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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

SEP 9 1994

MEMORANDUM

SUBJECT: EFED Recommendations and Mitigation Measures for Ethion
(Chemical # 58401) Case # 0090

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Background

Use Profile

Ethion is marketed by FMC Corporation as Ethion 4 Miscible insecticide-miticicide concentrate which contains 46.5 percent of active ingredient. The product is registered for use on citrus crops including grapefruit, lemons, limes, oranges, tangelos, and tangerines. Application methods include aerial and ground application as a foliar spray.

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Levels of Concern Exceedances

Ethion is an organophosphate cholinesterase inhibitor which has been shown to be highly to moderately toxic to mammals and birds on an oral basis, slightly toxic to birds on a dietary basis, chronically toxic to mallard duck reproductive success, very highly toxic to all freshwater and estuarine invertebrate and fish species tested to date, and highly toxic to bees exposed directly to residues during application. Additional evidence suggests that ethion may display phytotoxic characteristics as well.

Risk Reduction Measures

Ethion is very highly toxic to aquatic organisms and is applied by aerial and airblast ground sprayer application.

Ethion is not susceptible to hydrolysis under acidic or neutral conditions, is not significantly susceptible to direct photolysis in water, is somewhat persistent in soils, and can contaminate surface water through erosion and spray drift from aerial and blast orchard applications. However, no drinking water MCLs or HAs have been established for ethion or its major toxicologically significant degradate (ethion monoxon), and its relatively high soil/water partition coefficient (a K_{oc} of 8900 is listed in the USDA, Soil Conservation Service database) suggests that the standard primary treatment methodologies employed by almost all surface water source water supply systems would be effective in removing ethion. Consequently, EFED is not currently recommending any monitoring of surface water source drinking water supplies for ethion.

The following are some generic recommendations for spray drift reduction:

The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (See Wind, Temperature and Humidity, and Temperature Inversions).

CONTROLLING DROPLET SIZE

- o Volume - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- o Pressure - Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- o Number of nozzles - Use the minimum number of nozzles that provide uniform coverage.
- o Nozzle Orientation - Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is the recommended practice.

- o Nozzle Type - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.
- o Boom length - For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

APPLICATION HEIGHT

Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

SWATH ADJUSTMENT

When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase, with increasing drift potential (higher wind, smaller drops, etc.).

WIND

Drift potential is lowest between wind speeds of 3 - 10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given speed. Application should be avoided below 3 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

TEMPERATURE AND HUMIDITY

When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

TEMPERATURE INVERSIONS

Applications must not occur during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the

movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

SENSITIVE AREAS

The pesticide should only be applied when the wind is blowing away from adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops).

EFED has reported high Levels of Concern for acute effects to aquatic invertebrates and fish. Reported whole fish bioconcentration factors for ethion in bluegills exceed 1000X. Although a high sediment to water partitioning may substantially limit the bioavailability of ethion to fish and aquatic invertebrates, the relatively high LOCs for aquatic invertebrates coupled with the potential of ethion to accumulate from year to year in alkaline aquatic systems probably justify the inclusion of a surface water advisory on the label. EFED recommends the following wording for the surface water advisory:

Ethion can contaminate surface water through spray drift. Under some conditions, ethion may also have a high potential for runoff into surface water (primarily via adsorption to eroding soil), for several months post-application. These include poorly draining or wet soils with readily visible slopes toward adjacent surface waters, frequently flooded areas, areas over-laying extremely shallow ground water, areas with in-field canals or ditches that drain to surface water, areas not separated from adjacent surface waters with vegetated filter strips, and highly erodible soils cultivated using poor agricultural practices such as conventional tillage and down the slope plowing.

The previous risk reduction measures provide generic mitigation guidance, however, early entry data from the Spray Drift Task Force is in-house and has received preliminary review. EFED is prepared to develop more specific mitigation measures if we could receive the standard application scenario for the application of ethion to citrus trees. It has been recommended that this information could be gathered from the registrant and from Doug Sutherland in BEAD for his past experience on citrus. This risk mitigation measures that may result from this information may reduce the risk to nontarget organisms below the LOC.

Value of the Additional Information

Environmental Fate: Although the data submitted thus far suggest that ethion is not mobile in soil, an acceptable Adsorption/Desorption study (163-1) is needed in order to provide confirmatory information. Accurate K_d values for ethion and its toxicologically significant degradate, ethion monoxon, are needed in order to accurately determine their mobility in soil. K_d 's are also used in modeling.

In addition to the acceptable citrus field dissipation study reviewed in this package, a bare

ground field dissipation study (164-1) is also needed in order to provide a better understanding of the dissipation patterns of ethion and its degradates in soil under field conditions. Because soil concentrations of ethion in a bare ground study should be less variable than they were in the citrus study (a bare ground study does not include the complications introduced by the foliar application to a dense canopy), a bare ground study will provide a clearer understanding of the fate of ethion in soil.

