7-27-93

MEMORANDUM

SUBJECT: Revised EEC and Response to DowElanco Concerns of Flumetsulam (D192816)

FROM: Anthony F. Maciorowski, Chief
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Environmental Fate and Effects Division (H7507C)

TO: Joanne Miller, PM-23
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Registration Division (H7505C)

The Ecological Effects Branch has reviewed the DowElanco rebuttal for Flumetsulam EEC and EEB response of 6/21/93. In addition, EEB has provided a plant risk assessment with the updated EEC for ground applied flumetsulam based on EFGWB models and has provided a plant risk assessment based on calculated EEC for aerial application. This action is under D192816.

1. EEB has used incorrect application rate in some of EEC calculations. The EEC models done by EFGWB, and referred to in the 6-21-93 memorandum, used the correct application rate. Upon reviewing their previous PRZM model output EFGWB noticed a decimal point error in graphs showing edge of field percentage runoff. The percentages should be increased by a factor of 10 (figures C, D, and E attached). The following EEC calculations are updated to indicate corrections in both use rate and percentage runoff.

A. Ground applied EEC from models or calculations

PRZM1-EXAMS: Corn/Soybeans on Mississippi Loring Silt Loam
EEC's were based on the dissolved concentration (ppb) reported in the graphs from the PRZM1-EXAMS model from EFGWB using runoff potential (in percent) with an annual exceedence probability[1] of 10%. Using the 10% exceedence probability is consistent with current branch policy. Maximum initial 48 hour EEC in 6 ft pond is **14 ppb** (See Fig. A). In 6 inches of water, the EEC = **169 ppb.** EEC of semi-aquatic plants in wetlands would be **0.229508 lb ai/A**[2]. Both the concentration in 6 inches and the lb ai/acre were calculated from the 14 ppb concentration.

PRZM1-EXAMS: Corn or Soybeans on Iowa Fayette Silt Loam
EEC's were based on the dissolved concentration (ppb) reported in the graphs from the PRZM1-EXAMS model from EFGWB using runoff potential (in percent) with an annual exceedence probability of 10%. Maximum initial 48 hour EEC in 6 ft pond is **5.5 ppb** (See Fig. B). In 6 inches of water, the EEC = **66.3 ppb.** EEC of semi-aquatic plants in wetlands would be **0.090164 lb ai/A.**

PRZM: Corn or Soybean on Mississippi Loring Silt Loam
Runoff of flumetsulam from soybean or corn ground application will go onto adjacent acreage. The EEC values are based on PRZM model made by EFGWB over 36 year period with an annual exceedence probability of 10%. The loss of flumetsulam in runoff at the edge of the field from a single storm is 30% of the total application (See Fig. C). The EEC for runoff affecting non-target terrestrial plants is **0.0201 lb ai/A.**

PRZM: Corn or Soybean on Iowa Fayette Silt Loam
Runoff of flumetsulam from soybean or corn ground application will go onto adjacent acreage. The EEC values are based on PRZM model made by EFGWB over 36 year period with an annual exceedence probability of 10%. The loss of flumetsulam in runoff at the edge of the field from a single storm is 21% of the total application (See Fig. D). The EEC for runoff affecting non-target terrestrial plants is **0.0141 lb ai/A.**

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[1] This is the percentage of the time that the given dissolved concentration (ppb) will be exceeded over a 36-year period.

[2] This value is greater than the actual application rate because it takes the runoff (approximately 30%, see figure c) from **10 acres** and assumes it collects in a 1-acre pond.

B. Aerial application EEC calculation:

If aerial application is labeled at 0.067 lb ai/A;

The EEC from **drift** alone would be 0.00335 lb ai/A

A ten-acre drainage basin will have runoff into one-acre pond. The aquatic pond EEC from drift and Mississippi Loring Silt Loam soil runoff would be:

0.12395 lb ai/A or
8.604 ppb in 6 ft of water or
101.2 ppb in 6 inches of water (wetlands)

A ten-acre drainage basin will have runoff into one-acre pond. The aquatic pond EEC from drift and Iowa Fayette Silt Loam soil runoff would be:

0.08777 lb ai/A or
3.504 ppb in 6 ft of water or
42.24 ppb in 6 inches of water (wetlands)

The drift and runoff as a result of aerial application will go onto adjacent acreage to affect non-target terrestrial plants from one acre to one acre. EECs for runoff and drift affecting non-target terrestrial plants near site of application are **0.012395 lb ai/A** from Mississippi Loring Silt Loam soil and **0.008777 lb ai/A** from Iowa Fayette Silt Loam soil.

