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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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MEMORANDUM:

SUBJECT: Ethion- RED Team Review and Concurrence.

TO: Mark Hartman, Review Manager
Reregistration Branch II
Special Review and Reregistration Division (7508W)

FROM: Sid Abel, Environmental Scientist
Environmental Risk Branch IV
Environmental Fate & Effects Division

Dana S. Spatz, Chemist
Environmental Risk Branch IV
Environmental Fate & Effects Division

NOV 13 1997

11/17/97

THROUGH: Mah Shamim, Chief
Environmental Risk Branch IV
Environmental Fate and Effects Division (7507C)

This memo contains EFED's comments on the August 22, 1997 RED Team Review and Concurrence Copy of the Ethion RED. In addition to the suggested minor changes, we have expanded the Water Resource Assessment section to include monitoring data and we've completed a Drinking Water Exposure Assessment. Also, we have addressed FMC's comments made in the risk mitigation meeting on October 29, 1997.

A. **Suggested Changes to the August 22, 1997 Draft RED:**

Page I- **Remove** Elizabeth Resek's name.
Brian Montague is in Environmental Risk Branch I
Dana Spatz is in Environmental Risk Branch IV
Add Sid Abel, Environmental Risk Branch IV

Page 48- **2nd to last line after sentence ending with season, add the following**...
According to USDA data, (Montgomery, John H., 1993. Agrochemicals Desk Reference: Environmental Data. Lewis Publishers, Michigan) K_d's of 167, 215, 105, and 47 for sand, sandy loam, and two silty loams were determined, respectively.

Page 49- **Replace 1st paragraph with the following**...

Although it is not likely that Ethion will contaminate surface water by way of dissolved runoff, movement into surface water may occur through erosion and/or spray drift. Because of turf ground cover, erosion is not typically expected to be significant in an orchard environment, the primary use site of Ethion. However, studies conducted on citrus groves in Florida indicated significant offsite movement of suspended material (sediments and organic material) during significant storm events during peak application periods. Additionally, spray drift from airblast application can impact nearby bodies of water and canals. These issues might be important since concerns have been raised about Ethion's toxicity to aquatic organisms and because Ethion bioaccumulates in fish tissue.

1. Environmental Fate, line 3, after (201-1 and 202-1), add: FMC Corporation is a member of the Spray Drift Task Force, which has submitted data that is currently undergoing Agency review.

Page 56- **(14) Droplet size spectrum (201-1), line 2, remove**: both aerially and

The last sentence should read: These studies are being held in reserve pending Agency review of the data submitted by industry's Spray Drift Task Force, of which FMC Corporation is a member.

(15) Drift Field Evaluation (202-1), line 2, remove: both aerially and

(2)

The last sentence should read: These studies are being held in reserve pending " Agency review of the data submitted by industry's Spray Drift Task Force, of which FMC Corporation is a member.

Page 57 **Replace paragraph beginning with "Although" with the following**:

Although it is not likely that Ethion will contaminate surface water by way of dissolved runoff, movement into surface water may occur through erosion and/or spray drift. Because of turf ground cover, erosion is not typically expected to be significant in an orchard environment, the primary use site of Ethion. However, studies conducted on citrus groves in Florida indicated significant offsite movement of suspended material (sediments and organic material) during significant storm events during peak application periods. Additionally, spray drift from airblast application can impact nearby bodies of water and canals. These issues might be important since concerns have been raised about Ethion's toxicity to aquatic organisms and because Ethion bioaccumulates in fish tissue.

