed in the environmental fate laboratory studies. Degradate application was assumed to coincide with fipronil application. Because the fipronil degradates are formed through abiotic or biotic degradation pathways in soil and water, the degradates were assumed to have a 100% application efficiency on the soil surface. This approach for estimating degradate concentrations is expected to be conservative.

**Fate Properties of Fipronil Degradates**

| Fate Parameter | MB 46136 | MB 46513 | MB 45950 |
|---|---|---|---|
| Mean Koc | 4208 ml/g | 1290 ml/g | 2719 ml/g |
| Aerobic Soil Metabolism Half-life | 700 days | 660 days | 700 days |
| Aqueous Photolysis Half-life | 7 days | Stable | Stable |
| Hydrolysis Half-life | Stable | Stable | Stable |
| Aquatic Metabolism Half-lives | 1400 days | 1320 days | 1400 days |
| Water Solubility | 0.16 mg/L | 0.95 mg/L | 0.1 mg/L |
| Single Row Spacing Application Rate (kg a.i./ha) | 0.0349 | 0.0014 | 0.0072 |
| References | **RP# 201555 ACD/EAS/Im/255 Theissen 10/97** | MRID 44262831 44262830 **Theissen 10/97** | **RP 201578 Theissen 10/97** |

Concentrations, expressed as fipronil equivalents, are presented as individual concentrations and as cumulative fipronil residues. The cumulative residue approach assumes that fipronil and its degradation products have equal toxicity profiles.

### *Aquatic Exposure Measurement Values*

Tier II PRZM-EXAMS model simulation of at plant, in-furrow application indicates the 1 in 10 year daily peak, 21 day average and 60-day average concentrations for fipronil are not likely to exceed 417 and 341, and 253 ng/L respectively (see following table).

**Estimated Concentrations of Fipronil and its Degradation Products in the Standard Pond From In-furrow Turnip and Rutabaga Cropping Systems in Marion County, Oregon (ppt or ng $L^{-1}$)**

| Chemical | Peak | 96 Hour Average | 21 Day Average | 60 Day Average |
|---|---|---|---|---|
| Fipronil | 416.7 | 396.2 | 340.6 | 253.1 |
| MB46513[2] | 6.3 | 6.1 | 4.7 | 3.1 |
| MB46136[2] | 61 | 54.2 | 34.5 | 20.9 |
| MB45950[2] | 18.9 | 17.6 | 12.1 | 7.4 |

2-Indicates year to year correlation prevented calculation of a 1 in 10 year concentration. Reported concentrations represent the concentrations in the first simulation year (1961).

### *Uncertainties in Modeling*

A major uncertainty in the modeling was the use of an OR sweet corn scenario as a surrogate scenario for turnips and rutabagas. This scenario was selected because it represents an agricultural soil in Marion County, OR.

Another uncertainty is the half-life of fipronil and its degradates in aerobic aquatic environments. The aerobic aquatic metabolism data (MRID 44261909) indicate that fipronil has a half-life of 14.5 days in aerobic aquatic environments. These data appear to contradict the persistence of fipronil ($t_{1/2}$=128 to 308 days) in aerobic soil metabolism studies. The registrant has submitted additional aerobic aquatic data showing first-order half-life for fipronil was 16 days for Ongar and 35.62 days for Manningtree sediment/water systems (RPA Document 201604). Based on the available aerobic aquatic metabolism data, the 90$^{th}$ percentile aerobic aquatic half-life for fipronil is 33.7 days. It's important to note that the aerobic aquatic metabolism studies were conducted under stratified redox conditions which lead to the formation of MB45950, a toxic degradation product. This compound was predominately associated with the sediment phase. Similar formation patterns were not observed in the aerobic soil metabolism studies (MRID 42928663).

Tier II modeling indicates the individual residues contribute substantially to the summed residue concentration of fipronil. The concentration of MB 46513 is expected to be conservative because its application rate is base on a maximum degradate formation efficiency (1%) from aerobic soil metabolism study (MRID 42918663). Lower concentrations of MB 46513 have been detected in other environmental fate studies. MB 45950 had low concentrations in all environmental fate studies except for the aquatic metabolism studies. The highest conversion efficiency of MB45950 was not considered because it is associated with anoxic (anaerobic environments).

***Surface Water Monitoring***

Available monitoring data were taken from the several sources including a USGS presentation, registrant sponsored runoff studies, and rice monitoring studies. Although these studies provide some context on estimated environmental concentrations from fipronil use, the uses with the exception of in-furrow corn are not expected to be representative of the proposed in-furrow, at plant use on rutabagas and turnips.

The USGS found that most frequent detections (14 to 34%) of fipronil residues are associated with urban and integrated watersheds (Sandstrom and Madison, 2003). A maximum fipronil water concentration of 0.117 $\mu$g/L was detected in the integrated (mixed land use) watersheds. These detections may be associated with the above-ground uses of fipronil in turf for fire ant control in urban environment.

Preliminary results from registrant sponsored monitoring data in NC, FL, and TX show fipronil (applied as Chipco Topchoice®) concentrations in runoff from turf areas immediately post-application during high rainfall events. The maximum total fipronil water concentrations was 0.47 $\mu$g/L in an estuary at Gulf Breeze, FL. Fipronil residue concentrations in sediment were ≤ 0.1 $\mu$g/kg.

USGS monitoring studies in the southwestern LA rice growing region indicate that fipronil residues accumulated in bed sediment as fipronil sulfide (0.636 to 24.8 $\mu$g/kg), desulfiny fipronil (0.55 to 7.01 $\mu$g/kg), fipronil sulfone (ND to 10.5 $\mu$g/kg). Water concentrations of fipronil residues ranged from 0.829 to 5.29 $\mu$g/kg, which corresponded with the release of rice field water. (USGS, 2003)

Based on preliminary data from the Louisiana Department of Agriculture and Forestry from 23 monitoring sites in Calcasieu, Jefferson-Davis, Allen, Evangeline, Acadia, and Vermilion Parishes, the maximum water concentration of fipronil residues was 8.41 ug/l for fipronil, 1.96 ug/L for MB46513, 0.50 ug/L for MB46136, and 0.32 ug/L for MB45950 from March 6, 2000 to May 15, 2000. The detections frequencies (number of detection/total number of samples) were 85% for fipronil, 32% for MB46513, 11.7% for MB46136, and 6.9% for MB45950. Because the monitoring data were derived from presentation materials, the level of detail is insufficient to assess data quality.

The registrant (Aventis) has submitted surface water monitoring data for the Mermentau River and Lake Arthur (MRID 453499-01). The Mermentau River drains a large portion of the rice acreage in southern Louisiana from the mouths of Bayou Plaquemine and Bayou Nezpique. It should be noted this area does not have any community water systems using surface source water. The monitoring program was designed to provide a snapshot of concentrations on May 11, 1999 from 0-to-1 feet and 4 to 6 feet depth. Low rainfall was observed (0.5 inches) from March 14 to May 9, 1999. Point samples were taken using a 1 L beaker for surface samples at depth of 1 feet and PVC tube sample at 5.5 feet depth Samples were taken from 14 sampling points from the north to south including the mouth of the Bayou Plaquemine, mouth of the Bayou

Nezpique, 10,8,6,4,2,1 miles north of Lake Arthur Bridge; Lake Arthur Bridge, and 1,2,3,4, and 5 miles south of Lake Arthur Bridge. The reviewer notes that sample preparation (e.g. filtering) is not described in the submission. Concentrations of Fipronil, MB46513, MB45950, and MB46136 in water were determined by LC/MS/MS method. The limit of detection (LOD) and limit of quantification (LOQ) were 0.004 ug/L and 0.010 ug/L, respectively. Recoveries from spiked water samples at 0.10 ug/L ranged from 86.4 to 105.4%.

The maximum water concentration of fipronil residues at the mouth of the Bayou Plaquemine were 2.118 ug/L for fipronil in the 4 to 6 feet sample, 1.004 ug/L for MB46513 in the 0 to 1 feet sample, 0.269 ug/L for MB45950 in the 0 to 1 feet sample, and 0.270 ug/L for MB46136 in the 0 to 1 feet sample. The maximum total fipronil residue (summation of fipronil,MB46513, MB45950, and MB46136) concentration was 3.509 ug/L. There was a slight decrease in concentration downstream from the mouth of Plaquemine river to 5 miles south of Lake Arthur (18 miles downstream); concentrations were 1.027 ug/L for fipronil, 0.343 ug/L for MB46513, 0.034 ug/L for MB45950, and 0.130 ug/L for MB46136.

**Terrestrial Exposure Assessment**

Terrestrial wildlife exposure estimates were calculated for birds and mammals using three methods.

The first method involves the calculation of mass of pesticide per square foot of treatment area. This approach assumes that exposure may occur through a variety of routes (e.g. dietary, inhalation, dermal, drinking water) and that all of the pesticide at the soil surface is bioavailable, emphasizing a dietary exposure route for uptake of pesticide active ingredients. These exposures were considered as surrogates for terrestrial-phase amphibians and reptiles. The estimated measure of firponil exposure in this situation was calculated as follows and assumes 1% of applied pesticide at the soil surface for an in-furrow application:

$$((0.13 \text{ lb/acre} * 453592.4 \text{ mg/lb})/43560 \text{ ft}^2\text{/acre})\ 0.01 = 0.0135 \text{ mg/ft}^2$$

The degradates MB46950 and MB46136 have been observed in treated soils at 5% and 24% of the applied fipronil rate , respectively. Therefore, effective application rates for the two degrades may be conservatively estimated as follows:

$$\text{MB46950 mg/ft}^2 = (0.0135 \text{ mg/ft}^2)(0.05) = 0.000675 \text{ mg/ft}^2$$
$$\text{MB46136 mg/ft}^2 = (0.0135 \text{ mg/ft}^2)(0.24) = 0.00324 \text{ mg/ft}^2$$

The reader should note that terrestrial risk assessment does not quantitatively assess risks from the photolytic degradate MB46513 because (1) field studies do not show its predominance in terrestrial systems and (2) available soil photolysis data suggest that the degradate is only very slowly produced (half-life greater than 100 days).

The second approach involved estimation of pesticide concentrations in wildlife food items focusing on quantifying possible dietary ingestion of residues on vegetative matter and insects. The residue estimates were based on a nomogram that relates food item residues to pesticide application rate. The nomogram is based on an EPA database called UTAB (Uptake, Translocation, Accumulation, and Biotransformation), and is incorporated into the Agency model TREX, which serves as the basis for residue calculations, oral doses, and RQs. Because the use of fipronil involves an at-plant application scenario with in-furrow methods that minimize drift, the avian food items were limited primarily to seeds and insects present in the fields at the time of application. The following table provides the estimated concentrations in pertinent wildlife dietary sources:

**Fipronil Concentrations in Wildlife Dietary Items Directly within Spray Zone on Field at Application Time (UTAB-based residue assumptions as indicated by TREX)**

| Application rate (lb ai/acre) | Wildlife food item | Upper bound Estimate of Pesticide Residue at 1 lb ai /acre (mg/kg-fw) | Upper Bound Estimate of Pesticide Residue at Application Rate (mg/kg-fw)* |
|---|---|---|---|
| 0.13 | Seeds, Large Insects | 15 | 1.95 |
| | Small Insects | 135 | 17.55 |

* estimated residue @ 1 lb/acre X application rate = residue @ application rate

Additional exposure assessments for incidental ingestion of pesticide residues in soil and ingestion of pesticide accumulated in soil invertebrates are presented as part of the risk discussion in this risk assessment and are used to provide additional information relative to the exposures expressed as mass per unit area exposure model presented above.

**Effects Assessment**

The following sections of this screening-level risk assessment discuss the available data for fipronil and degradate effects on aquatic and terrestrial organisms. Available data consists largely of data submitted by the registrant in support of regulation. An ECOTOX search for publically literature has not been conducted at this time.

***Aquatic Organism Effects***

The following tables summarize the submitted acute and chronic toxicity data for freshwater aquatic and sediment sediment-dwelling organisms as well as effects data for freshwater aquatic plants.

**Freshwater Fish Acute Toxicity for Fipronil and Degradates**

| Species | Chemical | %A.I. | LC50 ug/L | MRID | Classification |
|---|---|---|---|---|---|
| ***Bluegill sunfish*** | ***fipronil*** | ***100*** | ***83*** | ***42918624*** | ***acceptable*** |
| Rainbow trout | fipronil | 100 | 246 | 42977902 | acceptable |
| Catfish | fipronil | 97 | 560 | 44299401 | acceptable |
| Rainbow trout | MB46136 | 99.2 | 39 | 42918673 | supplemental |
| *Bluegill sunfish* | *MB46136* | *99.2* | *25* | *42918674* | *supplemental* |
| *Bluegill sunfish* | *MB46513* | *no data* | *20* | *43279702* | *acceptable* |
| Rainbow trout | MB46513 | 94.7 | >100,000 | 43291718 | supplemental |
| Rainbow trout | MB46513 | 100 | >100,000 | 43279703 | acceptable |

**Freshwater Fish Chronic Exposure Toxicity for Fipronil**

| Species | Chemical | %A.I. | LOEL ug/L | NOEL ug/L | Effect | MRID | Classification |
|---|---|---|---|---|---|---|---|
| *Rainbow trout* | *fipronil* | *96.7* | *15* | *6.6* | *larval length* | *42918627* | *acceptable* |
| *Sheepshead minnow* | *fipronil* | *97* | *0.41* | *0.24* | *length, weight* | *44605502* | *acceptable* |
| Sheepshead minnow | fipronil | 95 | 1.7 | 0.85 | length | 45265101 | acceptable |

**Aquatic Invertebrate Acute Toxicity for Fipronil and Degradates**

| Species | Chemical | %A.I. | EC50 ug/L | MRID | Classification |
|---|---|---|---|---|---|
| *Daphnia magna* | fipronil | 100 | 190 | 42918625 | acceptable |
| *Daphnia magna* | RPA 10461 | 94.7 | 100,000 | 43291719 | supplemental |
| *Chironomus riparius* | RPA 200766 | 99.8 | 430 | 46376701 | supplemental |
| *Daphnia magna* | MB46136 | 100 | 29 | 42918671 | supplemental |
| *Daphnia magna* | MB46950 | 100 | 100 | 42918669 | supplemental |
| *Red Swamp Crayfish* | ICON 6.2 FS | 56.02 | 174 | 45029601 | supplemental |

**Aquatic Invertebrate Chronic Exposure Toxicity for Fipronil and Degradates**

| Species | Chemical | %A.I. | LOEL ug/L | NOEL ug/L | Effect | MRID | Classification |
|---|---|---|---|---|---|---|---|
| *Daphnia magna* | fipronil | 100 | 20 | 9.8 | length | 42918626 | supplemental |
| *Daphnia magna* | MB46513 | no data | 100 | 41 | growth | 43279704<br>44812801 | acceptable |
| *Daphnia magna* | MB46136 | no data | 1.5 | 0.63 | weight | DPR 15730 | acceptable |
| *Daphnia magna* | MB46950 | no data | 22 | 13 | reproduction, growth | DPR 15730 | acceptable |

**Aquatic Invertebrate Acute Toxicity ( Sediment Dwelling Organisms) Fipronil and Degradates**

| Species | Chemical | %A.I. | Sediment LC50 ug/kg | Pore Water LC50 ug/L | MRID | Classification |
|---|---|---|---|---|---|---|
| *Chironomus tentans* | MB45950 | 99.5 | 116.9 | 2.13 | 45084801 | acceptable |
| *Chironomus tentans* | MB46136 | 99.01 | 44.8 | 0.72 | 45175901 | acceptable |
| *Chironomus tentans* | MB46513 | 99.1 | 1300 | 200 | 45375901 | supplemental |
| *Chironomus tentans* | fipronil | 98.3 | 30.7 | 0.41 | 45878001 | acceptable |

**Nontarget Aquatic Plant Toxicity Fipronil**

| Species | % A.I. | 5 Day EC50 (μg/L) | NOEC (μg/L) | MRID # Author/year | Classification |
|---|---|---|---|---|---|
| *Navicula pelliculosa* | 96.1 | >120 | 120 | 42918658 | acceptable |
| *Lemna gibbons* | 96.1 | >100 | 100 | 42918656 | supplemental |
| *Selena strum capricornutum* | 96.1 | 140 | <140 | 42918660 | acceptable |
| *Skeletonema costatum* | 96.1 | >140 | 140 | 42918659 | acceptable |
| *Anabaena flos aquae* | 96.1 | >170 | 140 | 42918657 | acceptable |

*Terrestrial Organism Effects*

The following tables summarize the submitted acute and chronic toxicity data for terrestrial wildlife.

