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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

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MEMORANDUM

SUBJECT: Section 18- Use of Oxyfluorfen on Strawberry fields in Maine to control field pansy and wood sorrel
PC Code: 11601
DP Barcode: D248251

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A. Risk Characterization Summary

The proposed use of oxyfluorfen [Goal 2XL] on strawberries in Maine is not expected to pose adverse effects to ecological and water resources. Based on the suggested use pattern, tier 1 surface water modeling (GENEEC[1]), indicates that the estimated environmental concentrations (EECs) for use in the aquatic exposure assessment are not expected to exceed 3.04 μg/l for the peak (acute) concentration and 1.45 μg/l for the 56 day (chronic) concentration. The concentration of oxyfluorfen in shallow ground water sources, as

estimated by SCI-GROW[2] modeling, is not likely to exceed 0.012 μg/l. Since oxyfluorfen is expected to sorb on sediments and may be persistent in aquatic environments, long term exposure is possible for benthic organisms indigenous to these areas or to bottom feeders dependent upon them. No hazard is expected for most avian endangered species in Maine from the limited use of oxyfluorfen at the proposed application rate of 0.5 lb ai/acre. However, the avian risk quotient (RQ) for quail suggests a risk for endangered birds in this category.

For drinking water assessment, which is based on the highest registered use rate for oxyfluorfen (2.0 lb ai/acre), the GENEEC modeling predicts that the peak (acute) concentration of oxyfluorfen in drinking water from surface water sources is not likely to exceed 12.15 μg/l. The 56-day (chronic) concentration of oxyfluorfen in drinking water from surface water sources is predicted not likely to exceed 5.79 μg/l. SCI-GROW Modeling predicts that the concentration of oxyfluorfen in drinking water from ground water sources is not likely to exceed 0.049 μg/l.

B. Submission Purpose

The Maine Department of Agriculture, Food & Rural Resources has applied for a special exemption to use Goal herbicide (active ingredient oxyfluorfen). Goal 2XL will be used on an estimated total of 140 acres of strawberry fields in Maine to control field pansy (*Viola tricolor*) and wood sorrel (*Oxalis sp.*). Field pansy and wood sorrel lower the yields and reduce fruit quality. The maximum estimate of the total quantity of active ingredient required for the season is 70 lb ai. This estimate is based on one application of Goal at 0.50 lb ai per acre, applied by ground sprayer at post-emergence to dormant strawberry. Application should start around October 15 and conclude by December 15.

Terbacil (Sinbar), Sethoxydim (Poast), DCPA (Dacthal), Paraquat, Naprop-amide, and 2,4-D (Formula 40) are registered alternative herbicides for control of the site and pest. However, terbacil can only be used on soils with >2% organic matter content. Terbacil controls only about 50% of wood sorrel. Sethoxydim (Poast) is effective only on grasses. Sethoxydim is not effective on broadleaf weeds such as field pansy and wood sorrel. DCPA provides control of annual grasses, but is not effective for wood sorrel. Paraquat can only be used between strawberry rows for weed burndown. Napropamide, which provides pre-emergence control of annual grasses and limited control of broad-leaf weeds, does not provide control of wood sorrel. Finally, 2,4-D, which provides post-emergence control of certain broadleaf weed species, but does not control wood sorrel which germinates after the 2,4-D treatment. In addition, there are some mechanical cultivation and manual methods for control of wood sorrel and field pansy. However, these are costly and time consuming for the farmer.

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Product Information:

Product Name: Goal 2XL manufactured by Rohm and Haas; Philadelphia, PA.
Active Ingredient: Oxyfluorfen.....22%
Inert Ingredients.....78%

C. Environmental Assessment

1. Environmental Fate and Exposure Characterization

Acceptable and supplemental data indicate that oxyfluorfen is persistent in the environment (aerobic metabolism half-life = 291 to 596 days) and is moderately mobile to relatively immobile in soil (K_d = 8.5 to 228 mL/g, K_{oc} =2891 to 32381 mL/g). Oxyfluorfen is readily photodegraded when dissolved in water ($t_{1/2}$ = 2 and 7.5 days), and is moderately photodegraded on soil surfaces ($t_{1/2}$ = 28 days). Aerobic and anaerobic soil metabolism data show slow microbial mediated degradation. Soil binding and aqueous photodegradation are considered major routes of dissipation. Oxyfluorfen's high binding/sorption affinity for soils suggests that erosion on soil particles may be a principal route of dissipation in terrestrial environments.

Although oxyfluorfen accumulated in fish tissues (BCF values of 605X, 4360X, and 2200X reported for edible tissue, non-edible tissue, and whole fish, respectively), the total residues decreased by up to 91% after a 14 days post-treatment depuration period.

Estimated Environmental Concentrations:Terrestrial Vegetation

The maximum expected concentration of oxyfluorfen from a single application to a strawberry field is 120 ppm (short grasses, at 0.5 lb ai/acre).

