UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF
PESTICIDES AND
TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: EFED's Section 3 Registration Eligibility Decision Chapter for Fipronil Use Rice as a Pre-Plant Broadcast Treatment

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TO: Ann Sibold, PM Team Reviewer
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The Environmental Fate and Effects Division (EFED) has completed its review of potential ecological risks associated with a FIFRA Section 3 registration of fipronil as a broadcast application to rice field soils pre-plant and pre-flood. This risk assessment evaluates the potential risks to birds, fish, and aquatic invertebrates associated with the use of fipronil as a pre-plant soil treatment for rice.

The surface water residue characterization for this assessment utilizes an interim first-approximation dilution model (assuming sediment sorption only) for estimating environmental concentrations and drinking water concentrations. This model predicted the maximum concentration of fipronil in paddy water is not likely to exceed 5.32 μg/L.

This risk assessment indicates that, under the use scenario investigated, fipronil concentrations in wildlife food items are not likely to represent a high acute risk for non-endangered species. However, should endangered bird species be exposed to residues of fipronil originating from its use as a pre-plant insecticide on rice, these exposures are above the EFED level of concern for acute effects to endangered species. With the exception of predicted residues on short grass, no chronic exposure risks above (EFED) levels of concern for birds. In addition, the likelihood that maximum (95th percentile) predicted shortgrass residues will be a significant occurrence on bare ground rice fields is low and mean residues do not trigger the EFED chronic exposure effects level of concern.

In-paddy water concentrations of fipronil and degradates trigger the endangered species acute level of concern for freshwater fish and freshwater invertebrates. These excursions above the acute endangered species level of concern are limited to fipronil and MB46513 for freshwater fish. However, predicted rice paddy water concentrations of fipronil, MB46136, MB46513, and MB45950 exceed the acute toxicity thresholds established for estuarine invertebrates at levels high enough to trigger the EFED acute high risk level of concern. Predicted 21-day and 56-day average concentrations of fipronil,MB46136, MB46513, and MB45950 in rice paddy water are not sufficiently high to meet or exceed the EFED chronic exposure effects level of concern for freshwater species. However, these water concentrations for fipronil and degradates (MB46136, MB46513, and MB45950) exceed the chronic exposure effects level of concern for both estuarine fish and invertebrates.

No dilution effects in receiving water have been factored into the risk assessment for aquatic organisms. EFED believes that it is possible for paddy water releases to dominate the hydrology of some receiving waters. It is also possible that paddy water releases will result in a release of water that functions as a pulse in such systems. If dilution effects are important, it is possible that acute and chronic freshwater organims concerns are not warranted. However, dilution factors would have to exceed 1000, in order for risks to estuarine invertebrates to fall below EFED levels of concern. It should be noted that drinking water concentrations presented in this assessment consider dilution on a 1:20 basis with the model farm pond.

Fipronil

Environmental Fate and Ecological Effects

Assessment and Characterization

for a Section 3 for Broadcast Treatment of Rice Soils, Pre-Plant

EXECUTIVE SUMMARY

This risk assessment evaluates the potential risks to birds, fish, and aquatic invertebrates associated with the use of fipronil as a pre-plant soil treatment for rice. Mammalian wildlife risks were not evaluated directly, but the lower acute toxicity of fipronil to mammals versus birds suggests that equivalent exposures will result in lower risks for mammals than birds. Therefore, fipronil levels protective of birds will be correspondingly protective of mammalian wildlife.

The surface water residue characterization for this assessment utilizes an interim first-approximation dilution model (assuming sediment sorption only) for estimating environmental concentrations and drinking water concentrations. This model predicted the maximum concentration of fipronil in paddy water is not likely to exceed 5.32 μg/L. The results of this model were compared to GENEECX output showing that the interim model is more conservative. The results of the interim model were also compared with actual surface water monitoring results for California surface waters receiving rice paddy water, which suggests (to the limit of the monitored areas used in the comparison) that the paddy and drinking water predictions based on the interim model are generally over predictive of actual surface water concentrations.

This risk assessment indicates that, under the use scenario investigated, fipronil concentrations in wildlife food items are not likely to represent a high acute risk for non-endangered species. However, should endangered bird species be exposed to residues of fipronil originating from its use as a pre-plant insecticide on rice, these exposures are above the EFED level of concern for acute effects to endangered species. With the exception of predicted residues on short grass, no chronic exposure risks above Environmental Fate and Effects Division (EFED) levels of concern for birds. In addition, the likelihood that maximum (95th percentile) predicted shortgrass residues will be a significant occurrence on bare ground rice fields is low and mean residues do not trigger the EFED chronic exposure effects level of concern.

