3-22-91

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

EFGWB No.: 90-0695, 91-0155, 91-0156, 91-0302
Case No.: 2405
Chemical No.: 068103
DP Barcode No.: D158277, 158218, 159795

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: Review of Phase IV Package for Methyl Isothiocyanate

FROM: Dana S. Spatz, Chemist
Chemistry Review Section #2
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Environmental Fate and Effects Division (H7507C)

THRU: Henry Jacoby, Chief
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and

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Chemistry Review Section #2
Environmental Fate and Ground Water Branch
Environmental Fate and Effects Division (H7507C)

MAR 22 1991

TO: Amy Rispin, Chief
Science Analysis and Coordination Staff
Environmental Fate and Effects Division (H7507C)

Methyl Isothiocyanate (MITC) is a phytotoxic soil fumigant/wood preservative used for the control of fungi, insects, nematodes, and weed seeds. MITC has a melting point of 35°C, a boiling point of 119°C and a density of 1.069 g/ml at 37.2°C. MITC is readily soluble in most commonly used organic solvents and soluble in water (8.6 g/L at 25°C). The octanol/water partition coefficient (log P) is 1.023 at 25°C. MITC is a volatile compound with a vapor pressure of 15.97 mm Hg at 25°C.

A Ground Water Data Call-In for MITC was issued in 1985. MITC is a Restricted Use Pesticide.

The Phase IV review package for List B chemical Methyl Isothiocyanate (case no. 2405) was received by EFGWB on November 19, 1990. The package included the Phase II and Phase III responses from **Degussa Corporation** and **Nor-Am Chemical Company.** Degussa's Phase III response included waiver requests for five environmental fate studies (161-2, 161-4, 162-1, 162-2, and 162-3) and a summary of an existing, yet not submitted, Hydrolysis study. Nor-Am's Phase III response included summaries for seven environmental fate studies that had been previously submitted but had not been reviewed. Two waiver requests were also included (163-2 and 165-1).

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The LUIS report dated 1/21/91 listed the following use groups: Terrestrial Food, Terrestrial Feed, Terrestrial Non-Food, Greenhouse Food, Greenhouse Non-Food and Indoor Residential. Specific sites include: beverage crops, citrus, fiber crops, spices, fruiting vegetables, root crop and leafy vegetables, pome fruits, seed and pod vegetables, small fruits, stone fruits, subtropical/tropical fruits, sugar crops, ornamental/shade trees, tobacco, and wood protection treatments.

According to Degussa Corporation, they are supporting only one product, 54289-2. This fungicide for wood is packaged and applied in a closed delivery system. The methyl isothiocyanate is contained in a glass vial that is placed directly into a hole in a large structural timber, which is then plugged. Hence, Degussa's MITC, "MITC-FUME" will not be in contact with soil, water, or the surrounding environment. Because of the particular way Degussa's MITC product is applied, the only environmental fate data requirement levied for the reregistration of 54289-2 is the 161-1 Hydrolysis data requirement. However, should Degussa apply for other MITC registrations, a close examination of the intended uses of these products should be given to determine whether or not additional environmental fate studies should be required.

Nor-Am Chemical Company is supporting the use of MITC as a soil fumigant. The following environmental fate data requirements apply:

Data Requirement		Status
161-1	Hydrolysis	not satisfied
161-2	Photodegradation in Water	not satisfied
161-4	Photodegradation in Air	not satisfied
162-1	Aerobic Soil Metabolism	study to be reviewed in Phase V
162-2	Anaerobic Soil Metabolism	not satisfied
162-3	Anaerobic Aquatic Metabolism	not satisfied
163-1	Leaching-Adsorption/Desorption	not satisfied
163-2	Laboratory Volatility	not satisfied
163-3	Field Volatility	reserved
164-1	Soil Field Dissipation	not satisfied
164-5	Long-Term Soil Field Dissipation	reserved
165-1	Accumulation in Confined Rotational Crops	not satisfied
165-2	Accumulation in Field Rotational Crops	reserved
165-4	Bioaccumulation in Fish	not satisfied
165-5	Accumulation in Aquatic Non-Target Organisms	reserved
166-1	Small-Scale Prospective Ground Water Monitoring	reserved

Attached, please find a table listing the environmental fate data requirements for Methyl Isothiocyanate. Also attached is EFGWB's review of the summaries/studies submitted by the registrants.