**Avian Single Oral Dose Toxicity Data for Fipronil and Degradates**

| Species | Chemical | %A.I. | LD50 mg/kg-bw | MRID | Classification |
|---|---|---|---|---|---|
| Northern bobwhite | fipronil | 96 | 11.3 | 42918617 | acceptable |
| Mallard | fipronil | 96.8 | >2150 | 42918616 | acceptable |
| Pigeon | fipronil | 97.7 | >500 | 42918613 | supplemental |
| Red-legged partridge | fipronil | 95.4 | 34 | 42918614 | supplemental |
| Pheasant | fipronil | 95.4 | 31 | 42918615 | supplemental |
| House sparrow | fipronil | 96.7 | 1000 | 42918618 | supplemental |
| Northern bobwhite | MB46513 | 99.7 | 5 | 43776601 | supplemental |
| Mallard duck | MB46513 | 98.6 | 420 | 43776602 | supplemental |
| Northern bobwhite | MB46136 | 99.7 | 84 | 44890301 | acceptable |
| Northern bobwhite | MB45590 | 98.8 | 114 | 44890302 | acceptable |
| Northern bobwhite | fipronil (1.6 WG) | 1.6 | 1065 | 42918619 | supplemental |

**Avian Subacute Dietary Toxicity for Fipronil and Degradates**

| Species | Chemical | %A.I. | LC50 mg/kg-diet | MRID | Classification |
|---|---|---|---|---|---|
| Northern bobwhite | fipronil | 95 | 48 | 42918620 | acceptable |
| Mallard duck | fipronil | 95 | >5000 | 42918621 | acceptable |
| Northern bobwhite | MB46513 | 97.8 | 119.2 | 45259201 | acceptable |
| Northern bobwhite | MB46513 | 97.8 | <178 | 44920701 | supplemental |

**Avian Reproductive Toxicity for Fipronil**

| Species | Chemical | %A.I. | LOEC mg/kg-diet | NOEC mg/kg-diet | MRID | Classification |
|---|---|---|---|---|---|---|
| Northern bobwhite | fipronil | 96.7 | >10 | 10 | 42918622 | supplemental |
| Mallard duck | fipronil | 96.7 | >1000 | 1000 | 42918623 | acceptable |

## Fipronil and Degradate Toxicity to Mammals

| Species | % AI | $LD_{50}$ (mg/kg-bw) | MRID |
|---|---|---|---|
| Rat | 93% | $LD_{50}$ (mg/kg-bw) 97<br>reproduction NOEC 30 mg/kg-diet<br>effects: litter size and number of matings<br>reproduction NOEL 2.64 mg/kg-bw | 42918628<br>42918647 |
| Rat | MB46950 | $LD_{50}$ (mg/kg-bw) 83 | HED memo* |
| Rat | MB46513 | $LD_{50}$ (mg/kg-bw) 16 | 43235402 |
| Rat | MB46136 degr.(98%) | $LD_{50}$ (mg/kg-bw) 218 | 42918675 |
| Rat | 1.6(form.) EXP60655A | $LD_{50}$ (mg/kg-bw)>5000 | 42918636 |
| Rat | 0.25(form.) RM1601c | $LD_{50}$ (mg/kg-bw)>5000 | 43121104 |

*Fipronil - Review of toxicity studies (28-day dtudies with fipronil and metabolite RPA 200766, a developmental neurotoxicity study with fipronil and a paper on the toxicological significance of fipronil and its metabolites). From V.A. Dobozy (Registration Branch 1/HED) to M. Johnson (RD), 8/6/1997.

## Fipronil Toxicity to Nontarget Beneficial Insects

| Species | Study Type | Toxicity (µg ai/bee) | MRID Study Date | Category |
|---|---|---|---|---|
| Apis mellifera | Acute contact | LD50: 0.00593 | N/A | Unverified |
| Apis mellifera | Acute oral | LD50: 0.00417 | N/A | Unverified |
| Apis mellifera | Foliar contact | 72h LD100: 28g product/ha for residues up to 14 days post application | 44884101 | supplemental |

*Effects Endpoints Used in Risk Assessment*

The following tables present the effects endpoints used in the risk assessment for calculation of RQ values. Where extrapolations are made beyond the available testing data, they are described.

**Aquatic Organism Toxicity Endpoints Used in the Pest Risk Assessment**

| Chemical | Acute Toxicity Threshold ug/L | Chronic Toxicity Threshold ug/L | Acute Threshold Origin | Chronic Threshold Origin |
|---|---|---|---|---|
| **Freshwater Fish** | | | | |
| Fipronil | 83 | 6.6 | 1 | 1 |
| MB46136 | 25 | 0.67 | 1 | 2 |
| MB46513 | 20 | 0.59 | 1 | 2 |
| MB45950 | 83 | 6.6 | 3 | 3 |
| **Freshwater Invertebrates** | | | | |
| Fipronil | 0.41 | 0.021 | 1 | 4 |
| MB46136 | 0.72 | 0.016 | 1 | 5 |
| MB46513 | 200 | 10.4 | 1 | 6 |
| MB45950 | 2.13 | 0.28 | 1 | 5 |
| **Freshwater Plants** | | | | |
| fipronil | Non-vacsular<br>EC50 140<br>NOAEC <140<br>Vascular<br>EC50 >100<br>NOAEC 100 | not applicable | 1 | -- |

1 most sensitive species tested
2 most sensitive species tested acute value X multiplied by trout chronic:acute ratio of parent fipronil
3 assumed to be equivalent to parent fipronil
4 lowest parent fipronil acute value multiplied by chronic:acute ration for parent fipronil in D. magna
5 lowest acute value multiplied by metabolite chronic:acute ratio for D. magna
6 lowest acute value multiplied by fipronil chronic:acute ration of D. magna

**Terrestrial Organism Toxicity Endpoints Used in the Pest Risk Assessment**

| Chemical | Acute Toxicity Threshold | Chronic Toxicity Threshold | Acute Threshold Origin | Chronic Threshold Origin |
|---|---|---|---|---|
| **Birds** | | | | |
| Fipronil | $LD_{50}$ 11.3 mg/kg-bw<br>$LC_{50}$ 48 mg/kg-diet | NOEC 10 mg/kg-diet | 1 | 1 |
| MB46136 | $LD_{50}$ 8 mg/kg-bw | NOEC 10 mg/kg-diet | 1 | 2 |
| MB46513 | $LD_{50}$ 5 mg/kg-bw | NOEC 10 mg/kg-diet | 1* | 2* |
| MB45950 | $LD_{50}$ 114 mg/kg-bw | NOEC 10 mg/kg-diet | 1 | 2 |
| **Mammals** | | | | |
| Fipronil | $LD_{50}$ 97 mg/kg-bw | NOEC 30 mg/kg-diet<br>NOEL 2.64 mg/kg-bw | 1 | 1 |
| MB46136 | $LD_{50}$ 218 mg/kg-bw | NOEC 30 mg/kg-diet<br>NOEL 2.64 mg/kg-bw | 1 | 2 |
| MB46513 | LD50 16/mg/kg-bw | NOEC 30 mg/kg-diet<br>NOEL 2.64 mg/kg-bw | 1* | 2* |
| MB45950 | 83 | NOEC 30 mg/kg-diet<br>NOEL 2.64 mg/kg-bw | 1 | 2 |

1 most sensitive species tested
2 assumed to be equivalent to parent fipronil
* photodegradate toxicity endpoints provided for background information only as this degradate is not expected to appreciably occur in terrestrial systems due to the low photolysis half-life of fipronil and field study analyses

## V. RISK CHARACTERIZATION

### Risk Estimation

The following sections of this screening-level risk assessment present the results of the risk quotient calculations for terrestrial and aquatic organisms.

***Terrestrial Wildlife Risk Quotients***

Risk quotients calculated using the mass per unit area exposure estimate are presented in the following table. It is important to note that the mass per unit area RQ calculation is only used for acute effects assessment.

**Terrestrial Vertebrate Acute Risk Quotients for Fipronil Use Based on Mass Per Unit Area Exposure Estimates**

| Exposure Estimate mg ai/ft$^2$ | Effects Endpoint LD50 mg/kg-bw | Animal Type | Animal Body Weight g | Body Weight Adjusted Effects Endpoint* mg/kg-bw | Effects Endpoint mg/animal** | RQ |
|---|---|---|---|---|---|---|
| **Fipronil** | | | | | | |
| 0.013 | 11.3 | Bird | 20 | 8.4 | 0.17 | <0.1 |
| | | | 100 | 10.36 | 1.04 | <0.1 |
| | | | 1000 | 14.64 | 14.64 | <0.1 |
| | 97 | Mammal | 15 | 213.19 | 3.20 | <0.1 |
| | | | 35 | 172.49 | 6.04 | <0.1 |
| | | | 1000 | 74.61 | 74.61 | <0.1 |
| **MB46950** | | | | | | |
| 0.000675 | 114 | Bird | 20 | 82.13 | 1.64 | <0.1 |
| | | | 100 | 104.55 | 10.46 | <0.1 |
| | | | 1000 | 147.65 | 147.65 | <0.1 |
| **MB46136** | | | | | | |
| 0.00324 | 84 | Bird | 20 | 60.52 | 1.21 | <0.1 |
| | | | 100 | 77.04 | 7.70 | <0.1 |
| | | | 1000 | 108.82 | 108.82 | <0.1 |

* scaling to achieve adjusted toxicity endpoints uses the following approaches described in TREX v 1.22 documentation:
LD50 Assessed bird = Test bird LD50(assessed body weight /tested body weight)$^{0.15}$
LD50 Assessed mammal = Test mammal LD50(tested body weight/assess body weight)$^{0.25}$
** effects endpoint mg/animal=(body weight adjusted effects endpoint)(body weight/1000)
*** RQ= exposure estimate/effects endpoint mg/animal

Risk quotients for birds consuming terrestrial invertebrates and seeds in the field at the time of application are presented in the table below. These are calculated using the estimated fipronil concentration in food items as the exposure estimate and effects endpoints expressed as dietary concentrations. The acute listed species and restricted use levels of concern are exceeded for birds consuming small insects. The chronic level of concern for listed and non-listed species is exceeded.

**Bird Risk Quotients for Fipronil Based on Residues in Terrestrial Invertebrates and Seeds Present at Time of Application (concentration-based RQs)**

| Food Item | Fipronil Food Item Concentration mg ai/kg-fw | Acute Effects Endpoint LC50 mg/kg-diet | Chronic Effects Endpoint NOEC mg/kg-diet | Acute RQ | Chronic RQ |
|---|---|---|---|---|---|
| **Birds** | | | | | |
| Seeds, large insects | 1.95 | 48 | 10 | <0.1 | <1 |
| Small insects | 17.55 | | | **0.37** | **1.76** |
| **Mammals** | | | | | |
| Seeds, large insects | 1.95 | NA | 30 | NA | <1 |
| Small insects | 17.55 | | | NA | <1 |

RQ = Estimated daily dose/effects endpoint values in bold exceed one or more Agency levels of concern
where acute RQ ≥ 0.5 acute non-listed effects concerns
0.1 acute listed species effects concern
chronic RQ ≥1 listed and non-listed effects concern

The following table provides RQ calculations for birds and mammals consuming terrestrial invertebrates and seeds present in the field at the time of application. Unlike the table above, this approach converts pesticide concentration in wildlife food items to an ingested dose in the food item consumers. The advantage of this approach is that the effect of wildlife feeding rate for differing body sizes can be considered in the exposure assessment. The listed species and restricted use acute levels of concern are exceeded for 20 g birds and the listed species level of concern is exceeded for 100 g birds. Chronic RQs for insectivorous small mammals are the only quotients that exceed levels of concern.

**Bird and Mammal Risk Quotients for Fipronil Based on Residues in Terrestrial Invertebrates and Seeds Present at Time of Application (daily ingested dose-based RQs)**

| Food Item | Fipronil Food Item Concentration mg ai/kg-fw | Body weight g | Estimated Daily Dose mg/kg-bw | Weight Adjusted Acute Effects Endpoint LD50** mg/kg-bw | Weight Adjusted Chronic Effects Endpoint NOEL** mg/kg-bw | Acute RQ **** | Chronic RQ |
|---|---|---|---|---|---|---|---|
| **Birds** | | | | | | | |
| Seeds, large insects | 1.95 | 20 | 2.22 | 8.4 | NA*** | **0.26** | NA |
| | | 100 | 1.27 | 10.36 | NA | **0.12** | NA |
| | | 1000 | 0.57 | 14.64 | NA | <0.1 | NA |
| Small insects | 17.55 | 20 | 19.99 | 8.4 | NA | **2.38** | NA |
| | | 100 | 11.40 | 10.36 | NA | **1.10** | NA |
| | | 1000 | 5.10 | 15.64 | NA | **0.33** | NA |
| **Mammals (Insectivores)** | | | | | | | |
| Large insects | 1.95 | 15 | 1.86 | 213.19 | 5.80 | <0.1 | <1 |
| | | 35 | 1.28 | 172.49 | 4.69 | <0.1 | <1 |
| | | 1000 | 0.30 | 74.61 | 2.03 | <0.1 | <1 |
| Small insects | 17.55 | 15 | 16.73 | 213.19 | 5.80 | <0.1 | **2.88** |
| | | 35 | 11.56 | 172.49 | 4.69 | <0.1 | **2.46** |
| | | 1000 | 2.68 | 74.61 | 2.03 | <0.1 | **1.32** |
| **Mammals (Granivores)** | | | | | | | |
| Seeds | 1.95 | 15 | 0.41 | 213.19 | 5.80 | <0.1 | <1 |
| | | 35 | 0.29 | 172.49 | 4.69 | <0.1 | <1 |
| | | 100 | 0.07 | 74.61 | 2.03 | <0.1 | <1 |

*estimated daily dose calculated as per TREX v 1.22
** scaling to achieve adjusted toxicity endpoints as per TREX v 1.22
Endpoint Assessed Bird = Test Bird Endpoint (assessed body weight /tested body weight)$^{0.15}$
Endpoint Assessed Mammal = Test Mammal Endpoint (tested body weight/assess body weight
***NA no dose conversions aailble for chronic avian endpoints, study design limitation
****RQ = Estimated daily dose/effects endpoint values in bold exceed one or more Agency levels of concern
where acute RQ ≥ 0.5 acute non-listed effects concerns
0.1 acute listed species effects concern
chronic RQ ≥1 listed and non-listed effects concern

*Aquatic Organism Risk Quotients*

The acute and chronic risk quotients (RQ) for freshwater and estuarine organisms based on technical fipronil are summarized in Tables VV below. The application scenarios are based on a single 10 ha application with a 1.27 cm soil incorporation depth at 0.13 lbs ai/acre for single row cropping. Fipronil RQs exceed the acute non-listed and listed and chronic levels of concern. Risk quotients for MB46136 exceed the acute listed species and chronic levels of concern.