In-paddy water concentrations of fipronil and degradates trigger the endangered species acute level of concern for freshwater fish and freshwater invertebrates. These excursions above the acute endangered species level of concern are limited to fipronil and MB46513 for freshwater fish. However, predicted rice paddy water concentrations of fipronil, MB46136, MB46513, and MB45950 exceed the acute toxicity thresholds established for estuarine invertebrates at levels high enough to trigger the EFED acute high risk level of concern. Predicted 21-day and 56-day average concentrations of fipronil,MB46136, MB46513, and MB45950 in rice paddy water are not sufficiently high to meet or exceed the EFED chronic exposure effects level of concern for freshwater species. However, these water concentrations for fipronil and degradates (MB46136, MB46513, and MB45950) exceed the chronic exposure effects level of concern for both estuarine fish and invertebrates. Because the aquatic risks predicted for fipronil and degradates in this assessment are based on water paddy concentrations of the compounds, no dilution effects in receiving water have been factored into the assessment. EFED believes that it is possible for paddy water releases to dominate the hydrology of some receiving waters. It is also possible that paddy water releases will result in a release of water that functions as a pulse in such systems.

However, EFED does not have sufficient information of the hydrology of such systems to determine the duration and spacial extent of such pulses. If dilution effects are significant, it is possible that acute and chronic freshwater concerns are not warranted. However, even if dilution of paddy water was as high as a factor of 1000, risks to estuarine invertebrates would be still be above EFED levels of concern. It should be noted that drinking water concentrations presented in this assesment consider dilution on a 1:20 basis with the model farm pond

USE PROFILE

Chemical Identification

The subject chemical of this risk assessment is identified by the trade chemical name fipronil. The chemical identification number is 129121. The Chemical Abstract System number is 061662.

Type of Use

Fipronil is an insecticide.

Site of Use

The proposed use site is rice paddy soil.

Target Pest

The target pest is rice water weevil

Formulation Type

Two labeled formulations of fipronil are proposed for registration on rice as a broadcast soil treatment:

1. ICON™ 80WG: a wettable granule product composed 80% fipronil and 20% inert ingredients (Note: When mixed with water for application, the granules dissolve in-tank)

2. ICON™ 6.2 SC: a soluble concentrate composed of 56% fipronil and 44% inert ingredients.

Method, Rate, and Timing of Application

The recommended application methods for both products are ground and aerial broadcast to bare soil before rice planting. Soil incorporation of the applied material to 2 to 3 inches of the final seed bed must be performed by 48 hours after application.

TOXICOLOGICAL CHARACTERIZATION

The mechanism of toxicity of fipronil is through the gamma-amino butyric acid neurotransmission system, interfering with the chloride channel.

Toxicity to Terrestrial Animals

Tables 1, 2, and 3 summarize the available toxicity data for fipronil and its predominate environmental degradates.

Table 4 presents the toxicological thresholds for fipronil and the photodegradate MB46513. The photodegradate was selected for evaluation in the avian risk assessment because the broadcast use of fipronil may result in application to above ground wildlife food items subject to exposure to sunlight and therefore photodegradation. The selection of toxicity thresholds for this risk assessment concentrated on the subacute avian dietary and chronic exposure avian reproduction data. Because no subacute dietary or chronic exposure reproduction study were conducted for MB46513, toxicity. thresholds for these endpoints were calculated from the corresponding study for parent fipronil with bobwhite quail. The parent fipronil thresholds were multiplied by a relative sensitivity factor established by dividing the acute single oral dose LD_{50} for MB46513 in bobwhites by the acute single oral dose LD_{50} for fipronil in bobwhites.

Toxicity to Aquatic Animals

Tables 5 through 8 present the aquatic organism toxicity data for fipronil and degradates for freshwater and estuarine fish and invertebrates.

Table 9 presents the aquatic organism toxicity thresholds used in the assessment of risks to aquatic organisms. The table also presents the procedures to estimate toxicity endpoints for those degradates with no actual study information. The procedures generally involve using chronic:acute toxicity ratios relationships between freshwater organism toxicity endpoints for fipronil and a particular degradate to modify existing toxicity data for the degradate or parent fipronil. If there were insufficient data to make such comparisons, the degradate was assumed to be as toxic as parent fipronil.