2. Water Resource Assessment

Surface Water Assessment:

GENEEC

The GENEEC model was used to estimate surface water concentrations in aquatic environments for oxyfluorfen from the use in strawberry fields. The input values for

GENEEC are listed in Table 1. GENEEC version 1.2 dated May 3, 1995 was used for the calculations.

Table 1. GENEEC Input Parameters

MODEL INPUT VARIABLE	INPUT VALUE	SOURCE
Chemical Name	Oxyfluorfen	EFED One-liner
Solubility	0.116 ppm	EFED One-liner
Hydrolysis	stable at pH 4,7,10	MRID No. 00096882
Aqueous Photolysis	$T_{1/2}$ = 7.5 days	MRID No. 42142307
Aerobic Soil Metabolism	$T_{1/2}$ = 596 days	MRID No. 43840101
Aerobic Aquatic Metabolism	N/A	N/A
K_{oc}	2891*	MRID No. 92136112
Application Rate	0.5 lbs a.i./acre	Label (Goal 2XL EPA Reg. No. 700-243)
Number of Applications per season	1	Label (Goal 2XL EPA Reg. No. 700-243)

** The smallest K_{oc} value was used in order to produce the highest (most conservative) exposure value.*

The GENEEC modeling predicts that, for aquatic exposure assessment, the peak (acute) concentration of oxyfluorfen in surface water from the proposed use on strawberries is not likely to exceed 3.04 μg/l. The 56-day (chronic) concentration of oxyfluorfen in surface water is predicted not likely to exceed 1.45 μg/l (Table 2). These estimates are based on a total annual use rate of 0.5 lb ai/acre. The GENEEC values represent upper-bound estimates of the concentrations that might be found in surface water due to oxyfluorfen use on strawberries.

Table 2. GENEEC Concentrations For Oxyfluorfen Use on Strawberries

APPLICATION METHOD	GENEEC Peak EEC (μg/l)	GENEEC 56 Day EEC (μg/l)
Ground Spray	3.04	1.45

GENEEC is a screening model designed by the Environmental Fate and Effects Division (EFED) to estimate the concentrations found in surface water for use in ecological risk assessment. As such, it provides upper-bound values on the concentrations that might be found in ecologically sensitive environments because of the use of a pesticide. It was designed to be simple to use and to only require data which is typically available early in the pesticide registration process. GENEEC is a single event model (one runoff event), but can account for spray-drift from multiple applications. GENEEC is hardwired to represent a 10-hectare field immediately adjacent to a 1-hectare pond that is 2 meters deep with no outlet. The pond receives a spray drift event from each application plus one runoff event. The runoff event moves a maximum of 10% of the applied pesticide into the pond. This amount can be reduced due to degradation on the field and the effects of soil binding in the field. Spray drift is equal to 1% and 5% of the applied rate for ground and aerial spray application, respectively.

GENEEC is not an ideal tool for drinking water risk assessments. Drinking water from surface water sources tends to come from bodies of water that are substantially larger than a 1-hectare pond. Furthermore, GENEEC assumes that essentially the whole basin receives an application of the chemical. In virtually all cases, basins large enough to support a drinking water facility will contain a substantial fraction of area that does not receive the chemical. Furthermore, there is always at least some flow (in a river) or turn over (in a reservoir or lake) of the water so the persistence of the chemical near the drinking water facility is usually over estimated by GENEEC. Given all this, GENEEC should provide an upper bound on the concentration of pesticide that could be found in drinking water and therefore can be appropriately used in screening calculations. If a risk assessment performed using GENEEC output does not exceed the level of concern, then one can be reasonably confident that the risk will also be below the level of concern. However, since GENEEC can substantially overestimate true drinking water concentrations, it will be necessary to refine the GENEEC estimate if the level of concern is exceeded.

GROUND WATER ASSESSMENT

The ground water assessment is based on SCI-GROW modeling. The ground-water monitoring data[3] indicate that oxyfluorfen was not found in water samples taken from 188 wells between 1987-1988. SCI-GROW is a screening level model developed by Michael Barrett to estimate the maximum groundwater concentration from the use of pesticides. The input values for SCI-GROW are listed in Table 3. SCI-GROW version 1.0 dated May 22, 1997 was used for the calculations.

Table 3. SCI-GROW Input Parameters		
MODEL INPUT VARIABLE	**INPUT VALUE**	**SOURCE**
Chemical Name	Oxyfluorfen	EFED one-liner
Aerobic Soil Metabolism	$T_{1/2}$ = 596 days	MRID No. 43840101
K_{oc}	4238*	MRID No. 92136112
Application rate	0.5 lbs a.i./acre	Label (Goal 2XL EPA Reg. No. 700-243)
Number of Applications per season	1	Label (Goal 2XL EPA Reg. No. 700-243)

* *Median Value*

SCI-GROW Modeling predicts that the concentration of oxyfluorfen in shallow ground water sources for aquatic exposure assessment is not likely to exceed 0.012 μg/l (Table 4).