**Acute and Chronic Risk Quotients for Freshwater Organisms for Fipronil and its Degradation Products in the Standard Pond From In-furrow Fipronil Application for Turnips and Rutabagas**

| Taxonomic Group | Acute Toxcitiy Endpoint (ug/L) | Chronic Toxicity Endpoint (ug/L) | Peak EEC* (ug/L) | Chronic EEC[1] (ug/L) | Acute RQ | Chronic RQ |
|---|---|---|---|---|---|---|
| **Fipronil** | | | | | | |
| Freshwater Fish | 83 | 6.6 | 0.417 | 0.253 | <0.05 | <1 |
| Freshwater Invertebrate | 0.41 | 0.021 | 0.417 | 0.341 | **1.02** | **16.24** |
| **MB46136** | | | | | | |
| Freshwater Fish | 25 | 0.67 | 0.061 | 0.021 | <0.05 | <1 |
| Freshwater Invertebrate | 0.72 | 0.016 | 0.061 | 0.035 | **0.08** | **2.19** |

| Taxonomic Group | Acute Toxcitiy Endpoint (ug/L) | Chronic Toxicity Endpoint (ug/L) | Peak EEC* (ug/L) | Chronic EEC[1] (ug/L) | Acute RQ | Chronic RQ |
|---|---|---|---|---|---|---|
| **MB46513** | | | | | | |
| Freshwater Fish | 20 | 0.59 | 0.0063 | 0.0031 | <0.05 | <1 |
| Freshwater Invertebrate | 200 | 10.4 | 0.0063 | 0.0047 | <0.05 | <1 |
| **MB45950** | | | | | | |
| Freshwater Fish | 83 | 6.6 | 0.0189 | 0.0074 | <0.05 | <1 |
| Freshwater Invertebrate | 2.13 | 0.28 | 0.0189 | 0.0121 | <0.05 | <1 |

* Peak and chronic EECs for fipronil are based on PRZM/EXAMS. PEAK and chronic EECs for degradates are based on GENEEC. Although PRZM/EXAMS modeling was conducted for fipronil degradates, the one-in-ten year EECs were not used because accumulation was observed.

[1]Chronic Risk Quotients based on 1st year simulated 60-day (fish) and 21-day Invertebrates) average values.
RQ = Estimated daily dose/effects endpoint values in bold exceed one or more Agency levels of concern
Where acute RQ $\geq$ 0.5 acute non-listed effects concerns
0.05 acute listed species effects concern
Chronic RQ $\geq$1 listed and non-listed effects concern

The $EC_{50}$ for the aquatic plant species tested to date and the estimated aquatic concentrations from the proposed use on rutabagas and turnips will not exceed acute toxicity levels for aquatic plants.

The peak EEC for fipronil (0.41 ug/L) when compared with the EC50 and NOAEC values for vascular and non-vascular aquatic plants (a range of 100 to >140 ug/L) result in RQs that are well below 0.01.

**Risk Description**

As stated earlier in this document, the Agency relies on a suite of RQ interpretive values termed levels of concern (LOC), to evaluate the potential biological significance of RQ estimates. Risk quotient values below these LOCs do not indicate the absence of risk. Rather, RQ values below LOCs indicate that the Agency considers the risks to be low enough to preclude concerns for registration without the need for consideration of attendant benefits. In the case of Federally listed threatened and endangered species (listed species), RQ values below the listed species LOCs are interpreted as "no effect" scenarios. The following sections of this screening-level risk Assessement provide comparisons of the estimated RQs with the Agency LOCs and discuss other lines of evidence and method and data uncertainties in the context of the screening-level risk assessments predictive ability

***Terrestrial Animal Risks***

When exposure estimates are expressed on a mass of pesticide or degradate per unit area, the resulting RQ values are universally below OPP acute levels of concern for listed (RQ 0.1 and greater) and non-listed birds and mammals (RQ 0.5 and greater). However, this method of exposure and risk estimation is not instructive for assessing reproduction risks for birds and mammals.

To more fully evaluate risks from consumption of wildlife dietary materials that might be present on the field at the time of application of the pesticide to the furrow, the risk assessment considered wildlife consumption of fipronil residues in seeds and insects at the time of application. These exposures are compared to both acute lethality and reproduction endpoints for birds and mammals. When exposures are expressed on a dietry concentration basis, the avian RQ based on small insect residues exceed the listed-species level of concern (RQ 0.1 and greater) and the listed and non-listed reproduction effects level of concern RQ 1.0 and greater). The same dietary-concentration exposure based RQs exceed the mammalian reproduction level of concern (RQ 1.0 and greater) as well. The ingested dose-base RQs derived from this process for mammals did not exceed any acute (listed and non-listed species) level of concern. However, chronic dose-based RQs for mammalian insectivores exceed the OPP level of concern (RQ 1.0 and greater) for both listed and non-listed species in one food item class the small insect category (food item residues for this category of insect-based diet are based on observed residues for fruits and seeds of similar size) and for all body weight classes evaluated. Dose-based RQs for granivorous small mammals did not exceed any acute or reproduction level of concern. Dose based RQs for birds consuming seeds and insects indicate that concentrations of parent fipronil on seeds and large insects exceed the OPP acute levels of concern for non listed species (small insects food item for birds in the 20 and 100g bodyweight classes) and the listed species acute level of concern for both modeled food items in all bird weight classes (20, 100, and 100g).

If mean residues instead of upper bound residues of fipronil are assumed immediately after application, overall exposure model results are lower than those based on upper bound residue assumptions. The following table shows the results of dietary based RQs for birds and mammals. The table shows that an assumption of mean residues reduces all RQs below Agency LOCs, except listed bird acute effect concerns fo insectivores.

**Bird Risk Quotients for Fipronil Based on Mean Residues in Terrestrial Invertebrates and Seeds Present at Time of Application (concentration-based RQs)**

| Food Item | Fipronil Food Item Concentration mg ai/kg-fw | Acute Effects Endpoint LC50 mg/kg-diet | Chronic Effects Endpoint NOEC mg/kg-diet | Acute RQ | Chronic RQ |
|---|---|---|---|---|---|
| **Birds** | | | | | |
| Seeds, large insects | 0.91 | 48 | 10 | <0.1 | <1 |
| Small insects | 5.85 | | | **0.12** | <1 |
| **Mammals** | | | | | |
| Seeds, large insects | 0.91 | NA | 30 | NA | <1 |
| Small insects | 5.85 | | | NA | <1 |

The following table presents RQs calculated on a daily dose basis using mean dietary item residue assumptions at the time of application. When this mean residue assumption is employed, exposures for birds would still exceed listed and non-listed levels of concern for acute effects, but non-listed concerns would be confined to smaller birds consuming a largely insect diet. No acute nor chronic concerns would be evident for mammals.

**Bird and Mammal Risk Quotients for Fipronil Based on Mean Residues in Terrestrial Invertebrates and Seeds Present at Time of Application (daily ingested dose-based RQs)**

| Food Item | Fipronil Food Item Concentration mg ai/kg-fw | Body weight g | Estimated Daily Dose mg/kg-bw | Weight Adjusted Acute Effects Endpoint LD50** mg/kg-bw | Weight Adjusted Chronic Effects Endpoint NOEL** mg/kg-bw | Acute RQ **** | Chronic RQ |
|---|---|---|---|---|---|---|---|
| **Birds** | | | | | | | |
| Seeds, large insects | 0.91 | 20 | 1.04 | 8.14 | NA*** | **0.13** | NA |
| | | 100 | 0.59 | 10.36 | NA | <0.1 | NA |
| | | 1000 | 0.26 | 14.64 | NA | <0.1 | NA |
| Small insects | 5.85 | 20 | 6.67 | 8.4 | NA | **0.79** | NA |
| | | 100 | 3.80 | 10.36 | NA | **0.37** | NA |
| | | 1000 | 1.70 | 15.64 | NA | **0.11** | NA |

| Food Item | Fipronil Food Item Concentration mg ai/kg-fw | Body weight g | Estimated Daily Dose mg/kg-bw | Weight Adjusted Acute Effects Endpoint LD50** mg/kg-bw | Weight Adjusted Chronic Effects Endpoint NOEL** mg/kg-bw | Acute RQ **** | Chronic RQ |
|---|---|---|---|---|---|---|---|
| **Mammals (Insectivores)** | | | | | | | |
| Large insects | 0.91 | 15 | 0.86 | 213.19 | 5.80 | <0.1 | <1 |
| | | 35 | 0.60 | 172.49 | 4.69 | <0.1 | <1 |
| | | 1000 | 0.14 | 74.61 | 2.03 | <0.1 | <1 |
| Small insects | 5.85 | 15 | 5.56 | 213.19 | 5.80 | <0.1 | <1 |
| | | 35 | 3.86 | 172.49 | 4.69 | <0.1 | <1 |
| | | 1000 | 0.88 | 74.61 | 2.03 | <0.1 | <1 |
| **Mammals (Granivores)** | | | | | | | |
| Seeds | 0.91 | 15 | 0.19 | 213.19 | 5.80 | <0.1 | <1 |
| | | 35 | 0.14 | 172.49 | 4.69 | <0.1 | <1 |
| | | 100 | 0.03 | 74.61 | 2.03 | <0.1 | <1 |

*estimated daily dose calculated as per TREX v 1.22
** scaling to achieve adjusted toxicity endpoints as per TREX v 1.22
Endpoint Assessed Bird = Test Bird Endpoint (assessed body weight /tested body weight)$^{0.15}$
Endpoint Assessed Mammal = Test Mammal Endpoint (tested body weight/assess body weight
***NA no dose conversions available for chronic avian endpoints, study design limitation
****RQ = Estimated daily dose/effects endpoint

Although the standard terrestrial exposure assessment assumes foliar deposition on different non-target crops, it may not be completely applicable because fipronil use on rutabagas is strictly limited to in-furrow application. This type of application is expected to cause direct deposition on soil and limit direct foliar deposition. The following equations and input values were used to establish depth averaged fipronil concentrations in 1 and 15 cm depth soil profiles.

### Scenario 1: 15 " row spacing has 34,848 row ft per acre.

<u>**Calculation of estimated fipronil mass in furrow**</u>

0.13 lbs of fipronil/acre is label maximum rate.

@ 0.13 lbs/A/ 34,848 row ft/A= 3.730E-6 lbs of fipronil/ row ft * 454 gram/lb= 0.001693 grams per ft or 1,693 ug per ft

Calculation of Mass of Treated soil (@ soil bulk density=1.3 g/cm3)

15 " row spacing and 1 cm depth: 4 " (10 cm) x 12 " (30.48 cm) x 1 cm = 304.8 cm3 * 1.3 g/cm3 = 396 grams of soil in 1 cm furrow depth
15" row spacing and 15 cm depth: 4 " (10 cm) x 12" (30.48 cm) x 15 cm=4572 cm3 * 1.3 g/cm3= 5943 grams of soil in 15 cm furrow depth

Estimated Soil Concentrations

1 cm depth = 1693 ug/396 g of soil= 4.27 ug/g or 4.27 ppm
15 cm depth= 1693 ug/5943 g of soil= 0.284 ug/g or 0.284 ppm

## Scenario 2: 20 " row spacing has 26,133 row ft per acre.

Calculation of estimated fipronil mass in furrow

0.13 lbs of fipronil/acre is maximum rate.

@ 0.13 lbs/A/ 26133 row ft/A= 4.9745X 10-6 lbs of fipronil/ row ft * 454 gram/lb= 0.002258 grams per ft or 2,258 ug per ft

Calculation of Mass of Treated soil (@ soil bulk density=1.3 g/cm3)

20 " row spacing and 1 cm depth: 4" (10 cm) x 12 " (30.48 cm) x 1 cm = 304.8 cm3 * 1.3 g/cm3 = 396 grams of soil in 1 cm furrow depth
20" row spacing and 15 cm depth: 4" (10 cm) x 12" (30.48 cm) x 15 cm=4572 cm3 * 1.3 g/cm3= 5943 grams of soil in 15 cm furrow depth

Estimated Soil Concentrations

1 cm depth = 2258 ug/396 of soil= 5.70 ug/g or 5.70 ppm
15 cm depth= 2258 ug/5943 g of soil= 0.380 ug/g or 0.380 ppm

The depth avraged soil concentrations of fipronil from a single in furrow application could range from 4.27 to 5.7 mg/kg over a 1 depth and 0.284 to 0.380 mg/kg over a 15 cm depth. This concentration range accounts for application efficiency from the in furrow application process. These estimates are applicable only to soil particles and potential food sources in or surrounding furrows where ground sprays are applied. As nozzles will concentrate residues in small bands within the application site, residues on soil are expected to be limited to the immediate target zone of the spray.

The following table summarizes the estimated immediate post-treatment soil concentrations of fipronil and fipronil degradates (MB45950 and MB46136) as a result of in-furrow application.

**Estimated Soil Concentrations for Fipronil and Degradates In-Furrow Application (One Annual Application)**

| Chemical | Soil Concentration (mg/kg) ca 1 cm | Soil Concentration (mg/kg) ca 15 cm |
|---|---|---|
| fipronil | 4.27 to 5.7 | 0.284 to 0.380 |
| MB45950* | 0.214 to 0.285 | 0.014 to 0.019 |
| MB46136** | 1.025 to 1.368 | 0.068 to 0.091 |

* assumes a 5% conversion efficiency
** assumes a 24% conversion efficiency

In-furrow spray application of fipronil to rutabaga and turnip field soils is an application scenario not normally covered by routine exposure/risk assessment methods employed by EFED. Such a spray application does not involve application of active ingredient as a granule, precluding the use of the granular pesticide assessment methodology. Similarly, the extremely limited zone of spray application, restricted to individual furrows, would not involve general application across a field with concomitant residues on bare ground, foliage, etc. This would suggest that the use of Fletcher (1994) spray application residue values, except food items present in a pre-plant field, may not be completely reflective of such sprays applied to soil within individual furrows. Because the in furrow spray application is not completely compatible with these routine methods of risk assessment for terrestrial receptors, EFED considered an alternative approach for evaluating the exposure to terrestrial birds and mammals potentially foraging in fields treated with fipronil by this in furrow spray method.

Terrestrial wildlife foraging in or near application furrows may be exposed to residues adsorbed to soil particles or accumulated in soil organisms. Under the alternative exposure scenario for the in-furrow spray, exposures to wildlife were calculated as an oral dose (average mg/kg-bw./day) from consumption of fipronil and degradate residues accumulated in soil invertebrates and from incidental consumption of treated soil. The assessment of risk was based on comparison to oral toxicity thresholds for the most sensitive species tested.