EXPOSURE ASSESSMENT

Avian Exposure Assessment

For pesticides applied as a nongranular product (*e.g.*, liquid, dust), the estimated environmental concentrations (EECs) on food items following product application are compared to LC50 values to assess risk. The predicted 0-day maximum and mean residues of a pesticide that may be expected to occur on selected avian or mammalian food items immediately following a direct single application at 1 lb ai/A are in Table 10.

Table 10 also presents the estimated wildlife food item concentrations used in the avian and mammalian risk assessments. These are calculated from the residues predicted for an application at 1 lb ai/acre as modified by multiplying by the actual application rate for the subject active ingredient. It should be noted that EFED elected to use the maximum annual application rate as a worst-case assessment of exposure to terrestrial mammals and birds for fipronil. Furthermore, maximum concentrations of the photodegradate MB46513, were estimated based on a maximum recovery of the degradate as 43% of parent fipronil in photolysis tests.

AQUATIC EXPOSURE ASSESSMENT

A quantitative surface water assessment for fipronil use on rice is tentative for the following reasons: 1.) standard water models are not available for rice culture; 2.) no acceptable data are available on the aquatic metabolism of fipronil and its degradates; and 3.) interim environmental fate data for fipronil degradates have not be formally reviewed and documented Because there are no standard rice models for assessing exposure for drinking water and ecological exposure assessments. EFED utilized an interim first-approximation dilution model (assuming sediment sorption only) for estimating environmental concentrations and drinking water concentrations. The results from the dilution water model are compared with the model predictions from the beta-version of GENEECX model for a dry-seed rice cultivation scenario involving 2 inch soil incorporation and a 2-day period between treatment and flooding (Table 11). Additionally, model predictions for other rice pesticides (molinate, carbofuran, thiobencarb and methyl parathion) were compared with monitoring data from the Colusa Drain and Sacramento River (MRID 44632501). This assessment is expected to provide a relative comparison of the model predictions with actual monitoring data.

Estimated environmental concentrations for fipronil and its major degradates were estimated using the first-approximation dilution model and a beta-version of GENEECX (Table 11). Since the application rate of fipronil (0.05 lbs ai/A) are similar for the pre-plant soil incorporation and seed treatment methods, the aquatic exposure and drinking water modeling results are not expected to differ greatly from the Section 3 assessment. EFED also used a more refined method for calculating chronic pesticide concentration in the first-approximation dilution model.

In order to assess the conservativeness of model predictions in paddy waters and linked waterways, EFED conducted a preliminary comparison of modeling results and monitoring data for common rice pesticides from the Colusa Drain and Sacramento River (MRID 44632501). Based on monitoring data, the peak concentrations of molinate, thiobencarb, methyl parathion, and carbofuran were 697, 170, 6, and 13 µg/L, respectively. In all cases, except for one (thiobencarb concentrations in drinking water), the first-approximation model for the pesticide concentrations in paddy water and drinking water exceeded the monitoring data. However, the GENEECX model under predicts pesticide concentrations for molinate (peak 348 µg/L, and 56-day average 197 µg/L), thiobencarb (peak 0.038 µg/L, and 56-day average 0.0034 µg/L), and methyl parathion (peak 55 µg/L, and 56-day average 43 µg/L). However, GENEECX for carbaryl (peak 14.6µg/L, and 56-day average 4.78 µg/L) is comparable to monitoring data.

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Further analysis of the monitoring data indicates that the highest pesticide concentrations (molinate and thiobencarb) were detected from the Colousa Basin Drain at or near Highway 20 in 1982. This site is located in the upper portion of the watershed, which is close to rice production areas. However, monitoring data for the Sacramento River indicates that pesticide concentrations are approximately an order of magnitude lower (10X) than the monitoring data in the Calousa Basin Drain. Since the Sacramento River is used as source of drinking water, the monitoring data from the Sacramento River are more likely to be representative of the water quality of raw source water used for drinking water. The reason that GENEECX under-predicts the concentrations for is difficult to assess at this time but may be related to the rice agricultural management practices incorporated into the model that approximate the uses for fipronil. Based on a preliminary model analysis, the first approximation dilution model appears to be conservative in estimating pesticide concentrations in surface water receiving paddy water in linked waterways. However, in low flow streams it is possible that rice paddy water releases could dominate flow or result in pulses of contaminate. Therefore, it is reasonable to assess posible aquatic organism risks on the basis of rice paddy water without dilution. The same may not be true for drinking water.