Table 4. SCI-GROW Concentration for Oxyfluorfen Use on Strawberries		
Application Method	**Application Rate (lbs a.i./acre)**	**SCI-GROW Acute and Chronic EEC (μg/l)**
Ground Spray	0.5	0.012

SCI-GROW is based on the fate properties of the pesticide, the application rate, and the existing body of data from small-scale groundwater monitoring studies. The model assumes that the pesticide is applied at its maximum rate in areas where the groundwater is particularly vulnerable to contamination. In most cases, a considerable portion of any use area will have ground water that is less vulnerable to contamination than the areas used to derive the SCI-GROW estimates.

3. Ecological Toxicity Data Summary

Ecological Toxicity Data

The following toxicity data has been reviewed in conjunction with registration of oxyfluorfen.

Table 5. Terrestrial and Aquatic Toxicity

Guideline	Common Name	% AI	Toxicity	EPA-ID	Category
71-2b	Mallard duck	94	LC50 > 4000 ppm	0095583	Core
71-1b	Bobwhite quail	73.2	LD50 > 5000 ppm	0096881	Suppl
71-2a	Bobwhite quail	94	LC50 390 ppm	0095583	Core
72-2a	Water flea	82.2	EC50 1500 ppb	0096881	Core
72-3f	Grass shrimp	74	LC50 31.7 ppb	0096881	Core
72-3	Fiddler crab	74	LC50 56 ppm	0096881	Suppl
72-1	Channel catfish	74	LC50 400 ppb	0096881	Core
72-1	Bluegill sunfish	95	LC50 200 ppb	0095583	Core
72-1	Rainbow trout	94	LC50 410 ppb	0095583	Core
72-3e	Eastern oyster	74	EC50 > 32 ppb	0096881	Suppl
72-2	Freshwater clam	74	EC50 9579 ppb	0096881	Suppl

Oxyfluorfen is characterized as practically non-toxic to birds on acute oral basis. It is classified as highly to very highly toxic to aquatic organisms.

Calculation of Risk Quotients

Table 6. Avian Risk Quotients (RQ)		
Toxicological Endpoint (ppm)	**Terrestrial EEC (ppm)**	**RQ**
Mallard Duck LC_{50}>4000	120	0.030
Bobwhite Quail LC_{50} 390	120	0.310

Avian risk quotients were calculated for birds on the basis of estimated residues in terrestrial vegetation and available toxicological data. No levels of concern are exceeded for high acute risk or restricted use for a single application of oxyfluorfen at an application rate of 0.5 lb ai/acre. Levels of concern are exceeded for endangered terrestrial species.

Table 7. Aquatic Risk Quotients (RQ)		
Toxicological Endpoint (ppb)	**Peak EEC (μg/L)**	**RQ**
Water flea EC_{50} 1500	3.04	0.002
Grass shrimp LC_{50} 31.7	3.04	0.096
Blue gill LC_{50} 200	3.04	0.015
Trout LC_{50} 410	3.04	0.007
Oyster EC_{50} 32	3.04	0.095

Aquatic risk quotients were calculated on the basis of the GENEEC model estimate of surface water concentrations of oxyfluorfen at an application rate of 0.5 lbs ai/acre. No levels of concern are exceeded for high acute risk or restricted use at the proposed application rate. Levels of concern are exceeded for endangered terrestrial species.

Endangered Species

Based on toxicity data and predicted environmental concentrations the Agency believes that there will be an acute hazard to avian and aquatic invertebrate species.

D. Labeling Recommendations

Present label precautions shown below do not mention that the product is toxic to freshwater organisms(fish and invertebrates). The only precautions are that it is toxic to estuarine and marine invertebrates. This statement was presumably written before chronic toxicity data on freshwater organisms was reviewed. Oxyfluorfen displays high chronic toxicity to freshwater fish and invertebrates as well, and this should be reflected in the environmental hazard statement on the Folicur label as well as any other products containing oxyfluorfen. Other portions of the hazard statement appear appropriate.

Environmental Hazards:(From present label)

This pesticide is toxic to estuarine and marine invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwater or rinsate.

REFERENCES

1- U.S. Environmental Protection Agency. 1995. *GENEEC: A Screening Model for Pesticide Environmental Exposure Assessment.* The International Symposium on Water Quality Monitoring, April 2-5 1995. American Society of Agricultural Engineers. p 485.

2- Barrett, M. Proposal For a Method to Determine Screening Concentration Estimates for Drinking Water Derived from Ground Water Studies. EFED/OPP. September 20, 1997.

3- U.S. Environmental Protection Agency. 1992. Pesticides in Ground Water Database - A Compilation of Monitoring Studies: 1971 - 1991. Office of Prevention, Pesticides, and Toxic Substances, EPA 734-12-92-001, September 1992.