Ground and Surface Water Contamination Modeling of Penoxsulam Applied to Rice (MRID 458308-11)

"Expected Environmental Concentrations of XDE-638 in Ground Water and Surface Water Using US EPA Tier I Screening Models"; Krieger M.S.; Regulatory Laboratories-Indianapolis Lab, Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, Indiana 46268; October 28, 2002.

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Conclusions:

Dow Agrosciences has submitted a non-standard study which provides supplemental data for penoxsulam. The study is a modeling effort that addresses both ground and surface water contamination from Penoxsulam applied to rice. For ground water, the registrant used SCI-GROW and generated EECs of 0.0014 and 0.0042 ug/L. For ecological effects from surface water (Table 1 in Dow document), the highest estimated concentrations for ecological effects occurred in wet-seeded rice in Louisiana on the Gulf Coast. Based on the modeling results (Table 1 in Dow document), the highest estimated concentrations for ecological effects occurred in water-seeded rice in Louisiana on the Gulf Coast. The highest peak concentration was 42.7 ug/L, which declined to 1.56 ug/L by 21 days after application, and 0.0031 ug/L by 60 days after application. For drinking water, assuming effective "holding times" between 28 and 78 days, the highest peak concentration in the Index Reservoir from all scenarios was 0.26 ug/L, and the maximum chronic (365-day average) concentration was 0.005 ug/L. This concentration occurred in the water-seeded rice grown on the Gulf Coast in Louisiana. The Dow estimates are of questionable value due to (1) the use of inappropriate values for both degradation and partitioning, (2) because the residues identified by HED as being of toxicological concern were not considered in the calculated half-life estimates, and (3) because penoxsulam application dates differ, and therefore their assumed effective "holding times" should differ, from those of the rice herbicides used as the example for Dow's exposure modeling.

Ground Water Contamination from Penoxsulam Use on Rice

Dow provided modeling of ground water using the SCI-GROW model, which they state is not relevant to applied compounds in rice fields because of relatively impermeable layers that hold a flood. This conclusion is consistent with the molinate and thiobencarb REDs, However, the registrant did calculate ground water concentrations of 0.0014 and 0.0042 ug/L assuming wet-seeded and dry-seeded rice, respectively, using the SCI-GROW model as an "extremely conservative Tier I EEC." EFED notes that the registrant used field dissipation half-lives instead of laboratory aerobic soil metabolism half-lives as an input into the model, which may be inappropriate. Even so, EFED does not regard ground water contamination from a pesticide applied to rice to be a significant route of dissipation.

Surface Water Contamination from Penoxsulam Use on Rice

For surface water, Dow used the modeling approach from the propanil RED and cyhalofop butyl Section 3 documents with some modifications. Dow noted that EFED has no official Tier II model for surface water exposure from pesticides applied to rice. While most of these modifications were reasonable and scientifically sound, the registrant used "average" aerobic soil metabolism half-lives prior to flooding instead of upper 90[th] CB values. The registrant also used "average" aquatic field dissipation half-lives instead of aerobic aquatic metabolism half-lives. The use of field dissipation half-lives is questionable because field studies are not generally conducted under the same rigorous conditions, with good material balances verified, as required for acceptable laboratory studies. The registrant justified the use of field dissipation half-lives because penoxsulam degrades by both abiotic and biotic processes, and aquatic field dissipation rates they incorporate the results of many dissipation processes.

Ecological Effects Concentrations

Based on the modeling results (Table 1 in Dow document), the highest estimated concentrations for ecological effects occurred in water-seeded rice in Louisiana on the Gulf Coast. Without imposing mandatory holding times, the highest peak concentration was 42.7 ug/L, which declined to 1.56 ug/L by 21 days after application, and 0.0031 ug/L by 60 days after application.

Estimated Drinking Water Concentrations from Surface Water

For drinking water, assuming effective "holding times" between 28 and 78 days, the highest peak concentration in the Index Reservoir from all scenarios was 0.26 ug/L, and the maximum chronic (365-day average) concentration was 0.005 ug/L. This concentration occurred in the water-seeded rice grown on the Gulf Coast in Louisiana. Assumed effective "holding time" values were adopted directly from the exposure modeling EFED had conducted for the rice herbicides propanil and cyhalofop-butyl. The Dow estimates are of questionable value due to (1) the use of inappropriate values for both degradation and partitioning, (2) because the residues identified by HED as being of toxicological concern were not considered in the calculated half-life estimates, and (3) because penoxsulam application dates differ, and therefore their assumed effective "holding times" should differ, from those of the rice herbicides used as an example for Dow's exposure modeling.