RISK ASSESSMENT and CHARACTERIZATION

Risk Quotient (RQ) and the Levels of Concern (LOC)

Risk characterization integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. The means of this integration is called the quotient method. Risk quotients (RQs) are calculated by dividing acute and chronic exposure estimates by toxicity values.

RQ = EXPOSURE/TOXICITY

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are used by OPP to analyze potential risk to nontarget organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories: (1) acute high -- potential for acute risk is high; regulatory action may be warranted in addition to restricted use classification, (2) acute restricted use -- the potential for acute risk is high, but may be mitigated through restricted use classification, (3) acute endangered species - endangered species may be adversely affected, and (4) chronic risk - the potential for chronic risk is high, regulatory action may be warranted. Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to nontarget insects, or chronic risk from granular/bait formulations to birds or mammals.

The ecotoxicity test values (measurement endpoints) used in the acute and chronic risk quotients are derived from required studies. Examples of ecotoxicity values derived from short-term laboratory studies that assess acute effects are: (1) LC50 (fish and birds), (2) LD50 (birds and mammals), (3) EC50 (aquatic plants and aquatic invertebrates) and (4) EC25 (terrestrial plants).

Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic exposure-related effects are: (1) LOAEC (birds, fish, and aquatic invertebrates) and (2) NOAEC (birds, fish and aquatic invertebrates). For birds and mammals, the NOAEC generally is used as the ecotoxicity test value in assessing chronic exposure risks, although other values may be used when justified. Generally, the NOAEC is used as the ecotoxicity test value in assessing chronic exposure risks to fish and aquatic invertebrates.

Risk presumptions and the corresponding RQs and LOCs, are tabulated below.

Risk Presumptions for Terrestrial Animals

Risk Presumption	RQ	LOC
Birds		
Acute High Risk	EEC[1]/LC50 or LD50/sqft[2] or LD50/day[3]	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOEC	1

[1] abbreviation for Estimated Environmental Concentration (ppm) on avian/mammalian food items

[2] $\frac{\text{mg/ft}^2}{\text{LD50 * wt. of bird}}$ [3] $\frac{\text{mg of toxicant consumed/day}}{\text{LD50 * wt. of bird}}$

Risk Presumptions for Aquatic Animals

Risk Presumption	RQ	LOC
Acute High Risk	EEC[1]/LC50 or EC50*	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/MATC or NOEC	1

[1] EEC = (ppm or ppb) in water

Risk Assessment for Birds

The acute and chronic risk quotients for broadcast applications of quinclorac formulations are listed in Table 12 Under a conservative assumption of maximum annual application rates, EFED levels of concern (LOCs) are exceeded under the exposure scenarios assessed. Both fipronil and MB46513 residues predicted in short grass exceed the restricted use level of concern. Residues of both fipronil and MB46513 residues predicted in short grass, tall grass, and broadleaf forage/small insects exceed the endangered species level of concern. Only predicted maximum residues in short grass for fipronil and MB46513 exceed the chronic exposure effects level of concern.

Risk to Aquatic Animals

Table 13 presents the calculations of acute and chronic risk quotients for aquatic organisms. Only the endangered species acute level of concern for freshwater fish, freshwater invertebrates, and estuarine fish are exceeded by predicted maximum rice paddy water concentrations of fipronil or degradates. These excursions above the acute endangered species level of concern are limited to fipronil and MB46513 for freshwater fish. However, predicted rice paddy water concentrations of fipronil, MB46136, MB46513, and MB45950 exceed the acute toxicity thresholds established for estuarine invertebrates at levels high enough to trigger the EFED acute high risk level of concern.

Predicted 21-day and 56-day average concentrations of fipronil,MB46136, MB46513, and MB45950 in rice paddy water are not sufficiently high to meet or exceed the EFED chronic exposure effects level of concern for freshwater species. However, these water concentrations for fipronil and degradates (MB46136, MB46513, and MB45950) are high enough to exceed the chronic exposure effects level of concern for both estuarine fish and invertebrates.

Endangered Species

Assessment of potential risks to avian endangered species is limited by the receptor species selection process incorporated into this risk assessment. Direct application of the risk quotients calculated for avian receptors should be limited to endangered species of similar bodyweights and similar dietary habits. To this end, the calculated risk quotients suggest a potential for acute and chronic risks to endangered avian species that may (if any) utilize rice fields.