C. Plant toxicity values

Aquatic plant toxicity:

Selenastrum capricornutum EC_{50}=3.31 ppb
Lemna gibba EC_{50}= 3.1 ppb

Terrestrial plant toxicity:

cucumber emergence EC_{25}= 0.00159 lb ai/A (from seedling emergence study) for runoff

From the vegetative vigor study for drift only:
onion EC_{25} =0.0004 lb ai/A for shoot weight
radish EC_{25} =0.0003 lb ai/A for shoot length and shoot weight.

D. Plant Risk Assessment

a. Aerial application

EEC calculations indicate that **non-target aquatic and semi-aquatic plants (including endangered plants) in 6 feet or 6 inches of water (wetlands) are expected to be adversely affected from runoff and drift on soils that range from Iowa Fayette Silt Loam to Mississippi Loring Silt Loam.**

b. Ground application

EFGWB EEC models indicate that **aquatic and semi-aquatic (wetland) non-target plants (including endangered plants) are expected to be adversely affected from proposed labeled use of flumetsulam on soils that range from Iowa Fayette Silt Loam to Mississippi Loring Silt Loam in a 6 ft or 6 inch deep pond.**

EEC calculations indicate that **non-target terrestrial plants are expected to be adversely affected from runoff from proposed labeled use on adjacent sites.**

c. Irrigation concerns

EFGWB has described flumetsulam in 3/2/93 review as being **persistent** in soil and water with terrestrial field dissipation $t_{1/2}$= 1.5 to 3 months on sandy loam and silt loam soils, aerobic soils metabolism $t_{1/2}$=22 to 130 days, hydrolysis= stable, and anaerobic aquatic metabolism $t_{1/2}$=183 days. In addition, flumetsulam is **mobile** in soils as a leacher. There is concern for surface or groundwater contamination in EFGWB review. EEB has concerns that contaminated surface or groundwater used for irrigation may adversely affect non-target plants. **Data from EFGWB are insufficient** to make a valid assessment at this time on phytotoxicity from irrigation of contaminated water on non-target plants.

2. Registrant has provided much analysis in trying to show that endangered species of plants will not be adversely affected from the labeled use of flumetsulam. A perception is created that tolerant species in one family should suffice for entire family and that perennial plants will not be affected. Experience has shown that there are species in one family that are more tolerant to the herbicide and other species in the same family are very susceptible to the herbicide. One example is the use of Muster herbicide in canola (*Brassica campestris*) to control wild mustard (*Brassica kaber or B. arvensis*). The only possible family that may have some considerations as to being not as adversely affected as some species in other families would the grass family (Poaceae). The monocot species (corn, onion, oats) that were used in the plant studies were affected a liitle by flumetsulam and the label indicates that grass may be tolerant of flumetsulam. Yet, we cannot be certain that the use of the herbicide will not adversely affect endangered monocot species. EBB is unable to say for certain that all the species in this family will not be susceptible to flumetsulam at the labeled rate. **EEB maintains that exposed endangered species of plants may be adversely affected from the proposed use of flumetsulam for soybean and corn.**

Registrant has requested that if data by "DowElanco are not sufficient, what sort of data would convince EPA that there is not a problem" with endangered species of plants. Because of the extreme variation between various perennials, the EEB concludes it is unlikely that phytotoxicity data can be developed to show that there will be no adverse effects to endangered perennial plant species from flumetsulam. We do know that many of the plant families have both annual and perennial plants. There are wide variations in how perennial plants can be affected since many of the species have very different life cycles from each other as well as different physiological pathways. A common denominator among perennial plants is that they come up year after year from their roots. The root system is the key as to how much the plant can withstand the repeated doses from some herbicides. An example of this is johnsongrass and yellow nutsedge. There must be a herbicide **program** (several applications over period of time) to control or kill the johnsongrass or nutsedge plant because of the root reserves of the plant. Yet, dandelion (another perennial plant) can be killed with a single application of herbicide. These are some of the reasons why EEB cannot accept the argument that perennial plants may be tolerant of flumetsulam. In addition, endangered plants may be even less tolerant of flumetsulam since some endangered plants are endangered because of their inability to adapt to very small changes of the environment or their reproductive ability has been weakened from environmental affects that may include herbicides.

3. EEB has indicated a need for additional testing of seedling emergence in order to complete the risk assessment. The Rotational Crop Sensitivity To XRD-498 was submitted by the registrant. EEB cannot fully evaluate this study unless there is raw data permitting statistical analysis and more culture details including amount of time plants are evaluated after exposure to DE-498. EEB looks forward to analyzing the raw data and detailed culture methods or a new study incorporating EEB's concerns as expressed in 6-21-93 review.