Page 60 **Insert the following text before 2. Ecological Effects....**

2. Water Resource Assessment

I. *Ground Water Assessment*

Ethion appears to have a low potential to contaminate shallow groundwater according to an aged mobility study which indicated that more than 85 percent of the applied radioactivity remained in the top inch of soil and less than 4 percent was found in the leachate. Additionally, measured Koc values ranged from 3534 for a silty loam soil to greater than 22000 for a sand soil (Montgomery, John H., 1993. Agrochemicals Desk Reference: Environmental Data. Lewis Publishers, Michigan). Ground water monitoring studies conducted during the mid 1980's failed to identify ethion at concentration above the level of detection (EPA, 1992. Pesticides in Ground Water Database, A Compilation of Monitoring Studies: 1971-1991, National Survey. Office of Pesticide Programs). Later studies conducted and reported to the Office of Water's STORET system did not report finding ethion above the LOD in more than 1000 samples collected. LODs ranged from 0.01ppb to 0.4 ppb and were closely related to the age of the study with the older results having higher reported LODs. The frequency of reported results from ground water monitoring studies has declined steadily since 1986.

Combining the results of validated laboratory fate studies, measured partition coefficients, and ground water monitoring studies, neither a ground water advisory statement nor a small-scale prospective monitoring study is recommended at this time. Additionally, the decline in the frequency of ground water monitoring programs with concurrent improvement in the LODs and LOQs of ethion suggest that ethion has become a lower "contaminant of concern" in ground water relative to other pesticides.

(3)

II. Surface Water Assessment

Ethion may contaminate surface waters at application by both runoff on suspended materials and through spray drift. Substantial fractions of applied ethion may be transported offsite for a substantial period of time after application (aerobic soil half life of 101 days; stable to photolysis; stable to hydrolysis at pH 5 and 7 and $T_{1/2}$ of 18 days at pH 9). The reported Koc's (3534 to 22149) suggests that runoff will occur via adsorption to soils rather than by dissolution.

With the exception of alkaline waters (pH ~9), ethion is expected to be relatively persistent, although, not in the water column due to its high partition coefficients. Once in sediments, ethion is not likely to degrade substantially (an extrapolated anaerobic soil metabolism half-life of 167 days) with concentrations and toxicity driven by mass sediment load transport and burial. The behavior of ethion's toxicologically significant degradate, ethion monoxon, is largely unknown at this time.

Offsite transport to surface waters via spray drift is expected to occur in its major use area, Florida and to lesser degree in other areas. Due to the proximity of citrus groves to surface water sources (in many instances, up to the edge of surface water features), indeed just the general environment of the Florida peninsula, exacerbates the likelihood of spray drift contaminating surface waters in the state.

Surface water monitoring results reported to the STORET system over the past 18 years indicate that ethion is contaminating surface water of the U.S., especially in the high use areas in Florida. A review of STORET system on the occurrence of ethion in surface water features indicated more than 30,000 samples have been collected in the past 18 years. With the exception of samples collected during the late 1970's and early 1980's, when analytical techniques were not available to measure at sub-ppb levels, no water column samples exceeded 1 ppb.

An ongoing surface water monitoring study being conducted by the Florida Department of Environmental Protection (FDEP) in the Ten Mile Creek and North Fork of the St. Lucie River[1] basin provides one of the most extensive characterizations of surface water concentrations of ethion within its known use areas. Much of the data collected during this study (1993 to present) has been reported to the STORET system. Water column and sediment samples collected over the period indicate that ethion rapidly partitioned to the sediments with concentrations exceeding 100 times those in the water column at various times during maximum use periods.

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[1]Graves, G.A. and D.G. Strom, 1995. Pesticide Contamination in Ten Mile Creek. Major Tributary to the Outstanding Florida Waters of the North Fork of the St. Lucie River. Florida Department of Environmental Protection, Southeast District Ambient Water Quality Section, Port St. Lucie. 1995. and Personal communications between Gregory Graves and Douglas Strom (study leads) for the Florida Department of Environmental Protection and Sid Abel of the U.S. Environmental Protection Agency, November, 4, 1997.