An estimation of fipronil and its degradate concentrations potentially accumulated in the tissues of earthworms was calculated using a fugacity-based (equilibrium partitioning) approach based on the work of Trapp and McFarlane (1995) and Mackay and Paterson (1981). Earthworms dwelling within the soil are exposed to contaminants in both soil pore water and via the ingestion of soil (Belfroid et al. 1994). The concentrations of fipronil and its degradates in earthworms were calculated as a combination of uptake from soil pore water and gastrointestinal absorption from ingested soil:

$$C_{earthworm} = [(C_{soil})(Z_{earthworm}/Z_{soil})]+[(C_{soil\ water})(Z_{earthworm}/Z_{water})]$$

where: $C_{soil}$ is the concentration of chemical in bulk soil (note: a chemical concentration averaged over a 15 cm soil depth was used to reflect a concentration across the earthworm occupied area of soil)

$Z_{earthworm}$ is the fugacity capacity of chemical in earthworms = $(lipid)(K_{ow})(\rho_{earthworm})/H$

$Z_{soil}$ is the fugacity capacity of chemical in soil = $(K_d)(\rho_{soil})/H$

$Z_{water}$ is the fugacity capacity of chemical in water = 1/H

$C_{soil\ water}$ is the concentration of chemical in soil water = $C_{soil}/K_{bw}$

$K_{bw}$ is the bulk soil-to-water partitioning coefficient = $(\rho_{soil})(K_d)+\theta+(\varepsilon-\theta)(K_{aw})$

$K_{aw}$ is the air-to-water partitioning coefficient = H/RT

H = Henry's Constant specific to fipronil or degradate

R = universal gas constant, 8.31 Joules-$m^3$/mol-°K

T = temperature °K, assumed to be 298 °K

$K_d$ = soil partitioning coefficient = (chemical $K_{oc}$)(0.02 assumed fraction of soil organic carbon)

$\rho_{soil}$ = bulk density of soil, assumed to be 1.3 g/$cm^3$

$\theta$ = volumetric fraction of the soil, assumed to be 0.30

$\varepsilon$ = volumetric total porosity of the soil, assumed to be 0.50

lipid = fraction of lipid in organism 0.01 (Cobb et al. 1995)

$K_{ow}$ = fipronil or degradate octanol to water partitioning coefficient

$\rho_{earthworm}$ = the density of the organism g/$cm^3$, assumed to be 1 g/$cm^3$

The following summarizes the model inputs and exposure estimates. For this alternative exposure approach.

**Model Input Parameters and Dietary Exposure Estimates for Avian and Mammalian Receptors (for Soil Concentrations Immediately Posttreatment, lowest estimated soil concentrations)**

| Parameter | Fipronil | MB45950 | MB46136 |
|---|---|---|---|
| $C_{soil}$ (mg/kg @ 15 cm depth)* | 0.284 to 0.380 | 0.014 to 0.019 | 0.068 to 0.091 |
| Henry's Constant (Pa-$m^3$/mole) | 4.406E-01 | 6.37E-03 | 1.315E-01 |
| R universal gas constant (Joules-$m^3$/mol-°K) | 8.314 | 8.314 | 8.314 |
| T °K | 298 | 298 | 298 |
| $K_{ow}$ | 10570 | 6310 | 2818 |
| $K_d$ (L/kg) | 14.54 | 84.12 | 54.36 |
| $Z_{water}$ (1/H or moles/Pa-$m^3$) | 2.269632 | 156.9859 | 7.604563 |
| $Z_{soil}$ ((K.•$\rho_{soil}$)/H) | 42.90059 | 17167.35 | 537.3992 |
| $Z_{earthworm}$ ((lipid•$K_{ow}$•$\rho_{earthworm}$)/H) | 239.9001 | 9905.181 | 214.327 |
| $C_{soil\ water}$ (mg/L) | 0.0148 to 0.0198 | 0.000128 to 0.000173 | 0.000958 to 0.00128 |
| $\rho_{soil}$ (g/$cm^3$) | 1.3 | 1.3 | 1.3 |
| $\rho_{earthworm}$ (g/$cm^3$) | 1 | 1 | 1 |
| θ (unitless) | 0.3 | 0.3 | 0.3 |
| ε (unitless) | 0.5 | 0.5 | 0.5 |
| $K_{aw}$ (H/RT) | 0.000178 | 0.0000026 | 0.000053 |
| $K_{bw}$ (($\rho_{soil}$•Kd)+θ+(ε-θ)($K_{aw}$)) | 19.20204 | 109.656 | 70.96801 |
| Earthworm Concentration (mg/kg) | 3.15 to 4.22 | 0.016 to 0.022 | 0.054 to 0.072 |

Comparing these concentrations to the concentrations of fipronil used in the RQ calculations reveals that fipronil concentrations modeled in earthworms as a result of accumulation from soil would be between the two concentrations assumed to occur in terrestrial invertebrates at the time of application with the TREX residue model. The fipronil concentrations are more more than 10 fold lower than the subacute dietary LC50 for birds and are well under the avian and mammalian reproduction NOAEC values. When the estimated earthworm firponil concentrations are substituted in the TREX model for insects the resulting daily dose-based exposures would more than than a tenth of the LD50 (greater than the listed species LOC for RQ screening purposes) for all but 1000 g birds. All estimated fipronil doses for mammals would be below acute LD50 and reproduction NOAEL for mammals.

The concentrations of MB45950 in earthworms, when converted to daily dose exposures, would be less than than one tenth of the acute LD50 for all birds (a value that under normal RQ calculations that would be below concerns for listed wildlife). Similarly, the concentration of MB46136 in earthworms, expressed on a daily dose basis, would be less than a tenth of the avian LD50 for birds. These findings, if evaluated under normal RQ calculation methods, would not exceed concern for acute effects in listed and non-listed birds.

Finally, fipronil and the soil degradates may also be incidentally consumed as a part of feeding and preening behavior. Soil probing birds may consume soil at rates as high as 17% of daily dietary intake (dry) and common mammals of agricultural areas are reported to have such incidental soil ingestion rates as high a 9% of daily dietary intake (dry) (Beyer et al. 1994). The TREX model assumes that birds may consume 5, 13, and 58 g of dry mass food per day for 20, 100, and 1000 g birds, respectively. Applying an upper bound percentage of 17% to that value would yield incidental soil ingestion values of 0.9, 2.1, and 9.9 g for these birds. Using the 1 cm soil concentrations of firponil and soil degradates above and the following equation

daily soil route dose mg/kg/day = (soil concentration (mg/kg) X soil ingestion kg/day) bird weight (kg)

yields exposures for birds summarized in the following table.

**Incidental Soil Ingestion Exposure for Avian Wildlife**

| Bird Weight (g) | Soil Route Daily Dose mg//kg/day |
|---|---|
| **Fipronil** | |
| 20 | 1.425 |
| 100 | 0.741 |
| 1000 | 0.3306 |
| **MB45950** | |
| 20 | 0.07125 |
| 100 | 0.03705 |
| 1000 | 0.01653 |
| **MB46136** | |
| 20 | 0.342 |
| 100 | 0.17784 |
| 1000 | 0.079344 |

When compared to weight scaled bird LD50 values for the three compounds the exposures would be below the toxicity endpoints by factors well below those considered a concern for acute effects to listed and non-listed avian species. The sole exception to this finding is in the case of 20g birds where the ratio of exposure to effects endpoint:

(daily exposure 1.425 mg/kg/ 8.4 mg/kg LD50 = 0.169)

would exceed the acute toxicity endpoint by a factor above the concern level for listed species. The two degradates would not be of concern via the soil ingestion route as the exposures are much less than parent fipronil and the acute toxicity endpoints are much greater. Substituting the estimated bird exposures as surrogates for mammals (a conservative approach given the lower dietary intakes for mammals versus birds) and comparing those daily exposures with acute toxicity thresholds for mammals results in ratios of exposure to effects endpoint well below level triggering concern for both listed and non-listed species.

On the basis of the screening RQ calculations and the results of soil invertebrate bioaccumulation and soil ingestion modeling, it is expected that concerns for any risks to birds and mammals from the dietary route of exposure will be limited to exposures from consumption of directly treated insects and seeds at the time of application, with a single exception. That exception would be small (ca 20 g) bird exposure to fipronil accumulated in soil invertebrates and exposure to incidentally ingested soil residues.

In summation a consideration of the available effects, environmental fate, and use scenario information, when evaluated in accordance with screening-level risk assessment methods, *does not provide evidence to refute* the hypothesis that fipronil use in accordance with the proposed Section 18 label will cause adverse effects on avian survival and fecundity. These concerns seem to be most apparent for small to medium non-listed and listed insectivorous birds feeding on food organisms treated in the field at the time of application, and perhaps for those feeding on soil invertebrates accumulating fipronil from the soil. Concerns for effects on birds also extends to listed species of larger body weight (ca 1kg) and for those feeding upon seeds and large insects. Similarly the assessment indicates that the available information and analyses *do not provide evidence to refute* the hypothesis that reproduction effects in mammals of all size classifications modeled will result from the proposed fipronil use.

The models for chronic exposure estimates conservatively assume that receptor organisms feed only in treated fields and consequently receive all incidental soil invertebrate prey exposure from the treated fields. The dietary exposure models assumed a depth-integrated concentration of fipronil or degradate at 15 cm as the appropriate interval for soil invertebrate exposure. In addition, soil ingestion of these compounds was assumed to occur with soils at a 1 cm depth; fipronil and degradate concentrations at this depth were factored into models of the incidental soil ingestion exposure route. Uncertainties associated with the percentage of prey and foraging occurring in treated fields cannot be quantified as many site specific factors (e.g., field size and geographical distribution) are likely to greatly influence the frequency and intensity of the use of treated turnip fields as habitat.

It should be emphasized that the dietary exposure estimates for avian and mammalian receptors are for the first year of treatment only. The environmental stability of fipronil degradates suggests that there will be carry-over of annual application residues from year to year. Preliminary evaluation of the accumulation potential of fipronil degradates from multiyear applications of fipronil to corn fields in Illinois, Ohio, Nebraska, Washington, Texas, and Mississippi suggests that MB46136 and MB45950 accumulate in the 15 cm soil profile, reaching an asymptotic maximum approximately 10 times higher than initial application period concentrations with this plateau reached within two to three years.

**Nontarget Beneficial Insect Risk**

The Agency cannot quantitatively characterize the risk of adverse impacts to beneficial insects from application of fipronil insecticide products. The pesticide is very toxic to honeybees. However, given the nature of the application scenario employed for turnip treatment (in furrow spray), the extent of exposure to honeybees is assumed to be low.

**Aquatic Organism Risk**

As was stated in the problem formulation section of this risk assessment, habitats supporting estuarine and marine organisms are not expected to be significantly exposed to fipronil and degradates from the turnip use because the counties involved in the regulatory action are not contiguous with estuarine and marine habitats.

The acute and chronic levels of concern are exceeded by the calculated RQ for firponil and MB46136 for freahswater invertebrates. Therefore the available information and risk assessment do not provide evidence to refute the hypothesis that freshwater invertebrates (listed and non-listed) are will exhibit survival and reproduction effects from the proposed use of fipronil. Because the risk assessment uses endpoints from freshwater invertebrates that include benthic macroinvertebrates, the potential risks may extend to infaunal species as well. The risk assessment does provide evidence to refute the hypothesis that the proposed use of fipronil will directly produce adverse effect in freshwater fish and aquatic plants as no RQ values exceed Agency concern levels.

**Endangered Species Concerns**

***Direct Effects***

The assessment for potential direct effects on listed species relies on the taxonomic-based risk assessment, incorporating a lower set of LOCs than employed for non-listed species. The taxonomic groups identified as being of concern for potential direct toxic effects include granivorous and insectivorous birds, insectivorous mammals, and freshwater invertebrates.

***Dose Response Analyses***

For screening level risk assessment purposes, the LOC values used for the interpretation of animal RQs are established with the assumption of a log probit dose response relationship. The following table presents the available probit slope estimates for each acute effects measurement endpoint used in the risk assessment for fish, freshwater invertebrates, birds, and mammals. The table also presents the chance of an individual mortality should exposure of a population of organisms be actually exposed fipronil and degradates at a level corresponding to RQs equivalent to the endangered species LOC as well as the modeled RQs themselves. The dose response relationships established from the fipronil data in birds and the invertebrate data for MB46513 do not statistically support a probit relationship. In addition, data were not available for estimating a probit slope for the fipronil acute study in rats and so the dose response relationship was conservatively assumed to have a slope similar to the lope of degradate in avian acute studies. Consequently, chance of individual mortality for these three chemical/taxa combinations as well as for parent fipronil in mammals are highly uncertain.

**Dose Response Probit Slopes and Chances of Individual Mortality**

| Taxonomic Group/chemical | Probit Slope | Listed Species LOC | Individual Mortality Chance @LOC 1 in ___ | RQ | Individual Mortality Chance 1 in ___ |
|---|---|---|---|---|---|
| **Freshwater Fish** | | | | | |
| fipronil | 8.3 | 0.05 | $1X 10^{16}$ | <0.05 | $1X 10^{16}$ |
| MB45950 | | | | <0.05 | $1X 10^{16}$ |
| MB46513 | 8.5 | | $1 X 10^{16}$ | <0.05 | $1X 10^{16}$ |
| MB46136 | 5.1 | | $6.14 X 10^{10}$ | <0.05 | $1X 10^{16}$ |
| **Freshwater Invertebrate** | | | | | |
| fipronil | 9.01 | 0.05 | $10^{16}$ | 1.017 | 1.9 |
| MB45950 | 2.87 | | $1.75 X 10^{3}$ | <0.05 | $<1.75 X 10^{3}$ |
| MB46513 | 1.22* | | $1.78 X 10^{1}$ | <0.05 | $<1.78 X 10^{1}$ |
| MB46136 | 2.72 | | $4.97 X 10^{3}$ | 0.086 | $5.33 X 10^{2}$ |
| **Bird** | | | | | |
| fipronil | 22.9* | 0.1 | $1 X 10^{16}$ | 0.79 | $1.05 X 10^{2}$ |
| MB45950 | 3.4 | | $2.97 X 10^{3}$ | No RQ | -- |
| MB46513 | 3.62 | | $6.79 X 10^{3}$ | No RQ | -- |
| MB46136 | 7.7 | | $1.45 X 10^{14}$ | No RQ | -- |
| **Mammal** | | | | | |
| fipronil | No data, assumed 3.4** | 0.1 | $2.97 X 10^{3}$ | <0.01 | $<2.97 X 10^{3}$ |
| MB45950 | | | | No RQ | -- |
| MB46513 | | | | No RQ | -- |
| MB46136 | | | | No RQ | -- |

*Data do not readily fit probit model, results are highly uncertain

**Raw data unavailable for calculation of slope, conservative assumption of slope based on degradate data in other terrestrial vertebrates.