Conclusions

EEB has concluded that adjacent **non-target aquatic plants may be adversely affected by runoff from ground application of flumetsulam to soybean and corn.** The adverse effects on non-target aquatic plants may also adversely affect other aquatic organisms by food and shelter depletion.

There are insufficient data to conclude adverse effects to non-target terrestrial plants because only two species (cucumber and cabbage) were found to have EC_{25} values from the seedling emergence study. Yet, with the very limited data, it can be seen that flumetsulam **will adversely affect non-target terrestrial plants from runoff.** EEB needs data from additional testing of seedling emergence for a complete risk assessment to be done.

EEB has concluded that endangered species of plants may be adversely affected by the use of flumetsulam.

NOTE TO PM: While the current proposal does not include aerial application, RD has posed the question to EEB about the risk from such use. The EEB has concluded that aquatic, semi-aquatic (wetland), and terrestrial **non-target plants (including endangered species) will be adversely affected by aerial applications** of flumetsulam. Since the EC_{25} and EC_{50} indicate that flumetsulam is extremely toxic to non-grass plants and aerial application permits greater movement to nontarget terrestrial plants, **EEB recommends that flumetsulam not be used aerially.**

If you have any questions, please do not hesitate to contact Mike Davy at 305-7081.

EEC Calculations

PRZM1-EXAMS: Corn/Soybeans on Mississippi Loring Silt Loam
14 ppb/61 ppb per 1 lb/A in 6 feet of water= 0.229508 lb ai/A
14 ppb/61 ppb x 735 ppb= 169 ppb in 6 inches of water

PRZM1-EXAMS: Corn or Soybeans on Iowa Fayette Silt Loam
5.5 ppb/61 ppb per 1 lb/A in 6 feet of water= 0.090164 lb ai/A
5.5 ppb/61 ppb x 735 ppb= 66.3 ppb in 6 inches of water

PRZM: Corn or Soybean on Mississippi Loring Silt Loam
0.067 lb ai/A x 30% loss x 1 acre= 0.0201 lb ai/A

PRZM: Corn or Soybean on Iowa Fayette Silt Loam
0.067 lb ai/A x 21% loss x 1 acre = 0.0141 lb ai/A

Aerial application EEC calculation:

the EEC from drift alone would be 0.00335 lb ai/A (5% drift x 0.067 lb ai/A).

The aquatic pond EEC from drift and runoff in Mississippi Loring silt-loam soil would be:

(0.067 lb ai/A x 5% drift) + (0.6 efficiency x 30% runoff PRZM1-EXAMS for Loring soil EEC x 0.067 lb ai/A x 10 acre) = 0.12395 lb ai/A (wetlands)

[(0.067 lb ai/A x 5% drift) x 61 ppb] + (0.6 efficiency x 14 ppb from PRZM1-EXAMS for Loring soil EEC) =8.604 ppb in 6 ft of water

[(0.067 lb ai/A x 5% drift) x 735 ppb] + (0.6 efficiency x 169 ppb PRZM1-EXAMS for Loring soil EEC)= 101.2 ppb in 6 inches of water

Terrestrial EEC drift and runoff in Mississippi Loring Silt-loam soil for terrestrial plants:
(0.067 lb ai/A x 5% drift) + (0.6 efficiency x 30% loss from PRZM Loring [0.0201] on 1 acre)= 0.01541 lb ai/A.

The aquatic pond EEC from drift and runoff in Iowa Fayette Silt-loam soil would be:

(0.067 lb ai/A x 5% drift) + (0.6 efficiency x 21% runoff PRZM1-EXAMS for Loring soil EEC x 0.067 lb ai/A x 10 acre) = 0.08777 lb ai/A (wetlands)

[(0.067 lb ai/A x 5% drift) x 61 ppb] + (0.6 efficiency x 5.5 ppb from PRZM1-EXAMS for Loring soil EEC) =3.504 ppb in 6 ft of water

[(0.067 lb ai/A x 5% drift) x 735 ppb] + (0.6 efficiency x 66.3 ppb PRZM1-EXAMS for Loring soil EEC)= 42.24 ppb in 6 inches of water

7

Terrestrial EEC drift and runoff in Iowa Fayette Silt-loam soil for terrestrial plants:
(0.067 lb ai/A x 5% drift) + (0.6 efficiency x 21% loss from PRZM Loring [0.0141] on 1 acre)= 0.01181 lb ai/A.