Aquatic EECs suggest the potential for release water to contain sufficient levels of fipronil and MB46513in rice paddy water to pose an acute and chronic risk to endangered species, should direct exposure to paddy water occur.

Risk Characterization

Avian Risk Characterization

Given that the application of fipronil to rice fields is intended as a bare ground application, exposure assessments based on residues on tall and short grass may be over predictive for all but instances where these types of plants may exist on field edges or margins between fields. However, risks associated with small insect residues may be appropriate, as there may occur direct application to these organisms directly in the field. Therefore, predictions that short grass residues exceed restricted use levels of concern for acute risks may be over predictive. However, exposures above the acute endangered species level of concern may be more reasonable, especially when considering the small insect residue predictions.

Chronic exposure risks predicted for fipronil residues on short grass are quite uncertain. Under chronic exposure scenarios, it may be more appropriate to consider mean residues rather than 95th percentile residue predictions. In such a case, the mean predicted time zero residues are less than half the 95th percentile residues and resultant exposures would be below levels of concern for chronic exposure effects. EFED did not quantify avian exposures over a protracted period of time for fipronil nor the photodegradate MB46513. The formation of MB46513 is expected to be roughly inversely proportional to the degradation of parent fipronil. Because both are toxic to birds, the degradation of fipronil is offset by formation of MB46513. However, because maximum residues of both fipronil (time zero) and MB46513 (some time after application) are considered in the risk assessment, toxicological additivity of these residues is not temporally realistic and no such to add risks has been made in this assessment.

Aquatic Organism Risk Assessment

Risks predicted for fipronil and degradates in this assessment are based on water paddy concentrations of the compounds. No dilution effects in receiving water have been factored into the assessment EFED believes that it is possible for paddy water releases to dominate the hydrology of some receiving waters. It is possible that paddy water releases will result in a release of water that functions as a pulse in such systems. However, EFED does not have sufficient information of the hydrology of such systems to determine the duration of spacial extent of such pulses. If dilution effects are important, it is possible that acute and chronic freshwater concerns are not warranted. If the drinking water model dilution assumption for fipronil and degradate concentrations is considered (i.e., a 1:20 dilution in a farm pond), risk to freshwater endangered aquatic species are not evident, but risks for estuarine organisms remain above levels of concern. Even if dilution of paddy water was as high as a factor of 1000, risks to estuarine invertebrates would be still be above EFED levels of concern.

Table 1. Avian Single Oral Dose Toxicity Data for Fipronil and Degradates

Species	Chemical	%A.I.	LD50 mg/kg	MRID	Classification
Northern bobwhite	fipronil	96	11.3	42918617	core
Mallard	fipronil	96.8	>2150	42918616	core
Pigeon	fipronil	97.7	>500	42918613	supplemental
Red-legged partridg	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	fipronil (1.6 WG)	1.6	1065	42918619	supplemental

Table 2. Avian Subacute Dietary Toxicity for Fipronil

Species	Chemical	%A.I.	LC50 mg/kg-diet	MRID	Classification
Northern bobwhite	fipronil	95	48	42918620	core
Mallard duck	fipronil	95	>5000	42918621	core

Table 3. 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	core

Table 4. AvianToxicity Thresholds Used in the Fipronil Rice Soil Treatment Risk Assessmen

Chemical	Sub-Acute Dietary Toxicity Threshold mg/kg-diet	Reproductive Toxicity Threshold mg/kg-diet	Acute Threshold Origin	Reproductive Threshold Origin
Fipronil	48	10	1	1
MB46513	21	4.4	2	2

1 most senssitive species tested

2 fipronil threshold multiplied by metabolite:firponil acute single oral dose toxicity ratio

Table 5. Fish Acute Toxicity for Fipronil and Degradates

Species	Chemical	%A.I.	LC50 ug/L	MRID#	Classification
Bluegill sunfish	fipronil	100	83	42918624	ore
Rainbow trout	fipronil	100	246	42977902	core
Rainbow trout	MB46136	99.2	39	42918673	supplemental
Bluegill sunfish	MB46136	99.2	25	42918674	supplemental
Bluegill sunfish	MB46513	no data	20	DPR 157298	do DER
Rainbow trout	MB46513	94.7	>100,000	43291718	supplemental
Rainbow trout	MB46513	100	>100,000	43279703	core
Sheepshead minno	fipronil	96.1	130	43291702	core