*Indirect Effects*

The risk assessment process evaluates the Federal action's potential for indirect effects on listed species . The potential for such indirect effects arises when RQS exceed the listed species LOCs from one or more taxonomic groups evaluated in the screening assessment process. This concern is not limited to the listed species covered by the taxonomic group with RQS in excess of LOCs. Rather, a potential concern of indirect effects to any listed species in any taxonomic group that (1) has a dependancy on the taxa for which the RQ is in excess and (2) there is an indication of potential co-location between individuals of the listed species and the action area for the Federal action. Indirect effects may minimally include impacts to food supply, important biologically mediated habitat characteristics, or other important resources necessary for completion of the listed species life cycle.

The screening risk assessment has identified direct effects concerns for birds, mammals, and freshwater invertebrates. The extent to which other listed species rely on these organisms as a resource or as a biological mediator of important habitat characteristicsand the extent to which there is overlap between the locations of those listed species and the expected area where indirect effects would be of concern serve as the means to discriminate concern for indirect effects for this Federal action.

*Action Area*

At the screening level, the risk assessment evaluates impacts to listed and non-listed species that are on or immediate to the treatment area and are assumed to reside exclusively in this area. For terrestrial species this is the treated field and immediate field margins. For aquatic organisms this is a surface water body adjacent to the treated field. It is assumed that exposures, and so risks, are maximal in these areas and downwind and downstream exposures would be either equivalent or lower. If screening level assumptions result in no identifiable concerns for direct effects, no further analysis is needed and a no effect determination could be made. If screening levels identify concerns for direct effects on one or more taxa, then the assessment may proceed further to determine the degree to which listed species locatgions overlap with expected areas of pesticide use and the areas or impacts associated with those uses that may be farther afield than initial assumptions.

For this risk assessment, because direct effects concerns were triggered for at least one taxonomic group, a determination of listed species co-location with expected use areas was initiated at a county level of resolution. Locates version 2.9.7 was used as the tool, and every taxonomic group was searched for the counties proposed for the Section 18 registration of fipronil on turnips. The Section 18 is limited to Clackamas, Marion, Multnomah, and Umatilla counties of Oregon. The results of the search show the following county-level colocations:

| Taxa/Species | Counties |
|---|---|
| *Birds* | |
| bald eagle | All |
| northern spotted owl | Clackamas, Marion, Multnomah |
| *Mammals* | |
| Columbia white tail deer | Multnomah |

*Fish*

| | |
|---|---|
| Oregon chub | Clackamas, Marion |
| chinook salmon (lower Columbia) | Clackamas, Multnomah |
| chinook salmon (upper Willamette) | Clackamas, Marion, Multnomah |
| chinook salmon (Snake, fall and spring/summer) | Multnomah,Umatilla |
| chum salmon (Columbia) | Multnomah |
| steelhead (lower Columbia) | Clackamas, Marion, Multnomah, |
| steelhead (middle Columbia) | Multnomah, Umatilla |
| steelhead (upper Columbia) | Multnomah,Umatilla |
| steelhead (upper Willamette) | Clackamas, Marion, Multnomah |
| steelhead (Snake) | Multnomah, Umatilla |
| sockeye salmon (Snake) | Umatilla |
| bull trout | Clackamas, Multnomah, Umatilla |
| bull trout (Klamath) | Multnomah, Umatilla |

***Notes on Specific Species***

It is not likely that Columbia white-tailed deer will be exposed to fipronil or degradates through seeds and insect dietary items. The organism is a browser and grazer, feeding on leafy vegetation and grasses according to the US Fish and Wildlife Service recovery plan for the species (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.Species_FRDoc#top). Effects on the northern spotted owl my be limited to concerns for indirect effects through impact on mammalian prey. However, the the US Fish and Wildlife Service Species profile for the owl (http://www.fws.gov/cno/arcata/es/birds/ns_owl.html) indicates that the species is a predator of old growth late successional forests with a primary prey base of forest-dwelling small mammals. The likelihood that it will actively rely on a small mammal prey base in turnip fields is extremely limited. Effects on bald eagles and the various species of fish listed in the co-location analysis may possibly include indirect effects on energy transfer and food availability in aquatic systems, owing to the potential for fipronil use to directly affect aquatic invertebrates.

## Critical Habitat Assessment

In the evaluation of pesticide effects on designated critical habitat, consideration is given to the physical and biological features (constituent elements) of a critical habitat identified by the US 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 constituent elements and is accomplished using the screening-level taxonomic analysis (risk quotients, 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 has identified potential concerns for indirect effects on listed species for those organisms dependant upon aquatic invertebrates, mammals and birds. For the species co-occurring with the proposed Section 18 counties, the northern spotted owl, bull trout and salmonid species have designated critical habitats. 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 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 the pesticide. Then EPA would determine whether use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA does not permit use of either analytical approach to make a definitive identification of species that are potentially impacted indirectly or critical habitats that is potentially impacted directly by the use of the pesticide. 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 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 the following (enter the taxonomic groups for which listed species LOCs are exceeded). 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"

**References**

Austin, M.E. 1972. Land Resources Regions and Major Land Resource Areas of the United States. USDA Handbook 296. Washington, DC.

Belfroid, A., M. Sikkenk, W. Seinen, K.V. Gestel, J. Hermens. 1994. The toxicokinetic behavior of chlorobenzenes in earthworm (*Eisenia andrei*) experiments in soil. Environ. Toxicol. Chem. 13: 93-99

Beyer, W.N., E.E. Connor, S. Gerould. 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manage. 58: 375-382.

Hainzl, D. And J.E. Casida. 1996. Fipronil insecticide: Novel photochemical desulfinylation with retention of neurotoxicity. Proc. Natl. Acad. Sci. 93: 12764-12767.

Mackay, D. And S. Paterson. 1981. Calculating fugacity. Environ. Sci. Technol. 15: 1006-1014.

Trapp, S. And J.C McFarlane (eds.). 1995. Plant Contamination Modeling and Simulation of Organic Chemical Processes. Lewis Publishers. Boca Raton, Florida.

United States Environmental Protection Agency (EPA). 1993. Wildlife Exposure Factors Handbook. EPA/600/9-93/187a. Office of Research and Development. Washington, DC.

# APPENDIX A -- Aquatic Exposure Assessment

## In-Furrow, At Plant for Turnip/Rutabagas_Fipronil

stored as Sec18FIP.out
Chemical: Fiproniil
PRZM environment: ORswcornC.txt modified Satday, 12 October 2002 at 17:21:42
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

| Year | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 1961 | 0.1959 | 0.1847 | 0.1481 | 0.1199 | 0.09721 | 0.02591 |
| 1962 | 0.4102 | 0.3815 | 0.3021 | 0.2532 | 0.2242 | 0.07559 |
| 1963 | 0.3277 | 0.3084 | 0.2713 | 0.2182 | 0.1652 | 0.06623 |
| 1964 | 0.2639 | 0.2532 | 0.2159 | 0.1746 | 0.118 | 0.04938 |
| 1965 | 0.3666 | 0.3491 | 0.2799 | 0.2041 | 0.1499 | 0.06557 |
| 1966 | 0.316 | 0.3058 | 0.2624 | 0.2133 | 0.1506 | 0.06937 |
| 1967 | 0.2785 | 0.2688 | 0.221 | 0.1875 | 0.1572 | 0.06444 |
| 1968 | 0.302 | 0.2894 | 0.2446 | 0.1858 | 0.1715 | 0.08215 |
| 1969 | 0.4068 | 0.3734 | 0.294 | 0.2522 | 0.224 | 0.08993 |
| 1970 | 0.2922 | 0.2784 | 0.2553 | 0.1984 | 0.1639 | 0.0654 |
| 1971 | 0.2403 | 0.2242 | 0.1593 | 0.1433 | 0.135 | 0.07321 |
| 1972 | 0.3286 | 0.3104 | 0.219 | 0.1475 | 0.1153 | 0.04477 |
| 1973 | 0.4174 | 0.3968 | 0.341 | 0.2427 | 0.1872 | 0.08497 |
| 1974 | 0.4461 | 0.4283 | 0.352 | 0.273 | 0.187 | 0.06717 |
| 1975 | 0.2659 | 0.2506 | 0.2213 | 0.1903 | 0.143 | 0.06499 |
| 1976 | 0.1078 | 0.1034 | 0.09059 | 0.06548 | 0.05356 | 0.02186 |
| 1977 | 0.1989 | 0.1876 | 0.1703 | 0.1324 | 0.1022 | 0.03552 |
| 1978 | 0.1727 | 0.1605 | 0.1455 | 0.1022 | 0.07232 | 0.039 |
| 1979 | 0.4082 | 0.3909 | 0.3367 | 0.2607 | 0.2073 | 0.08251 |
| 1980 | 0.3618 | 0.3429 | 0.2726 | 0.1934 | 0.1327 | 0.05935 |
| 1981 | 0.3944 | 0.3706 | 0.2801 | 0.2375 | 0.2215 | 0.1016 |
| 1982 | 0.2259 | 0.2149 | 0.1918 | 0.1352 | 0.0995 | 0.0458 |
| 1983 | 0.1841 | 0.1741 | 0.1536 | 0.1201 | 0.08576 | 0.0501 |
| 1984 | 0.2544 | 0.2428 | 0.2186 | 0.1592 | 0.1292 | 0.05645 |
| 1985 | 0.3676 | 0.3394 | 0.2439 | 0.1425 | 0.1088 | 0.06243 |
| 1986 | 0.2496 | 0.2372 | 0.2008 | 0.1482 | 0.1226 | 0.04876 |
| 1987 | 0.5193 | 0.4881 | 0.4282 | 0.2292 | 0.1568 | 0.07399 |
| 1988 | 0.3029 | 0.2897 | 0.2387 | 0.1674 | 0.1312 | 0.07098 |
| 1989 | 0.3631 | 0.3413 | 0.2672 | 0.1956 | 0.152 | 0.05833 |
| 1990 | 0.3196 | 0.2988 | 0.2592 | 0.2207 | 0.1692 | 0.07583 |

Sorted results

| Prob. | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 0.032258064516129 | 0.5193 | 0.4881 | 0.4282 | 0.273 | 0.2242 | 0.1016 |
| 0.0645161290322581 | 0.4461 | 0.4283 | 0.352 | 0.2607 | 0.224 | 0.08993 |
| 0.0967741935483871 | 0.4174 | 0.3968 | 0.341 | 0.2532 | 0.2215 | 0.08497 |
| 0.129032258064516 | 0.4102 | 0.3909 | 0.3367 | 0.2522 | 0.2073 | 0.08251 |
| 0.161290322580645 | 0.4082 | 0.3815 | 0.3021 | 0.2427 | 0.1872 | 0.08215 |
| 0.193548387096774 | 0.4068 | 0.3734 | 0.294 | 0.2375 | 0.187 | 0.07583 |
| 0.225806451612903 | 0.3944 | 0.3706 | 0.2801 | 0.2292 | 0.1715 | 0.07559 |
| 0.258064516129032 | 0.3676 | 0.3491 | 0.2799 | 0.2207 | 0.1692 | 0.07399 |
| 0.290322580645161 | 0.3666 | 0.3429 | 0.2726 | 0.2182 | 0.1652 | 0.07321 |
| 0.32258064516129 | 0.3631 | 0.3413 | 0.2713 | 0.2133 | 0.1639 | 0.07098 |
| 0.354838709677419 | 0.3618 | 0.3394 | 0.2672 | 0.2041 | 0.1572 | 0.06937 |
| 0.387096774193548 | 0.3286 | 0.3104 | 0.2624 | 0.1984 | 0.1568 | 0.06717 |
| 0.419354838709677 | 0.3277 | 0.3084 | 0.2592 | 0.1956 | 0.152 | 0.06623 |
| 0.451612903225806 | 0.3196 | 0.3058 | 0.2553 | 0.1934 | 0.1506 | 0.06557 |
| 0.483870967741936 | 0.316 | 0.2988 | 0.2446 | 0.1903 | 0.1499 | 0.0654 |
| 0.516129032258065 | 0.3029 | 0.2897 | 0.2439 | 0.1875 | 0.143 | 0.06499 |
| 0.548387096774194 | 0.302 | 0.2894 | 0.2387 | 0.1858 | 0.135 | 0.06444 |
| 0.580645161290323 | 0.2922 | 0.2784 | 0.2213 | 0.1746 | 0.1327 | 0.06243 |
| 0.612903225806452 | 0.2785 | 0.2688 | 0.221 | 0.1674 | 0.1312 | 0.05935 |
| 0.645161290322581 | 0.2659 | 0.2532 | 0.219 | 0.1592 | 0.1292 | 0.05833 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.67741935483871 | 0.2639 | 0.2506 | 0.2186 | 0.1482 | 0.1226 | 0.05645 |
| 0.709677419354839 | 0.2544 | 0.2428 | 0.2159 | 0.1475 | 0.118 | 0.0501 |
| 0.741935483870968 | 0.2496 | 0.2372 | 0.2008 | 0.1433 | 0.1153 | 0.04938 |
| 0.774193548387097 | 0.2403 | 0.2242 | 0.1918 | 0.1425 | 0.1088 | 0.04876 |
| 0.806451612903226 | 0.2259 | 0.2149 | 0.1703 | 0.1352 | 0.1022 | 0.0458 |
| 0.838709677419355 | 0.1989 | 0.1876 | 0.1593 | 0.1324 | 0.0995 | 0.04477 |
| 0.870967741935484 | 0.1959 | 0.1847 | 0.1536 | 0.1201 | 0.09721 | 0.039 |
| 0.903225806451613 | 0.1841 | 0.1741 | 0.1481 | 0.1199 | 0.08576 | 0.03552 |
| 0.935483870967742 | 0.1727 | 0.1605 | 0.1455 | 0.1022 | 0.07232 | 0.02591 |
| 0.967741935483871 | 0.1078 | 0.1034 | 0.09059 | 0.06548 | 0.05356 | 0.02186 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.41668 | 0.39621 | 0.34057 | 0.2531 | 0.22008 | 0.084724 | |
| | | | | | Average of yearly averages: | | 0.0623863333333333 |

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: Sec18FIP
Metfile: w24232.dvf
PRZM scenario: ORswcornC.txt
EXAMS environment file: pond298.exv
Chemical Name: Fipronil

| Description | Variable Name | | Value | Units | Comments |
|---|---|---|---|---|---|
| Molecular weight | mwt | 437 | g/mol | | |
| Henry's Law Const. | henry | | atm-m^3/mol | | |
| Vapor Pressure | vapr | | torr | | |
| Solubility | sol | 2.4 | mg/L | | |
| Kd | Kd | | mg/L | | |
| Koc | Koc | 727 | mg/L | | |
| Photolysis half-life | kdp | 0.16 | days | Half-life | |
| Aerobic Aquatic Metabolism | kbacw | 33.7 | days | Halfife | |
| Anaerobic Aquatic Metabolism | kbacs | 33.7 | days | Halfife | |
| Aerobic Soil Metabolism | asm | 128 | days | Halfife | |
| Hydrolysis: | pH 7 | | days | Half-life | |
| Method: | CAM | 5 | integer | See PRZM manual | |
| Incorporation Depth: | DEPI | 1.27 | cm | | |
| Application Rate: | TAPP | 0.1456 | kg/ha | | |
| Application Efficiency: | APPEFF | 1.0 | fraction | | |
| Spray Drift | DRFT | | fraction of application rate applied to pond | | |
| Application Date | Date | 25-5 | dd/mm or dd/mmm or dd-mm or dd-mmm | | |
| Record 17: | FILTRA | | | | |
| | IPSCND | | | | |
| | UPTKF | | | | |
| Record 18: | PLVKRT | | | | |
| | PLDKRT | | | | |
| | FEXTRC | 0.5 | | | |
| Flag for Index Res. Run | IR | | Pond | | |
| Flag for runoff calc. | RUNOFF | none | none, monthly or total(average of entire run) | | |