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Date: 4/20/91
Case No: 2405
Chemical No: 068103

PHASE IV
DATA REQUIREMENTS FOR **Methyl Isothiocyanate**

Data Requirement	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No, or Partially)	Bibliographic Citation	Must Additional Data Be Submitted under FIFRA 3(c)(2)(B)?
§158.290 Environmental Fate					
DEGRADATION STUDIES-LAB:					
161-1 Hydrolysis	TGAI or PAIRA	1,2,3,8,9	No		Yes[3]
161-2 Photodegradation In Water	TGAI or PAIRA	1,2,3	No		Yes[4]
161-3 Photodegradation On Soil	TGAI or PAIRA	1,2,3	No		No[5]
161-4 Photodegradation In Air	TGAI or PAIRA	1,2,3,8,9	No		Yes[6]
METABOLISM STUDIES-LAB:					
162-1 Aerobic Soil	TGAI or PAIRA	1,2,3,8,9	No		No[7]
162-2 Anaerobic Soil	TGAI or PAIRA	1,2,3	No		Yes[8]
162-3 Anaerobic Aquatic	TGAI or PAIRA	1,2,3	No		Yes[9]
162-4 Aerobic Aquatic	TGAI or PAIRA				
MOBILITY STUDIES:					
163-1 Leaching-Adsorption/Desorption	TGAI or PAIRA	1,2,3,8,9	No		Yes[10]
163-2 Volatility (Lab)	TEP	1,2,8,9	No		Yes[11]
163-3 Volatility (Field)	TEP	1,2,8,9	No		Reserved
DISSIPATION STUDIES-FIELD:					
164-1 Soil	TEP	1,2,3	No		Yes[12]
164-2 Aquatic (Sediment)	TEP				
164-3 Forestry	TEP				
164-5 Soil, Long-term	TEP	1,2,3	No		Reserved[13]

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Data Requirement	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No, or Partially)	Bibliographic Citation	Must Additional Data Be Submitted under FIFRA 3(c)(2)(B)?
§158.290 Environmental Fate (con't)					
ACCUMULATIONSTUDIES:					
165-1 Rotational Crops (Confined)	PAIRA	1,2,3	No		Yes[14]
165-2 Rotational Crops (Field)	TEP	1,2,3	No		Reserved
165-3 Irrigated Crops	TEP				
165-4 In Fish	TGAI or PAIRA	1,2,3	No		Yes
165-5 In Aquatic Non-Target Organisms	TEP	1,2,3	No		Reserved
166-1 Ground Water Small Prospective	TEP	1,2,3	No		Reserved
166-2 Ground Water Small Retrospective	TEP	1,2,3	No		No
166-3 Ground Water Large Retrospective	TEP	1,2,3	No		No
§158.440 SPRAY DRIFT:					
201-1 Droplet Size Spectrum	TEP	1,2,3	No		No[15]
202-1 Drift Field Evaluation	TEP	1,2,3	No		No[15]

FOOTNOTES:

1. Composition: TGAI= Technical grade of the active ingredient; PAIRA= Pure active ingredient, radiolabeled; TEP= Typical end-use product.

2. Use Patterns: 1= Terrestrial Food; 2= Terrestrial Feed; 3= Terrestrial Non-Food; 4= Aquatic Food; 5= Aquatic Non-Food (Outdoor); 6= Aquatic Non-Food (Industrial); 7= Aquatic Non-Food (Residential); 8= Greenhouse Food; 9= Greenhouse Non-Food; 10= Forestry; 11= Residential Outdoor; 12= Indoor Food; 13= Indoor Non-Food; 14= Indoor Medical; 15= Indoor Residential.

3. 00158162 was found to be unacceptable on 6/19/85. Degussa has submitted a summary of a yet to be submitted study. This study should be promptly submitted to the Agency so that it may be reviewed in Phase V.

4. The Phase III summary as well as a screening of the submitted studies (00158163 and 41221415) established that they do not satisfy Subdivision N requirements.

5. A waiver was granted on February 3, 1987. The Agency concluded that because the chemical is injected into the soil at a depth of at least 6 to 8" below the soil (planting surface), the soil photolysis study is not required.

6. Registrant has committed to submit a new study.

7. 41221416 will be reviewed in Phase V.

8. 40622401 was found to be unacceptable on 4/25/89.

9. This study may be used to satisfy the Anaerobic Soil Metabolism data requirement.

10. The Phase III summaries as well as a screening of the submitted studies established that the studies (41221417 and 00158164) do not satisfy Subdivision N requirements.

11. Waiver request on the grounds that this product is applied by soil injection is denied. The greenhouse use particularly triggers the need for these data.

12. The Phase III summary as well as a screening of the submitted study (41221418) established that it does not satisfy Subdivision N requirements.

13. Reserved pending results of metabolism studies and short-term dissipation studies.

14. A waiver request on the grounds that MITC does not persist in the soil is denied. According to data submitted to DEB, residues have been found in crops grown in soils treated with the soil fumigant. The potential for accumulation in rotated crops must be determined.