Table 6. 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	core
Sheepshead minno	fipronil	97	0.41	0.24	length,weight	44605502	core

Table 7. Aquatic Invertebrate Acute Toxicity for Fipronil and Degradates

Species	Chemical	%A.I.	EC50 ug/L	MRID	Classification
Daphnia magna	fipronil	100	190	42918625	core
Daphnia magna	RPA 10461	94.7	100,000	43291719	supplemental
Daphnia magna	MB46136	100	29	42918671	supplemental
Daphnia magna	MB46950	100	100	42918669	supplemental
Crassostrea virginic	fipronil	96.1	770	43291701	core
Mysidopsis bahia	fipronil	96.1	0.14	43279701	core

Table 8. 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
Mysidopsis bahia	fipronil	97.7	0.005	none	survival. growth, reproduction	43681201	supplemental
Daphnia magna	MB46513	no data	100	41	growth	DPR 15730	no DER
Daphnia magna	MB46136	no data	1.5	0.63	weight	DPR 15730	no DER
Daphnia magna	MB46950	no data	22	13	reproduction, growth	DPR 15730	no DER

DPR - California Department of Pesticide Regulation Study Number - Note: these studies not reviewed by EPA

Table 9. Aquatic Organism Toxicity Thresholds Used in the Fipronil Rice Soil Treatment 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	2.0	1	2
MB46513	20	1.6	1	2
MB45950	83	6.6	3	3
Freshwater Invertebrates				
Fipronil	190	9.8	1	1
MB46136	29	0.63	1	1
MB46513	190	41	3	1
MB45950	100	13	1	1
Estuarine Fish				
Fipronil	130	0.24	1	1
MB46136	39	0.07	4	5
MB46513	31	0.06	4	5
MB45950	130	0.24	3	3
Estuarine Invertebrates				
Fipronil	0.14	0.005	1	1
MB46136	0.02	0.0003	6	7
MB46513	0.14	0.005	3	3
MB45950	0.07	0.007	6	7

1 most sensitive species tested

2 most sensitive species tested acute value Xmultiplied by chronic:acute ratio of parent fipronil

3 assumed to be equivalent to parent fipronil

4 parent firponil acute value multiplied by metabolite:parent fipronil ratio for freshwater fish acute values

5 parent fipronil chronic value multiplied by metabolite:parent fipronil ratio for freshwater fish acute values

6 acute freshwater metabolite value multiplied by acute estuarine:acute freshwater ratio for parent fipronil

7 chronic freshwater for metabolite multiplied by chronic estuarine:chronic freshwater ratio for parent fipronil

Table 10. Fipronil and MB46513 Concentrations in Wildlife Food Items

Wildlife Food Item	[illegible] Percentile Nomograph-Based Food Item Concentration mg/kg/1 lb ai/acre	[illegible] Percentile Nomograph-Based Food Item Concentration mg/kg/1 lb ai/acre	Application Rate [illegible]/acre	[illegible] Percentile Predicted Food Item Concentration mg/kg	Mean Predicted Food Item Concentration mg/kg
Fipronil					
Short grass	240	85	0.05	12	4.25
Tall grass	110	36		5.5	1.8
Broadleaf/forage plants and small insects	135	45		6.75	2.25
Fruits, pods, seeds, large insects	15	7		0.75	0.35
MB46513					
Short grass	240	85	0.0215	5.16	1.8275
Tall grass	110	36		2.365	0.774
Broadleaf/forage plants and small insects	135	45		2.9025	0.9675
Fruits, pods, seeds, large insects	15	7		0.3225	0.1505

MB46513 application rate equivalent to maximum degradate at 43% of parent fipronil

Table 11: Comparison of Estimated Environmental Concentrations from First-Approximation Dilution Rice Model and Beta GENEECX Models with Monitoring Data for Sacramento Waterways