# In-Furrow, At Plant for Turnip/Rutabagas_MB45950

stored as SecMB45950.out
Chemical: MB45950
PRZM environment: ORswcornC.txt modified Satday, 12 October 2002 at 17:21:42
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

| Year | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 1961 | 0.01893 | 0.01755 | 0.0121 | 0.007422 | 0.005591 | 0.001438 |
| 1962 | 0.03774 | 0.03583 | 0.03183 | 0.02591 | 0.02409 | 0.01352 |
| 1963 | 0.04765 | 0.04636 | 0.04344 | 0.04094 | 0.03819 | 0.03157 |
| 1964 | 0.08664 | 0.08408 | 0.06824 | 0.05666 | 0.05143 | 0.04529 |
| 1965 | 0.08791 | 0.08656 | 0.07264 | 0.0701 | 0.06646 | 0.06252 |
| 1966 | 0.09614 | 0.09496 | 0.09208 | 0.08534 | 0.08075 | 0.07626 |
| 1967 | 0.103 | 0.1019 | 0.0975 | 0.09164 | 0.08936 | 0.08513 |
| 1968 | 0.1207 | 0.1191 | 0.1158 | 0.1102 | 0.108 | 0.09895 |
| 1969 | 0.1307 | 0.1294 | 0.1267 | 0.1211 | 0.1189 | 0.112 |
| 1970 | 0.1464 | 0.1401 | 0.1358 | 0.1316 | 0.1285 | 0.1249 |
| 1971 | 0.1467 | 0.1457 | 0.1445 | 0.1402 | 0.1384 | 0.1354 |
| 1972 | 0.1615 | 0.1595 | 0.1508 | 0.1464 | 0.1454 | 0.1414 |
| 1973 | 0.1829 | 0.1801 | 0.1746 | 0.1679 | 0.1591 | 0.1481 |
| 1974 | 0.1826 | 0.1809 | 0.1754 | 0.1702 | 0.1688 | 0.1638 |
| 1975 | 0.1811 | 0.1795 | 0.175 | 0.172 | 0.169 | 0.1661 |
| 1976 | 0.1785 | 0.1776 | 0.1753 | 0.173 | 0.1728 | 0.1675 |
| 1977 | 0.191 | 0.1883 | 0.1814 | 0.1708 | 0.1659 | 0.1613 |
| 1978 | 0.1809 | 0.1795 | 0.1763 | 0.1733 | 0.1717 | 0.1663 |
| 1979 | 0.1797 | 0.1783 | 0.1758 | 0.1731 | 0.1711 | 0.1662 |
| 1980 | 0.2033 | 0.2003 | 0.1888 | 0.18 | 0.1761 | 0.1727 |
| 1981 | 0.2015 | 0.2 | 0.198 | 0.1927 | 0.1896 | 0.1807 |
| 1982 | 0.2025 | 0.2008 | 0.1979 | 0.1933 | 0.1925 | 0.1877 |
| 1983 | 0.2021 | 0.2015 | 0.1999 | 0.1979 | 0.1968 | 0.1924 |
| 1984 | 0.207 | 0.2058 | 0.2017 | 0.2 | 0.1957 | 0.192 |
| 1985 | 0.1982 | 0.1975 | 0.1951 | 0.1946 | 0.1942 | 0.1915 |
| 1986 | 0.2039 | 0.2027 | 0.1998 | 0.1962 | 0.1951 | 0.1908 |
| 1987 | 0.2234 | 0.2201 | 0.214 | 0.199 | 0.1967 | 0.1929 |
| 1988 | 0.2144 | 0.2126 | 0.2086 | 0.2035 | 0.2019 | 0.1965 |
| 1989 | 0.2139 | 0.2116 | 0.2049 | 0.1985 | 0.1989 | 0.1946 |
| 1990 | 0.2111 | 0.21 | 0.2087 | 0.2058 | 0.2043 | 0.1984 |

Sorted results

| Prob. | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 0.032258064516129 | 0.2234 | 0.2201 | 0.214 | 0.2058 | 0.2043 | 0.1984 |
| 0.0645161290322581 | 0.2144 | 0.2126 | 0.2087 | 0.2035 | 0.2019 | 0.1965 |
| 0.0967741935483871 | 0.2139 | 0.2116 | 0.2086 | 0.2 | 0.1989 | 0.1946 |
| 0.129032258064516 | 0.2111 | 0.21 | 0.2049 | 0.199 | 0.1968 | 0.1929 |
| 0.161290322580645 | 0.207 | 0.2058 | 0.2017 | 0.1985 | 0.1967 | 0.1924 |
| 0.193548387096774 | 0.2039 | 0.2027 | 0.1999 | 0.1979 | 0.1957 | 0.192 |
| 0.225806451612903 | 0.2033 | 0.2015 | 0.1998 | 0.1962 | 0.1951 | 0.1915 |
| 0.258064516129032 | 0.2025 | 0.2008 | 0.198 | 0.1946 | 0.1942 | 0.1908 |
| 0.290322580645161 | 0.2021 | 0.2003 | 0.1979 | 0.1933 | 0.1925 | 0.1877 |
| 0.32258064516129 | 0.2015 | 0.2 | 0.1951 | 0.1927 | 0.1896 | 0.1807 |
| 0.354838709677419 | 0.1982 | 0.1975 | 0.1888 | 0.18 | 0.1761 | 0.1727 |
| 0.387096774193548 | 0.191 | 0.1883 | 0.1814 | 0.1733 | 0.1728 | 0.1675 |
| 0.419354838709677 | 0.1829 | 0.1809 | 0.1763 | 0.1731 | 0.1717 | 0.1663 |
| 0.451612903225806 | 0.1826 | 0.1801 | 0.1758 | 0.173 | 0.1711 | 0.1662 |
| 0.483870967741936 | 0.1811 | 0.1795 | 0.1754 | 0.172 | 0.169 | 0.1661 |
| 0.516129032258065 | 0.1809 | 0.1795 | 0.1753 | 0.1708 | 0.1688 | 0.1638 |
| 0.548387096774194 | 0.1797 | 0.1783 | 0.175 | 0.1702 | 0.1659 | 0.1613 |
| 0.580645161290323 | 0.1785 | 0.1776 | 0.1746 | 0.1679 | 0.1591 | 0.1481 |
| 0.612903225806452 | 0.1615 | 0.1595 | 0.1508 | 0.1464 | 0.1454 | 0.1414 |
| 0.645161290322581 | 0.1467 | 0.1457 | 0.1445 | 0.1402 | 0.1384 | 0.1354 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.67741935483871 | 0.1464 | 0.1401 | 0.1358 | 0.1316 | 0.1285 | 0.1249 |
| 0.709677419354839 | 0.1307 | 0.1294 | 0.1267 | 0.1211 | 0.1189 | 0.112 |
| 0.741935483870968 | 0.1207 | 0.1191 | 0.1158 | 0.1102 | 0.108 | 0.09895 |
| 0.774193548387097 | 0.103 | 0.1019 | 0.0975 | 0.09164 | 0.08936 | 0.08513 |
| 0.806451612903226 | 0.09614 | 0.09496 | 0.09208 | 0.08534 | 0.08075 | 0.07626 |
| 0.838709677419355 | 0.08791 | 0.08656 | 0.07264 | 0.0701 | 0.06646 | 0.06252 |
| 0.870967741935484 | 0.08664 | 0.08408 | 0.06824 | 0.05666 | 0.05143 | 0.04529 |
| 0.903225806451613 | 0.04765 | 0.04636 | 0.04344 | 0.04094 | 0.03819 | 0.03157 |
| 0.935483870967742 | 0.03774 | 0.03583 | 0.03183 | 0.02591 | 0.02409 | 0.01352 |
| 0.967741935483871 | 0.01893 | 0.01755 | 0.0121 | 0.007422 | 0.005591 | 0.001438 |

0.1 0.21362 0.21144 0.20823 0.1999 0.19869 0.19443

Average of yearly averages: 0.138595933333333

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: SecMB45950
Metfile: w24232.dvf
PRZM scenario: ORswcornC.txt
EXAMS environment file: pond298.exv
Chemical Name: MB45950

| Description | Variable Name | Value | Units | Comments |
|---|---|---|---|---|
| Molecular weight | mwt | 421 | g/mol | |
| Henry's Law Const. | henry | | atm-m^3/mol | |
| Vapor Pressure | vapr | | torr | |
| Solubility | sol | 0.1 | mg/L | |
| Kd | Kd | | mg/L | |
| Koc | Koc | 2719 | mg/L | |
| Photolysis half-life | kdp | | days | Half-life |
| Aerobic Aquatic Metabolism | kbacw | 1400 | days | Halfife |
| Anaerobic Aquatic Metabolism | kbacs | 1400 | days | Halfife |
| Aerobic Soil Metabolism | asm | 700 | days | Halfife |
| Hydrolysis: | pH 7 | | days | Half-life |
| Method: | CAM | 5 | integer | See PRZM manual |
| Incorporation Depth: | DEPI | 1.27 | cm | |
| Application Rate: | TAPP | 0.0072 | kg/ha | |
| Application Efficiency: | APPEFF | 1.0 | fraction | |
| Spray Drift | DRFT | | fraction of application rate applied to pond | |
| Application Date | Date | 25-5 | dd/mm or dd/mmm or dd-mm or dd-mmm | |
| Record 17: | FILTRA | | | |
| | IPSCND | | | |
| | UPTKF | | | |
| Record 18: | PLVKRT | | | |
| | PLDKRT | | | |
| | FEXTRC | 0.5 | | |
| Flag for Index Res. Run | IR | | Pond | |
| Flag for runoff calc. | RUNOFF | none | none, monthly or total(average of entire run) | |

## In-Furrow, At Plant for Turnip/Rutabagas_MB46136

stored as SecMB46136.out
Chemical: MB46136
PRZM environment: ORswcornC.txt modified Satday, 12 October 2002 at 17:21:42
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

| Year | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 1961 | 0.06096 | 0.05419 | 0.03453 | 0.02088 | 0.01584 | 0.004058 |
| 1962 | 0.1238 | 0.1134 | 0.09278 | 0.07251 | 0.0677 | 0.03678 |
| 1963 | 0.1478 | 0.141 | 0.1288 | 0.1197 | 0.1113 | 0.09119 |
| 1964 | 0.2992 | 0.2849 | 0.2151 | 0.1734 | 0.1551 | 0.1341 |
| 1965 | 0.285 | 0.2774 | 0.2189 | 0.2099 | 0.198 | 0.1859 |
| 1966 | 0.3059 | 0.2974 | 0.2763 | 0.2542 | 0.2393 | 0.2261 |
| 1967 | 0.317 | 0.3112 | 0.2886 | 0.2683 | 0.261 | 0.2491 |
| 1968 | 0.3742 | 0.3647 | 0.3478 | 0.3252 | 0.3178 | 0.2891 |
| 1969 | 0.394 | 0.3873 | 0.3766 | 0.3553 | 0.3478 | 0.3287 |
| 1970 | 0.4444 | 0.4173 | 0.4006 | 0.3879 | 0.3806 | 0.3654 |
| 1971 | 0.4332 | 0.4256 | 0.4212 | 0.4066 | 0.4004 | 0.3927 |
| 1972 | 0.4858 | 0.4738 | 0.444 | 0.428 | 0.4241 | 0.408 |
| 1973 | 0.5577 | 0.5402 | 0.5084 | 0.484 | 0.4548 | 0.4203 |
| 1974 | 0.5661 | 0.5548 | 0.5201 | 0.4959 | 0.4917 | 0.4704 |
| 1975 | 0.5237 | 0.5146 | 0.4941 | 0.4839 | 0.4809 | 0.4687 |
| 1976 | 0.5173 | 0.5112 | 0.498 | 0.4874 | 0.4862 | 0.4659 |
| 1977 | 0.5494 | 0.5359 | 0.5029 | 0.4691 | 0.4529 | 0.4394 |
| 1978 | 0.5025 | 0.4957 | 0.4817 | 0.4718 | 0.4666 | 0.449 |
| 1979 | 0.493 | 0.4854 | 0.4736 | 0.465 | 0.4585 | 0.4452 |
| 1980 | 0.5795 | 0.5627 | 0.5139 | 0.4864 | 0.4735 | 0.4615 |
| 1981 | 0.558 | 0.5463 | 0.5359 | 0.518 | 0.5076 | 0.4804 |
| 1982 | 0.5528 | 0.5444 | 0.5328 | 0.5201 | 0.5171 | 0.5002 |
| 1983 | 0.5572 | 0.5533 | 0.5441 | 0.5359 | 0.5307 | 0.5142 |
| 1984 | 0.5647 | 0.5577 | 0.5403 | 0.5334 | 0.5199 | 0.5088 |
| 1985 | 0.5275 | 0.5243 | 0.5164 | 0.5128 | 0.5118 | 0.5007 |
| 1986 | 0.548 | 0.542 | 0.5303 | 0.514 | 0.5098 | 0.4942 |
| 1987 | 0.6136 | 0.5957 | 0.5704 | 0.5169 | 0.5113 | 0.4972 |
| 1988 | 0.574 | 0.5641 | 0.5459 | 0.5254 | 0.5203 | 0.5023 |
| 1989 | 0.5736 | 0.5602 | 0.5266 | 0.507 | 0.5079 | 0.4928 |
| 1990 | 0.5511 | 0.5452 | 0.5389 | 0.5272 | 0.5215 | 0.5015 |