St. Lucie county, where much of the sampling occurred, ranks first amongst Florida counties in citrus production, with grapefruit being the dominant citrus crop, a large portion, of which occurs in the Ten Mile Creek drainage basin. The Ten Mile Creek drainage basin has been highly modified with an extensive system of canals where citrus groves are often planted up to the edge of these features. Additionally, ethion is extensively used during the period of the year when precipitation is at its maximum often resulting in frequent applications of ethion or substitute pesticides. Considering the geomorphological features and agricultural practices of the area, concentrations of ethion in surface waters in this region should be the highest encountered in the U.S. Additionally, the extent to which ethion has and is being used in the area further supports this conclusion.

Measured water column concentrations of ethion during the use window (approximately April thru August) ranged from <0.1 to 0.77 ppb, with samples often reported as below the LOD of 0.048-0.049 ppb. The sample-to-ethion use interval was rarely more than one month and often within a week or two. Results of sampling conducted outside the use window were below 0.08 ppb (which is below the known LOQ) and more often less than the LOD.

Measured sediment concentrations (the ultimate sink for ethion) were considerably higher than those found in the water column. Concentrations ranged from <6 µg/kg to >80 µg/kg during the use window. Sediment concentrations were found to be similar in the terminal reach indicating substantial mass sediment transport in the study streams and the persistence of ethion.

III. Drinking Water Exposure Assessment

Source water drinking water concentrations of ethion were estimated using the Pesticide Root Zone Model (PRZM2.3) and the Exposure Analysis Modeling System (Exams 2.94). Citrus grown in Florida was selected as the modeled crop and location due to the extent to which ethion is used on these crops and in Florida. Additionally, potential to contaminate surface and ground waters because of the agriculture practices and the meteorological conditions should provide a "high end" exposure scenario. The following data were used as inputs to the model.

Parameter	Value	Source
Molecular Weight	348.46	EFED One-Liner August 1997
Vapor Pressure	1.5E-06	EFED One-Liner August 1997
Henry's Law Constant	3.8E-07	EFED One-Liner August 1997
Solubility	2 mg/L	EFED One-Liner August 1997
K_{oc}	22149 ml/g	Agrochemicals Desk Reference, 1993
Hydrolysis Half-Life	17.8 days @ pH 9	EFED One-Liner August 1997
Aerobic Soil Metabolism	101 days	EFED One-Liner August 1997
Anaerobic Soil Metabolism	167 days	EFED One-Liner August 1997

Table 1 provides the estimated EECs for ethion according to the registrants memo dated July 26, 1995 in which FMC proposes risk mitigation by modifying applications rates to 2.5 lbs per acre, application number to twice per year, and increasing the application interval to 90 days.

Table 1. Concentrations of Ethion in Surface Water (µg/L)

Crop	Maximum	96 Hour	21 Day	60 Day	90 Day	Mean
Citrus	25	15	9.8	9.2	8.7	6.6

The recommended estimated concentration for acute risk assessments is 25 µg/L (maximum concentration) and for long-term chronic assessments 6.6 µg/L (mean). However, EFED recommends that for the long-term drinking water risk assessment (e.g., cancer risks) the monitoring data generated in the Ten Mile Creek study be used, in part, because it represents quality data and a high, if not maximum, exposure scenario. Extensive long-term monitoring suggests that under high exposure scenarios, concentrations do not approach those estimated by PRZM-EXAMS. The recommended surface water concentration for chronic exposures is 1.0 µg/L which represents a rounding of the maximum concentration observed in the Ten Mile Creek study of 0.77 µg/L in the pelagic whole water phase.

Finally, beyond the concentrations in drinking water source water, the relatively high soil/water partitioning coefficient (K_{oc} up to 22149) of ethion suggests that it will be effectively removed in most surface water source drinking water treatment utilities through primary settling and flocculation/coagulation followed by settling. Thereby, resulting in concentrations of ethion that may reach the consumer tap being considerably less than those estimated by PRZM-EXAMS or observed in the monitoring studies reviewed.