Pesticide	[illegible] Application Rate (lbs ai/A)	[illegible] Dilution Model						Beta GENEECX	
		[illegible] Paddy Water [illegible]	[illegible] Paddy Water Concentration [illegible]	Estimated[1] 21-Day Ave. Paddy Water Concentration [illegible]	Estimated[1] 56-Day Ave. Paddy Water Concentration (µg/L)	Peak Raw Drinking Water Concentration (µg/L)	[illegible] (Chronic) Raw Drinking Water Concentration (µg/L)	Peak Paddy[1] Water Concentration [illegible]	56-day Average Paddy Water Concentration (µg/L)
Fipronil	0.05	552	5.32	5.03	4.59	1.33	0.37	0.687	0.457
MB 46136	0.012	132	0.24	0.24	0.23	0.06	0.004	0.046	0.031
MB 46513	0.0215	237	1.34	1.33	1.30	0.32	0.06	0.297	0.297
MB 45950	0.0235	259	0.51	0.50	0.50	0.12	0.01	0.147	0.147
Molinate	9	99393	4457.79	3535.50	2506.39	1096.62	860.84	348	197
Thiobencarb	4	44174	342.70	313.53	271.97	84.30	20.23	55	43
Methyl Parathion	0.79	8724	109.84	61.62	30.83	27.02	9.48	0.038	0.0034
Carbofuran	0.6	6626	504	480.17	443.72	123.98	121.75	14.6	4.78

1- EFED notes that chronic concentrations were estimated using numerical interval of 1 day in the original Section 3 registration. In order to refine the chronic concentrations, a integrated equation of the first-order degradation curve was employed using the following equation: $X*(e^{(K*time)}-1)/(K/time)$

where:
X = Pesticide concentration in the paddy water
K= Aerobic Soil Metabolism Rate (days-1)
Time= Time Interval for Average Concentration

Table 12. Avian Risk Quotient Calculations for Fipronil and Degradates

Wildlife Food Item	95th Percentile Nomograph [illegible] Concentration [illegible] lb ai/acre	Nomograph [illegible]	95th Percentile Predicted Food Item Concentration mg/kg	[illegible] Acute Toxicity threshold mg/kg-diet	Reproductive Toxicity Threshold mg/kg-diet	Acute RQ	Chronic RQ
Fipronil							
Short grass	240	85	12	48	10	0.250	1.200
Tall grass	110	36	5.5			0.115	0.550
Broadleaf/forage plants and small insects	135	45	6.75			0.141	0.675
Fruits, pods, seeds, large insects	15	7	0.75			0.016	0.075
MB46513							
Short grass	240	85	5.16	21	4.4	0.246	1.173
Tall grass	110	36	2.365			0.113	0.538
Broadleaf/forage plants and small insects	135	45	2.9025			0.138	0.660
Fruits, pods, seeds, large insects	15	7	0.3225			0.015	0.073

Risk Presumption	RQ	LOC
Acute High Risk	EEC/LC50	0.5
Acute Restricted Use	EEC/LC50	0.2
Acute Endangered Species	EEC/LC50	0.1
Chronic Risk	EEC/NOEC	1

Table 13. Aquatic Organism Risk Quotient Calculations for Fipronil and Degradates

Chemical	Acute Toxicity Threshold ug/L	Chronic Toxicity Threshold ug/L	Peak Paddy Water Concentration ug/L	Acute RQ	21-day Average Paddy Water Concentration ug/L	56-day Average Paddy Water Concentration ug/L	Chronic RQ
Freshwater Fish							
Fipronil	83	6.6	5.32	0.06409639		4.59	0.70
MB46136	25	2.0	0.24	0.0096		0.23	0.12
MB46513	20	1.6	1.34	0.067		1.30	0.82
MB45950	83	6.6	0.51	0.00614458		0.50	0.08
Freshwater Invertebrates							
Fipronil	190	9.8	5.32	0.028	5.03		0.51
MB46136	29	0.63	0.24	0.00827586	0.24		0.38
MB46513	190	41	1.34	0.00705263	1.33		0.03
MB45950	100	13	0.51	0.0051	0.50		0.04
Estuarine Fish							
Fipronil	130	0.24	5.32	0.04092308		4.59	19.13
MB46136	39	0.07	0.24	0.00612923		0.23	3.18
MB46513	31	0.06	1.34	0.04277692		1.30	22.48
MB45950	130	0.24	0.51	0.00392308		0.50	2.08
Estuarine Inveterbrates							
Fipronil	0.14	0.005	5.32	38	5.03		1006.00
MB46136	0.02	0.0003	0.24	11.2315271	0.24		746.67
MB46513	0.14	0.005	1.34	9.57142857	1.33		266.00
MB45950	0.07	0.007	0.51	6.92142857	0.50		75.38

Risk Presumption	RQ	LOC
Acute High Risk	EEC1/LC50 or EC50	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/NOEC	1