Sorted results

| Prob. | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly | |
|---|---|---|---|---|---|---|---|
| 0.032258064516129 | 0.6136 | 0.5957 | 0.5704 | 0.5359 | 0.5307 | 0.5142 | |
| 0.0645161290322581 | 0.5795 | 0.5641 | 0.5459 | 0.5334 | 0.5215 | 0.5088 | |
| 0.0967741935483871 | 0.574 | 0.5627 | 0.5441 | 0.5272 | 0.5203 | 0.5023 | |
| 0.129032258064516 | 0.5736 | 0.5602 | 0.5403 | 0.5254 | 0.5199 | 0.5015 | |
| 0.161290322580645 | 0.5661 | 0.5577 | 0.5389 | 0.5201 | 0.5171 | 0.5007 | |
| 0.193548387096774 | 0.5647 | 0.5548 | 0.5359 | 0.518 | 0.5118 | 0.5002 | |
| 0.225806451612903 | 0.558 | 0.5533 | 0.5328 | 0.5169 | 0.5113 | 0.4972 | |
| 0.258064516129032 | 0.5577 | 0.5463 | 0.5303 | 0.514 | 0.5098 | 0.4942 | |
| 0.290322580645161 | 0.5572 | 0.5452 | 0.5266 | 0.5128 | 0.5079 | 0.4928 | |
| 0.32258064516129 | 0.5528 | 0.5444 | 0.5201 | 0.507 | 0.5076 | 0.4804 | |
| 0.354838709677419 | 0.5511 | 0.542 | 0.5164 | 0.4959 | 0.4917 | 0.4704 | |
| 0.387096774193548 | 0.5494 | 0.5402 | 0.5139 | 0.4874 | 0.4862 | 0.4687 | |
| 0.419354838709677 | 0.548 | 0.5359 | 0.5084 | 0.4864 | 0.4809 | 0.4659 | |
| 0.451612903225806 | 0.5275 | 0.5243 | 0.5029 | 0.484 | 0.4735 | 0.4615 | |
| 0.483870967741936 | 0.5237 | 0.5146 | 0.498 | 0.4839 | 0.4666 | 0.449 | |
| 0.516129032258065 | 0.5173 | 0.5112 | 0.4941 | 0.4718 | 0.4585 | 0.4452 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.548387096774194 | 0.5025 | 0.4957 | 0.4817 | 0.4691 | 0.4548 | 0.4394 |
| 0.580645161290323 | 0.493 | 0.4854 | 0.4736 | 0.465 | 0.4529 | 0.4203 |
| 0.612903225806452 | 0.4858 | 0.4738 | 0.444 | 0.428 | 0.4241 | 0.408 |
| 0.645161290322581 | 0.4444 | 0.4256 | 0.4212 | 0.4066 | 0.4004 | 0.3927 |
| 0.67741935483871 | 0.4332 | 0.4173 | 0.4006 | 0.3879 | 0.3806 | 0.3654 |
| 0.709677419354839 | 0.394 | 0.3873 | 0.3766 | 0.3553 | 0.3478 | 0.3287 |
| 0.741935483870968 | 0.3742 | 0.3647 | 0.3478 | 0.3252 | 0.3178 | 0.2891 |
| 0.774193548387097 | 0.317 | 0.3112 | 0.2886 | 0.2683 | 0.261 | 0.2491 |
| 0.806451612903226 | 0.3059 | 0.2974 | 0.2763 | 0.2542 | 0.2393 | 0.2261 |
| 0.838709677419355 | 0.2992 | 0.2849 | 0.2189 | 0.2099 | 0.198 | 0.1859 |
| 0.870967741935484 | 0.285 | 0.2774 | 0.2151 | 0.1734 | 0.1551 | 0.1341 |
| 0.903225806451613 | 0.1478 | 0.141 | 0.1288 | 0.1197 | 0.1113 | 0.09119 |
| 0.935483870967742 | 0.1238 | 0.1134 | 0.09278 | 0.07251 | 0.0677 | 0.03678 |
| 0.967741935483871 | 0.06096 | 0.05419 | 0.03453 | 0.02088 | 0.01584 | 0.004058 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.57396 | 0.56245 | 0.54372 | 0.52702 | 0.52026 | 0.50222 | |
| | | | | Average of yearly averages: | | | 0.377460933333333 |

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: SecMB46136
Metfile: w24232.dvf
PRZM scenario: ORswcornC.txt
EXAMS environment file: pond298.exv
Chemical Name: MB46136

| Description | Variable Name | | Value | Units | Comments |
|---|---|---|---|---|---|
| Molecular weight | mwt | 453 | g/mol | | |
| Henry's Law Const. | henry | | atm-m^3/mol | | |
| Vapor Pressure | vapr | | torr | | |
| Solubility sol | 0.16 | mg/L | | | |
| Kd Kd | | mg/L | | | |
| Koc Koc | 4208 | mg/L | | | |
| Photolysis half-life | kdp | 7 | days | Half-life | |
| Aerobic Aquatic Metabolism | | kbacw | 1400 | days | Halfife |
| Anaerobic Aquatic Metabolism | | kbacs | 1400 | days | Halfife |
| Aerobic Soil Metabolism | | asm | 700 | days | Halfife |
| Hydrolysis: | pH 7 | | days | Half-life | |
| Method: CAM | 5 | integer | See PRZM manual | | |
| Incorporation Depth: | DEPI | 1.27 | cm | | |
| Application Rate: | TAPP | 0.0349 | kg/ha | | |
| Application Efficiency: | | APPEFF | 1.0 | fraction | |
| Spray Drift | DRFT | | fraction of application rate applied to pond | | |
| Application Date | Date | 25-5 | dd/mm or dd/mmm or dd-mm or dd-mmm | | |
| Record 17: FILTRA | | | | | |
| IPSCND | | | | | |
| UPTKF | | | | | |
| Record 18: PLVKRT | | | | | |
| PLDKRT | | | | | |
| FEXTRC | 0.5 | | | | |
| Flag for Index Res. Run | | IR | Pond | | |
| Flag for runoff calc. | RUNOFF | none | none, monthly or total(average of entire run) | | |

## In-Furrow, At Plant for Turnip/Rutabagas_MB46513

stored as SecMB46513.out
Chemical: MB46513
PRZM environment: ORswcornC.txt modified Satday, 12 October 2002 at 17:21:42
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

| Year | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 1961 | 0.006315 | 0.006104 | 0.004739 | 0.003087 | 0.002326 | 0.0006062 |
| 1962 | 0.01214 | 0.01188 | 0.01136 | 0.009826 | 0.009078 | 0.005249 |
| 1963 | 0.01581 | 0.01561 | 0.01493 | 0.01439 | 0.01326 | 0.01083 |
| 1964 | 0.0243 | 0.02398 | 0.02115 | 0.01821 | 0.01669 | 0.01492 |
| 1965 | 0.02687 | 0.02668 | 0.02365 | 0.02292 | 0.02162 | 0.0201 |
| 1966 | 0.03055 | 0.03031 | 0.02991 | 0.02776 | 0.0262 | 0.02461 |
| 1967 | 0.03281 | 0.03265 | 0.03195 | 0.03027 | 0.02937 | 0.0278 |
| 1968 | 0.03687 | 0.03672 | 0.0363 | 0.03551 | 0.03503 | 0.03213 |
| 1969 | 0.04151 | 0.04131 | 0.04078 | 0.03947 | 0.03874 | 0.03562 |
| 1970 | 0.04539 | 0.04439 | 0.0437 | 0.04218 | 0.04097 | 0.03947 |
| 1971 | 0.04575 | 0.04563 | 0.0455 | 0.04456 | 0.04407 | 0.04281 |
| 1972 | 0.05005 | 0.04977 | 0.04724 | 0.0451 | 0.04488 | 0.04384 |
| 1973 | 0.05509 | 0.05476 | 0.05401 | 0.05221 | 0.04984 | 0.04695 |
| 1974 | 0.05492 | 0.05471 | 0.05387 | 0.05272 | 0.05094 | 0.04981 |
| 1975 | 0.0556 | 0.05536 | 0.05457 | 0.05371 | 0.05262 | 0.05154 |
| 1976 | 0.05425 | 0.05412 | 0.05394 | 0.0535 | 0.05336 | 0.05162 |
| 1977 | 0.05579 | 0.0555 | 0.05456 | 0.05203 | 0.05076 | 0.04965 |
| 1978 | 0.05427 | 0.05409 | 0.05364 | 0.05287 | 0.05245 | 0.05073 |
| 1979 | 0.05547 | 0.05524 | 0.0548 | 0.05409 | 0.05321 | 0.0512 |
| 1980 | 0.06137 | 0.06096 | 0.05846 | 0.05546 | 0.05429 | 0.05315 |
| 1981 | 0.0621 | 0.06189 | 0.0616 | 0.06037 | 0.05948 | 0.05658 |
| 1982 | 0.0624 | 0.06213 | 0.06148 | 0.05991 | 0.05961 | 0.05806 |
| 1983 | 0.06206 | 0.06192 | 0.06134 | 0.06073 | 0.06045 | 0.05889 |
| 1984 | 0.06253 | 0.06236 | 0.0617 | 0.06128 | 0.05988 | 0.05855 |
| 1985 | 0.0605 | 0.06036 | 0.06009 | 0.05971 | 0.05952 | 0.05878 |
| 1986 | 0.06193 | 0.06176 | 0.061 | 0.05974 | 0.0596 | 0.05845 |
| 1987 | 0.06772 | 0.06725 | 0.06598 | 0.06145 | 0.06016 | 0.05917 |
| 1988 | 0.06588 | 0.06561 | 0.06494 | 0.06385 | 0.0633 | 0.06133 |
| 1989 | 0.06578 | 0.06546 | 0.06436 | 0.06242 | 0.0623 | 0.06086 |
| 1990 | 0.06555 | 0.0654 | 0.06518 | 0.06468 | 0.06429 | 0.06247 |

Sorted results

| Prob. | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly | |
|---|---|---|---|---|---|---|---|
| 0.0322580645161290.06772 | | 0.06725 | 0.06598 | 0.06468 | 0.06429 | 0.06247 | |
| 0.0645161290322581 | 0.06588 | 0.06561 | 0.06518 | 0.06385 | 0.0633 | 0.06133 | |
| 0.0967741935483871 | 0.06578 | 0.06546 | 0.06494 | 0.06242 | 0.0623 | 0.06086 | |
| 0.129032258064516 | 0.06555 | 0.0654 | 0.06436 | 0.06145 | 0.06045 | 0.05917 | |
| 0.161290322580645 | 0.06253 | 0.06236 | 0.0617 | 0.06128 | 0.06016 | 0.05889 | |
| 0.193548387096774 | 0.0624 | 0.06213 | 0.0616 | 0.06073 | 0.05988 | 0.05878 | |
| 0.225806451612903 | 0.0621 | 0.06192 | 0.06148 | 0.06037 | 0.05961 | 0.05855 | |
| 0.258064516129032 | 0.06206 | 0.06189 | 0.06134 | 0.05991 | 0.0596 | 0.05845 | |
| 0.290322580645161 | 0.06193 | 0.06176 | 0.061 | 0.05974 | 0.05952 | 0.05806 | |
| 0.32258064516129 | 0.06137 | 0.06096 | 0.06009 | 0.05971 | 0.05948 | 0.05658 | |
| 0.354838709677419 | 0.0605 | 0.06036 | 0.05846 | 0.05546 | 0.05429 | 0.05315 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.387096774193548 | 0.05579 | 0.0555 | 0.0548 | 0.05409 | 0.05336 | 0.05162 |
| 0.419354838709677 | 0.0556 | 0.05536 | 0.05457 | 0.05371 | 0.05321 | 0.05154 |
| 0.451612903225806 | 0.05547 | 0.05524 | 0.05456 | 0.0535 | 0.05262 | 0.0512 |
| 0.483870967741936 | 0.05509 | 0.05476 | 0.05401 | 0.05287 | 0.05245 | 0.05073 |
| 0.516129032258065 | 0.05492 | 0.05471 | 0.05394 | 0.05272 | 0.05094 | 0.04981 |
| 0.548387096774194 | 0.05427 | 0.05412 | 0.05387 | 0.05221 | 0.05076 | 0.04965 |
| 0.580645161290323 | 0.05425 | 0.05409 | 0.05364 | 0.05203 | 0.04984 | 0.04695 |
| 0.612903225806452 | 0.05005 | 0.04977 | 0.04724 | 0.0451 | 0.04488 | 0.04384 |
| 0.645161290322581 | 0.04575 | 0.04563 | 0.0455 | 0.04456 | 0.04407 | 0.04281 |
| 0.67741935483871 | 0.04539 | 0.04439 | 0.0437 | 0.04218 | 0.04097 | 0.03947 |
| 0.709677419354839 | 0.04151 | 0.04131 | 0.04078 | 0.03947 | 0.03874 | 0.03562 |
| 0.741935483870968 | 0.03687 | 0.03672 | 0.0363 | 0.03551 | 0.03503 | 0.03213 |
| 0.774193548387097 | 0.03281 | 0.03265 | 0.03195 | 0.03027 | 0.02937 | 0.0278 |
| 0.806451612903226 | 0.03055 | 0.03031 | 0.02991 | 0.02776 | 0.0262 | 0.02461 |
| 0.838709677419355 | 0.02687 | 0.02668 | 0.02365 | 0.02292 | 0.02162 | 0.0201 |
| 0.870967741935484 | 0.0243 | 0.02398 | 0.02115 | 0.01821 | 0.01669 | 0.01492 |
| 0.903225806451613 | 0.01581 | 0.01561 | 0.01493 | 0.01439 | 0.01326 | 0.01083 |
| 0.935483870967742 | 0.01214 | 0.01188 | 0.01136 | 0.009826 | 0.009078 | 0.005249 |
| 0.967741935483871 | 0.006315 | 0.006104 | 0.004739 | 0.003087 | 0.002326 | 0.0006062 |
| | | | | | | |
| 0.1 | 0.065757 | 0.065454 | 0.064882 | 0.062323 | 0.062115 | 0.060691 |

Average of yearly averages: 0.0431925066666667

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: SecMB46513
Metfile: w24232.dvf
PRZM scenario: ORswcornC.txt
EXAMS environment file: pond298.exv
Chemical Name: MB46513

| Description | Variable Name | | Value | Units | Comments |
|---|---|---|---|---|---|
| Molecular weight | mwt | 389 | g/mol | | |
| Henry's Law Const. | henry | | atm-m^3/mol | | |
| Vapor Pressure | vapr | | torr | | |
| Solubility sol | 0.95 | mg/L | | | |
| Kd Kd | | mg/L | | | |
| Koc Koc | 1290 | mg/L | | | |
| Photolysis half-life | kdp | | days | Half-life | |
| Aerobic Aquatic Metabolism | | kbacw | 1320 | days | Halfife |
| Anaerobic Aquatic Metabolism | | kbacs | 1320 | days | Halfife |
| Aerobic Soil Metabolism | | asm | 660 | days | Halfife |
| Hydrolysis: | pH 7 | | days | Half-life | |
| Method: CAM | 5 | integer | See PRZM manual | | |
| Incorporation Depth: | DEPI | 1.27 | cm | | |
| Application Rate: | TAPP | 0.0014 | kg/ha | | |
| Application Efficiency: | | APPEFF | 1.0 | fraction | |
| Spray Drift | DRFT | | fraction of application rate applied to pond | | |
| Application Date | Date | 25-5 | dd/mm or dd/mmm or dd-mm or dd-mmm | | |
| Record 17: FILTRA | | | | | |
| IPSCND | | | | | |
| UPTKF | | | | | |
| Record 18: PLVKRT | | | | | |
| PLDKRT | | | | | |
| FEXTRC | 0.5 | | | | |
| Flag for Index Res. Run | | IR | Pond | | |
| Flag for runoff calc. | RUNOFF | none | none, monthly or total(average of entire run) | | |

## Appendix B: Environmental Fate Data

### DEGRADATION

Hydrolysis (161-1)
MRID No. 42194701

Radiolabelled fipronil was stable (<3% degraded by day 30 posttreatment) in pH 5 and pH 7 buffered solutions and hydrolyzed slowly ($t_{1/2}$=28 days) in pH 9 buffer solutions. The major degradate of fipronil was RPA 200766. In pH 9 buffer solution, RPA 200766 reached a maximum concentration of 51.7% of applied radioactivity at 30 days posttreatment. These data suggest that abiotic hydrolysis of fipronil is an alkaline-catalyzed degradation process.

The study (MRID 42194701) fulfills the hydrolysis (161-1) data requirement for fipronil. No additional data are needed at this time.