For drinking water derived from surface water, Dow drained all the fields at once into the Index Reservoir and calculated peak and annual mean values for acute and chronic exposure. The peak concentration leaving the fields was divided by two (2) because the volume of water from the rice paddies and the volume of the Index Reservoir were very similar. The chronic exposure was determined by degrading the peak concentrations from California (continuous flood rice), the Mississippi Delta (dry-seeded rice), and South Louisiana (pinpoint flood or delayed flood rice) for one year to get an annual mean concentration for each location.

Ground and Surface Water Modeling Inputs

- Application Rate–0.045 lb ai/acre
- No. Apps–1

2

- Koc (l/kg)–90
- $T_{1/2}$ (for water-seeded rice)–6.5 days (average total system half-life from water-seeded aquatic field dissipation studies)
- $T^{1/2}$ (for dry-seeded rice)–14.6 days (average total system half-life from dry-seeded aquatic field dissipation studies)

Appendix I EFED Modeling Approaches

Interim Rice Model

EFED has used different modeling approaches for rice tailwater runoff to date. The first appproach, known as the Interim Rice Model, includes only sorption as a dissipation process. It provides a conservative Tier I estimate of the concentration of an applied pesticide in surface water with the following assumptions:

- Sorption is the only dissipation process the model considers
- 100 % of perfectly-normal application is applied to flooded field, reaches the flood water, and instantaneously partitions between water and soil
- No degradation, drift, volatility, foliar interception, runoff, or leaching occurs in the field
- The field is drained the day of application

Refined Modeling used for Propanil RED

Dry-seeded Rice

EFED modeled the dissipation of propanil in the field by incorporating both degradation (aerobic soil and aerobic aquatic metabolism) and partitioning between water and soil. For dry-seeded rice, the refined modeling used for propanil estimates the concentration in paddy water 10 days after the day of application to a non-flooded field. Most of the rice grown in the U.S. is produced using this cultural practice, and is primarily located in the lower Mississippi River Delta and in southeastern Texas. This modeling approach provides a maximum concentration in paddy water, after an effective "holding time" incorporated into the calculations in order to estimate the time required for paddy tail water to reach drinking water intakes. It also predicts concentrations for ecological effects to organisms living at the edge of the rice paddy. Required water-holding times to reduce aquatic exposure below a given level of concern can be estimated. The assumptions for dry-seeded rice and application to non-flooded soil include:

- 100 % of application reaches the soil and instantaneously sorbs
- Degradation occurs by aerobic soil metabolism (average $T_{1/2}$=46 days for propanil) for non-flooded fields
- Degradation occurs by aquatic field dissipation (average $T_{1/2}$=4.4 days for propanil) for flooded fields.
- No drift, volatility, foliar interception, runoff, or leaching occurs
- Flooding over the entire field is instantaneous
- The field is flooded 10 days after the day of application, followed by immediate partitioning between soil and water.
- No outflow or overflow from the fields occurs after flooding.
- For ecological effects, the concentration of paddy water was used as exposure to aquatic

organisms

- For drinking water, the paddy water was drained to the Index Reservoir, diluted, and then degraded using the aerobic aquatic metabolism rate

Water-Seeded Rice

Water-seeded rice is grown in southwestern Louisiana and in California. The primary method of water-seeded rice production in Louisiana that uses propanil is called "delayed flood rice." The pregerminated seeds are dropped into standing water, which is drained 1-2 days later. A permanent flood is established about 3-4 weeks after planting and is held for about 10 weeks in the first crop. The modeling assumes that the compound is applied before the permanent flood, and that the water is held until 28 days after herbicide application when drainage is necessary due to a rainfall event causing overflow. California uses the "permanent flood" method of producing rice. Pregerminated seeds are dropped into standing water where a flow of aerobic water is established, but is NOT normally drained totally until a postemergence herbicide is applied about 30 days later. After treatment with a herbicide, a 4-inch flood is reestablished and later increased to 8 inches of depth in Mid-July to ensure proper seed formation. It is drained about 2-3 weeks prior to harvest. The maximum surface water concentration is that achieved on the day of application, and the later concentrations are predicted for drinking water assuming California agricultural waters are held within a water management district for up to 78 days after propanil application. The aerobic aquatic metabolism rate is used to degrade the pesticide. The modeling assumptions used in the propanil modeling follow:

- 100 % of perfectly-normal application reaches flooded soil and instantaneously partitions between the soil and floodwater
- Degradation occurs by aquatic field dissipation half-life of 4.4 days for propanil
- No drift, volatility, foliar interception, runoff, or leaching occurs
- Flooding over the entire field is instantaneous
- The flood water is released 28 days later for southern Louisiana and 78 days in California.
- No outflow or overflow from the fields occurs after flooding prior to release.
- For ecological effects, the concentration of paddy water was used as exposure to aquatic organisms
- For drinking water, the paddy water was drained to the Index Reservoir, diluted, and then degraded using aerobic aquatic metabolism