Because ethion is very highly toxic to aquatic organisms and is applied both aerially and by airblast, the Spray Drift requirements (201-1 and 202-1) were imposed in order to assess the extent of nearby bodies of water to ethion. These studies are held in reserve pending the work currently being conducted by industry's Spray Drift Task Force.

Ecological Effects: The Ecological Effects Branch has completed review of all ecological effects data submitted to date by FMC Corporation and Chemminova in support of reregistration of ethion insecticide products for use on citrus crops in Florida and Texas only.

Although the majority of the data requirements for ethion have been fulfilled, there are several remain unsatisfied. These data are necessary before a complete assessment of risk to nontarget organisms can be completed. Please refer to the data table below indicating the present ecological effect data gaps for ethion.

GDLN NO.	TYPE OF TEST	MRID OR ID. NO.	REPLACEMENT VALUE
71-4	Avian Reproduction (bobwhite quail)	421137-06 - Invalid - unacceptable control mortality.	HIGH: In order to assess risk to upland game birds an acceptable study with the bobwhite quail is needed.
72-2b	Freshwater invertebrate acute (TEP)		HIGH: TEP testing is required when the TGAI is very highly toxic to aquatic invertebrates.
72-4b	Freshwater invertebrate lifecycle	426393-01 - Invalid - number of offspring in control too low	HIGH: Chronic testing required when acute LC ₅₀ values are < 1 mg/L. Also, ethion is stable to hydrolysis.
72-5	Full fish life cycle		HIGH: EEC ≥ 1/10 NOEL for tested fish species.
122-1	Tier I Seed germination		HIGH: Tier I -- Label indications of phytotoxicity and previous aquatic plant studies indicate phytotoxic effects. Tier II -- reserved pending results of Tier I testing.
122-1	Tier I Seedling emergence		
122-1	Tier I Vegetative vigor		
122-2	Tier I Aquatic plant growth		
123-1 & 123-2	Tier II Plant studies reserved pending results of Tier I testing.		

A low replacement value is assigned when there is a low probability that a new test will effectively challenge/change significantly previous assumptions, previously-determined levels of risk and/or decrease the overall level of uncertainty of adverse effects when other, core, scientifically sound and similar type of tests to the one under

consideration are in the data base.

A **medium replacement value** is given to a test when the new results have some probability of altering previous assumptions or levels of risk and/or because it is likely to have a higher value in completing a toxicological data base that would otherwise be somehow incomplete for this type of test and, therefore, vulnerable to sound scientific challenge.

A **high replacement value** is given to a test when without a new test it would be impossible and scientifically incorrect to make assumptions and a determination of the level of risk involved. Furthermore, without a replacement test the level of uncertainty will remain high and the ecotoxicological data base will be incomplete and totally vulnerable to scientific challenge.

Labeling Requirements for Manufacturing-Use Products

The following label statement is required on all manufacturing-use products:

This product is extremely toxic to fish and aquatic invertebrates.
This product is toxic to bees. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or public water unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

Labeling Requirements for End-Use Products

The following label statement is required on all end-use products:

"This pesticide is extremely toxic to fish, and aquatic invertebrates. Fish and aquatic invertebrates may be killed in areas where this pesticide is used. Do not contaminate water when disposing of equipment washwaters.

This product is toxic to bees and should not be applied when bees are actively visiting the area.

Do not allow this material to drift onto neighboring crops or noncrop areas or use in a manner or at a time other than in accordance with label directions because animal, plant or crop injury, illegal residues or other undesirable results may occur."

Adequacy of Labeling:

The present label statement should be revised to include reference to acute and chronic toxicity to birds. The present environmental hazard statement does not reference possible hazard to birds from ingestion of concentrated residues or chronic effects to exposed nesting birds. Labeling should be revised to reflect these points as stated below:

"This chemical is highly toxic birds on an oral basis. Avoid exposure of birds to

foliar spray mix containing ethion. "

Regarding chronic avian exposure the label should state:

"The product is chronically toxic to birds exposed to treated food sources. Avoid exposure to bird nesting areas during application as reproduction effects may occur."

The label statement regarding aquatic toxicity should be revised to include estuarine organisms by stating:

"This pesticide is very highly toxic to freshwater and marine/estuarine, fish and aquatic invertebrates including shrimp and oyster. Do not apply in a manner which will directly expose canals, lakes, streams, ponds, marshes or estuaries to aerial drift. Do not contaminate water when disposing of equipment washwaters."

Labeling for Endangered Species

No use limitations to protect endangered species will be suggested until the OPP Endangered Species Protection Program is complete.