Photodegradation in water (161-2)
MRID No. 42918661
Ref.#ID: ACD/EAS/Im/255 (Interim Study)

Radiolabelled fipronil had a half-life of 3.63 hours in pH 5 buffer solution when irradiated with Xenon light. There was no fipronil degradation in the dark controls. Two degradates, MB46513 and RPA 104615, were identified in irradiated test samples. MB 46513 reached a maximum concentration of ≈43% of applied radioactivity at 6 hours postexposure. RPA 104615 reached a maximum concentration of ≈8% of applied radioactivity. One unidentified degradate, characterized as with a molecular weight of 410 a.m.u., reached a maximum concentration of ≈5.5% of applied radioactivity. Radioactive volatiles were not detected (<0.04% of applied radioactivity) in ethylene glycol and NaOH gas traps.

The study (MRID 42918661) fulfills the photodegradation in water data requirement (161-2). No additional data are needed at this time.

Photodegradation on soil (161-3)
MRID No. 42918662

Radiolabelled fipronil had a half-life of 34 days (dark control corrected half-life = 110 days) on loam soil when exposed to intermittent (8 hour photodegradation period) Xenon light. Radiolabelled fipronil had a half-life of 49 days in dark controls. Photodegradates were RPA 200766 (11% of applied), MB 46136 (4% of applied), MB 45590 (1.91% of applied), MB 46513 and RPA 104615 (each at 8% of applied). Organic volatiles were not detected (<0.5% of applied) in the gas traps from irradiated or dark control samples. However, carbon dioxide evolution was detected (2.5% of applied) from irradiated samples.

The study (MRID 42918662) fulfills the photodegradation on soil data requirement (161-3) for fipronil. No additional data are needed at this time.

## METABOLISM

Aerobic soil metabolism
MRID No. 42928663
MRID No. 44262830

Radiolabelled fipronil, applied at 0.2 $\mu$g/g, had half-lives ranging from 128 to 308 days in sandy loam and sand soils when incubated aerobically in the dark at 25°C. Major degradates of fipronil were identified as RPA 200766 (27 to 38% of applied) and MB 46136 (14-24% of applied). Minor degradates of fipronil were identified as MB 45950 (< 5%), MB 46513 (1% of applied), and MB 45897 (<1% of applied). Additionally, six unidentified degradates were detected (each < 4% of applied radioactivity) in sandy loam and sand soil samples. No discernable decline patterns were observed for the fipronil degradates during the testing period. Unextractable radioactivity accounted for 6 to 15% of the applied radioactive fipronil. Radioactive volatiles (organic + $CO_2$) did not account for a discernible amount of applied radioactivity.

Radiolabelled MB 46513, applied at 0.1 $\mu$g/g, had an extrapolated half-life of 630 and 693 days in loamy sand soils when incubated aerobically in the dark at 25°C. Major metabolites were RPA 105048 (5-amino-3-carbamoyl-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulfonyl pyrazone). RPA 105048 reached a reported maximum concentration of 0.014 ppm and 0.017 (14% and 17% of applied, respectively). In addition, an unidentified degradate was detected at a maximum concentration of 0.003 ppm or 3% of applied radioactivity. Radiolabelled volatiles (organic + $CO_2$) were also detected (≤2% of applied radioactivity).

The registrant submitted aerobic soil metabolism data for MB 46513. Since no aerobic soil metabolism data are available for the other fipronil degradates, it is assumed the fipronil degradates are persistent ($t_{1/2}$=700 days; stable) in terrestrial environments.

The study (MRID 42928663) in conjunction with the degradate metabolism study (MRID 44262830) fulfills the aerobic soil metabolism (162-1) data requirement for parent fipronil and MB46513. No additional data are needed at this time. EFED notes the registrant assumes that fipronil degradates MB45950 and MB46136 are persistent in terrestrial environments. Further refinement of the comprehensive fate and exposure assessment for fipronil would require additional data on aerobic soil metabolism of MB45950 and MB46136.

Anaerobic Aquatic Metabolism (162-3)
MRID No. 43291704

Radiolabelled fipronil, applied at 0.75 ppm in water or 1.5 ppm in soil, had half-lives of 116-130 days in anaerobic pond water/sediment when incubated under $N_2$ in the dark. Major degradates of fipronil were MB 45950 (47% of applied) and RPA 200766 (18% of applied). MB 45950 was predominantly detected in the soil extracts. In contrast, RPA 200766 was detected in both water and soil extracts. Numerous minor degradates (≤6% of the applied radioactivity) were detected in soil and water extracts. Unextractable radioactivity accounted for ≈18% of the applied radioactive fipronil.

The study (MRID No. 43291704) fulfills the anaerobic aquatic metabolism (162-3) and anaerobic soil (162-2) data requirement for fipronil. No additional data are needed at this time.

Aerobic Aquatic Metabolism (162-4)
MRID No. 44261909, 44262826

Radiolabelled fipronil, applied at 0.05 ppm (w/w), rapidly degraded ($t_{1/2} \approx 14.5$ days) in sandy loam soil when incubated under stratified redox conditions in the dark at 25°C. Parent fipronil had a maximum concentration of 0.0497 ppm (0.05 ppm application rate) at time 0 (immediately posttreatment), 0.0009 ppm at 90 days posttreatment, and < 0.0003 ppm at 365 days posttreatment. Major metabolites of fipronil were MB 45950 (82.58% of applied at 365 days posttreatment) and RPA 200766 (11.09% of applied at 60 days). Minor metabolites were RPA 105048 (7.73% of applied) and MB 46513 (0.33% of applied). Two unidentified metabolites had maximum concentrations ranging from 3.34 to 4.58% Organic volatiles had a maximum cumulative concentration of 0.0005 ppm. Radioactive $CO_2$ had a maximum cumulative concentration of 0.001 ppm (% of applied).

Radiolabelled fipronil had half-lives of 16 and 35 days in stratified whole system water/sediment from United Kingdom. Fipronil disappearance from the water column was associated with the formation of MB45950 on sediment. The maximum concentration of MB45950 was 80% of applied radioactivity at 121 days posttreatment. Minor degradation products(<10% of applied) were RPA 200766 and MB46126.

The aerobic aquatic metabolism (162-4) data requirement is fulfilled at this time. The study (MRID 44261909) inconjunction with the aerobic aquatic metabolism study (MRID 44661301) provide marginally acceptable data on the aerobic aquatic metabolism of fipronil. The data are deemed as marginally acceptable because the aerobic aquatic metabolism studies were conducted in stratified redox conditions which confounds interpretations on aerobic metabolism processes in aquatic environments. All the available data indicate fipronil degradation is dominated by anaerobic metabolism in the sediment as evident by the formation of MB45950. The main uncertainty is the persistence of fipronil in slightly acid (pH 5.5 to 7.0), oxic sediments. No additional data are needed at the time.

**MOBILITY**

Leaching mobility study (163-1)
MRID No. 42918664
MRID No. 43018801 and 44039003

Radiolabelled fipronil had Freundlich coefficients of 4.19 mL/g (1/n=0.947; $K_{oc}$= 1248) for sand loam soil, 9.32 mL/g (1/n=0.969; $K_{oc}$= 800) sandy clay loam soil, 10.73 mL/g (1/n=0.949; $K_{oc}$=673) for Speyer 2.2 soil, 14.32 mL/g (1/n=0.947; $K_{oc}$=427) for sandy clay loam soil, and 20.69 mL/g (1/n= 0.969; Koc=486)for loam soil. Desorption coefficients for fipronil ranged from 7.25 to 21.51 mL/g. Fipronil sorption appears to be lower ($K_f$< 5 mL/g) on coarse-textured soils with low organic matter contents. These data suggest that fipronil sorption on soil is not a completely reversible process. Since the fipronil sorption affinity correlates (r= 0.97) with soil organic matter content, fipronil mobility may be adequately described using a $K_{oc}$ partitioning model. Soil column leaching studies confirm the potential immobility of fipronil.

Radiolabelled fipronil was relatively immobile (>80% of the applied radioactivity in the 0-to-8 cm segment) in soil columns for five different foreign soils including a German loamy soil, Manningtree UK loamy sand (called sandy loam in study), Manningtree UK loam, French sandy clay loam (1), and French sandy clay loam (2). In the Manningtree UK loamy-sand soil, however, radiolabelled fipronil residues were detected in the 0-14 cm segment. Radioactive fipronil residues (1-8% of applied) were detected in leachate samples from all test soils. Leachate residues were not identified.

Radiolabelled MB 46513 had Freundlich adsorption coefficients of 4.3 mL/g ($K_{oc}$=1150 mL/g) for sand soil, 5.1 mL/g ($K_{oc}$= 1498 mL/g) for loamy sand soil, 5.5 mL/g ($K_{oc}$=1164 mL/g) for silt loam soil, 15.2 mL/g ($K_{oc}$=1245 mL/g) for clay, and 69.3 mL/g for pond sediment ($K_{oc}$=1392). Initial desorption coefficients of MB46513 are 5.8, 5.9, 6.2, 14.7, and 66.2 mL/g for sand, loamy sand, silt loam, clay, and pond sediment, respectively. All soils and sediment showed increasing $K_{des}$ values (cycle 2 $K_{des}$ values ranged from 6.9 to 73.6 mL/g and cycle 3 $K_{des}$ values ranged from 9.5 to 85.9 mL/g) for successive desorption cycles. These data suggest that MB 45950 sorption on soil is not a completely reversible process.

The degradates MB 45950 and MB 46136 have a moderate to high sorption affinity to organic carbon. Interim data indicate MB46136 had $K_{oc}$ adsorption coefficients of 5310 mL/g in a silt loam soil, 4054 mL/g in a sandy loam soil, 6745 mL/g in a loam soil, 3486 mL/g in a sandy clay loam soil, and 1448 mL/g in silt loam soil. MB 45950 had $K_{oc}$ adsorption coefficients of 2404 mL/g in a silt loam soil, 3120 mL/g in a sandy loam soil, 2925 mL/g in a loam soil, 3521 mL/g in a sandy clay loam soil, and 1619 mL/g in silt loam soil.

Aged soil column leaching studies demonstrated immobility of RPA 200766, MB 45950, MB 46136 and RPA 104615. RPA 200766 was detected (2-17% of applied) in all soil columns except the Manningtree sandy loam. Detections of MB 45950 and MB 46136 were more sporadic in soil columns. Radioactive residues were detected ( < 1 to 4% of applied radioactivity) in leachate samples. Leachate residues were not identified.

The unaged residue mobility studies (MRID No.43018801 and 42918664) fulfill the batch equilibrium/adsorption-desorption data (163-1) requirement for fipronil. The aged residues mobility studies (MRID No. 43018801 and 42918664) in conjunction with batch equilibrium studies on MB 46513 (MRID 44262831), MB 46136 and MB 45950 (Theissen, 10/97) should fulfill the aged portion of the 163-1 data requirement. EFED notes the batch equilibrium data for MB 46136 and MB 45950 were taken from interim reports. Complete study submissions for the interim reports are needed to confirm the validity of the batch equilibrium data.

**DISSIPATION**

Terrestrial field dissipation (164-1):
MRID No. 43291705, 43401103, 44298001

Fipronil, applied as REGENT 1.5G at an in furrow rate of 0.13 lbs a.i./A, had dissipation half-lives ranging from 3.4 to 7.3 months in a loam soil in San Juan Bautista, CA, a clay loam soil in York, NE, a sand soil in Clayton, NC, and a loamy sand soil in Ephrate, WA. Degradation products of fipronil detected in field soils were MB 46136, MB 45950, and RPA 200766. Fipronil residues were detected predominately in the top 0 to 15 cm soil depth at all test sites. However, there was detection of fipronil, MB 45950, MB 46136 and RPA 200766 at a depth of 15 to 45 cm for in-furrow treatments on coarse sandy loam soil in Ephrata, Washington. Although the field dissipation half-life of individual residues was not reported, the half-live of combined fipronil residues (including fipronil, MB 46136, MB 46513, MB 45950, and RPA 200766) ranged from 9 to 16 months.

Fipronil, applied at a rate of 0.05 lbs a.i/A, had dissipation half-lives of 1.1 months for bare ground on sand soil in Florida, 0.4 months for turf on a sand soil in Florida , 1.5 months for bare ground on loamy sand soil in North Carolina, and 0.5 months for turf on sandy loam soil in North Carolina. MB 46136 and RPA 200766 were detected (>2 μg/kg) in field soil samples. MB 46136 had a maximum concentration ranging from 5.6 to 8.9 μg/kg at 2-3 months post treatment. RPA 200766 was detected in bare ground samples at a maximum concentration of 3.7 μg/kg at 3 months posttreatment. Despite excess rainfall/irrigation levels, the fipronil residues remained in the upper 6 inch soil layer at each location during the 4 month testing period. Although the field dissipation half-life of individual residues was not reported, the half-live of combined fipronil residues (including fipronil, MB 46136, MB 46513, MB 45950, and RPA 200766) ranged from 2.5 to 5.33 months. EFED notes there was generally a poor fit ($R^2$=0.3 to 0.7) of the first-order degradation model to describe combined fipronil residue dissipation.

Fipronil, foliar applied as 80 WG at a rate of 0.3 lbs ai/A, had half-lives ranging from 132 to 159 days on a California cotton site, 14 to 31 days on Texas cotton site, and 193 days on Washington potato site. Fipronil residues (fipronil, MB45950, MB46136, MB46513, and RPA200766) had half-lives of 478 days for the California site, 134 days for the Texas site, and 745 days for the Washington site. Because the registrant did not provide a site water balance (total precipation & rainfall minus pan evaporation) , a leaching assessment cannot be made at this time. However, the field dissipation data indicate fipronil residues did not appear to leach below the 0.3 m soil layer. The detection of MB46136 and MB46513 indicate that photodegradation and microbial-mediated degradation are probable routes of field dissipation for foliar-applied fipronil.

The field dissipation studies (MRID 43291705 and 43401103) in conjunction with the registrant's rebuttal (MRID 44298001) provide an understanding of field dissipation of fipronil and its degradation products for in-furrow and turf uses. The field dissipation study (MRID 44262826) for cotton is deemed as supplemental because a field water balance could not be estimated. EFED is requesting pan evaporation data to assess the leaching potential for each site. Upon receipt and review of the pan evaporation data, the data will be reviewed for the leaching potential.

## ACCUMULATION

Fish Accumulation (165-4):
MRID No. 43291706, 43291707, 44298002

The bioconcentration factor (BCF) of radiolabelled fipronil, applied at a constant concentration of ≈900 ng equiv.$L^{-1}$, in bluegill sunfish was 321X in whole fish, 164X in edible tissue, and 575X in non-edible tissues. Major fipronil residues in fish tissues were identified as MB 46136, MB 45897, and MB 45950. In edible fish tissues, the maximum residue concentration was 55% of accumulated for MB 46136, 14% of accumulated for MB 45897, and 9% of accumulated for MB 45950. In inedible fish tissues, the maximum residue concentration was 59% of accumulated for MB 46136, 23% of accumulated for MB 45897, and 9% of accumulated for MB 45950. In whole fish tissues, the maximum residue concentration was 28% of accumulated for MB 46136, 24% of accumulated for MB 45897, and 9% of accumulated for MB 45950. RPA 200766 was as a minor degradate in fish tissues. Accumulated fipronil residues were eliminated (>96%) after a 14 day depuration period.

The studies MRID 43291706 and 43291707 in conjunction with rebuttal comments, MRID 44298002, satisfy the bioaccumulation in fish (165-4) data requirement. No additional data are needed at this time.