IV. Aquatic Exposure Assessment

Estimated Environmental Concentrations (EECs) in the aquatic environment using PRZM-EXAMS are presented in Table 1. The PRZM model simulates pesticide field runoff on daily time steps, incorporating runoff, infiltration, erosion, and evaporation. The model calculates foliar dissipation and runoff, plant uptake, microbial transformation, volatilization, and soil dispersion and retardation. The EXAMS system simulates pesticide fate and transport in an aquatic environment.

Environmental fate studies indicate that ethion will be persistent in the environment and tend to sorb to sediments and soils. Monitoring studies conducted over the past 18 years supports this phenomenon. Concentrations in sediments may pose a greater risk to aquatic

organisms because of the propensity of ethion to sorb to sediments. Concentrations reported to STORET and in the Ten Mile Creek study range from less than 1 µg/kg to greater than 80 µg/kg.

Page 92 **remove shaded text**

Page 93 **last sentence should read**: The mobility of its toxicologically significant degradate, ethion monoxon, is unknown.

Page 95 **b. Spray Drift Advisory, here is the updated boilerplate**...

Droplet size spectrum (201-1) and drift field evaluation (202-1) studies were required since ethion is applied by airblast and poses a potential risk to nontarget aquatic organisms. However, the registrant is part of the Spray Drift Task Force (SDTF), which has submitted to the Agency its series of studies which are intended to characterize spray droplet drift potential. After its review of the new studies the Agency will determine whether a reassessment of the potential risks to nontarget organisms from the application of ethion is warranted.

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Labeling Recommendations

EFED recommends that the labels for all ethion products carry the following:

Label statement to minimize the potential for surface water contamination:

> This chemical can contaminate surface water through spray drift. Under some conditions, it may also have a high potential for runoff into surface water for several days to weeks after application. These include poorly draining or wet soils with readily visible slopes toward adjacent surface waters, frequently flooded areas, areas overlaying 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 areas over-laying tile drainage systems that drain to surface water.

Label statements for toxicity to nontarget organisms:

> Manufacturing Use Products
>
> This pesticide is toxic to fish and wildlife. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying

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the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

End Use Products
This pesticide is toxic to fish and wildlife. Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high-water mark. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwater or rinsate.

Remove the sentence beginning with "Do not apply by ground equipment" and replace with the following:

Do not apply within 25 feet of bodies of water such as lakes, reservoirs, rivers, permanent streams, natural ponds, marshes or estuaries.

For all plantings within 100 feet of bodies of water as described above, spray trees only from outside the planting away from the bodies of water, shutting off nozzles on the side away from the grove.

Shut off the sprayer when turning at row ends.

Remove the paragraph beginning with "Spray the outside three rows..."

.Issues Raised by FMC Corporation in the Oct. 29, 1997 Risk Mitigation Meeting:

I. One of the outstanding environmental fate data requirements is Soil Field Dissipation [164-1]. In addition to the acceptable citrus field dissipation study, a bare ground field dissipation study is required in order to provide a better understanding of the dissipation patterns of ethion and its degradates in soil under field conditions. In the meeting, FMC asked if the 1985 bare ground study conducted in Princeton, New Jersey would satisfy this data requirement.

EFED has reevaluated this study, which was originally deemed "supplemental," and has confirmed that the study cannot be used to fulfill the data requirement because of several serious flaws, which include:

a. Day 0 recovery was only 61% of applied.

b. Between the first and second samplings, (0 and 7 days), the concentration of ethion in the soil unexpectedly decreased by 76%.

c. High variability between duplicate samples affecting half-life, e.g., day 14 sample 1 was 0.04 ppm while sample 2 was 0.58 ppm.

d. No meteorological data were provided.

II. FMC questioned the 48 hr. EC_{50} value [Johnson, et. al.(1980) MRID#: 00003503] for the daphnia magna since it was significantly lower than the next most sensitive freshwater invertebrate. However, FMC has not submitted a new study nor have they provided any data to rebut the Johnson, et.al. study.