15. Not required for present uses/application methods.

1. CHEMICAL:

chemical name: Methyl Isothiocyanate

common name: MITC

structure: CH_3-N=C=S

physical/chemical properties:

Empirical formula:	C_2H_3NS
Molecular weight:	73.11
Melting point:	35°C
Solubility:	8.6 g/L in water at 25°C
Vapor Pressure:	15.97 mm Hg at 25°C

2. TEST MATERIAL:

Methyl Isothiocyanate

3. STUDY/ACTION TYPE:

Review summaries/studies for Branch's Phase IV response.

4. STUDY IDENTIFICATION:

Degussa Corporation

Walzer, Egon. "Hydrolysis Summary Sheet for Methylisothiocyanate". Original study performed by Degussa AG. Submitted by Degussa and received by EPA on December 4, 1990. MRID #: 41710901.

Nor-Am Chemical Company

Davis, Christopher J. "Phase III Summary of MRID 00158162: Determination of the Rate of Hydrolysis of Methyl Isothiocyanate in Buffered Water Solutions at pH Values of 5, 7, and 9 at 25°C." Original study prepared by Schering AG. MRID #: 92114020. Original study received by EPA on 2/1/85.

Davis, Christopher J. "Phase III Summary of MRID 00158163 and 41221415; Photolysis of Methylisothiocyanate in Aqueous Solution." Original study prepared by Schering AG. MRID #: 92114022. Original study received by EPA on 8/31/89.

Davis, Christopher J. "Phase III Summary of MRID 41221416: Aerobic Degradation of Methyl Isothiocyanate in a Sandy Loam (Schering Soil No. 168)." Original study prepared by Schering AG. MRID #: 92114023. Original study received by EPA on 8/31/89.

Davis, Christopher J. "Phase III Summary of MRID 40622401: Degradation of Methyl Isothiocyanate in a Loamy Sand Under Anaerobic Conditions (Schering Soil No. 165)." Original study prepared by Schering AG. MRID #: 92114024. Original study received by EPA on 5/12/88.

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Davis, Christopher J. "Phase III Summary of MRID 41221417: Leaching Study of TRAPEX in Three German Standard Soils Under Laboratory Conditions." Original study prepared by Schering AG. MRID #: 92114025. Original study received by EPA on 8/31/89.

Davis, Christopher J. "Phase III Summary of MRID 00158164: Aged Leaching of Methyl Isothiocyanate in a Sandy Loam Soil." Original study performed by Schering AG. MRID #: 92114026. Original study received by EPA 11/86.

Davis, Christopher J. "Phase III Summary of MRID 41221418: Dissipation of Methyl Isothiocyanate in Soil Following Fumigation of Fields at Several Sites in the USA in 1986." Original study performed by Nor-Am Chemical Company. MRID #: 92114027. Original study received by EPA on 8/31/89.

5. REVIEWED BY:

Dana Spatz
Chemist, ECRS #2
EFGWB/EFED/OPP

Date: MAR 21 1991

6. CONCLUSIONS:

A. *Walzer, Egon. "Hydrolysis Summary Sheet for Methylisothiocyanate". Original study performed by Degussa AG. Submitted by Degussa and received by EPA on December 4, 1990. MRID #: 41710901.*

Based upon a review of the summary for this Hydrolysis study, EFGWB concludes that the study warrants a comprehensive review which will be performed in Phase V.

B. *Davis, Christopher J. "Phase III Summary of MRID 00158162: Determination of the Rate of Hydrolysis of Methyl Isothiocyanate in Buffered Water Solutions at pH Values of 5, 7, and 9 at 25°C." Original study prepared by Schering AG. MRID #: 92114020. Original study received by EPA on 2/1/85.*

This study was reviewed by EFGWB on June 19, 1985 and was found to be unacceptable in support of the hydrolysis data requirement.

C. *Davis, Christopher J. "Phase III Summary of MRID 00158163 and 41221415; Photolysis of Methylisothiocyanate in Aqueous Solution." Original study prepared by Schering AG. MRID #: 92114022. Original study received by EPA on 8/31/89.*

This study is not acceptable in fulfilling the Photodegradation in Water (161-2) data requirement. The Phase III Summary as well as a screening of the submitted study established that it does not satisfy Subdivision N requirements for the following reasons:

a. The artificial light source used in this study (mercury arc lamp) was not similar to sunlight. The study author stated that the radiant energy of natural sunlight at noon, on a summer day, at 40° northern latitude, with a cloudless sky was 1.9 mW/cm^2 for wavelengths <350 nm, and 5.5 mW/cm^2 for wavelengths <400 nm. The transmitted radiant energy reaching the irradiated test solutions was approximately 9 mW/cm^2 for wavelengths <350 nm, and 39 mW/cm^2 for wavelengths <400 nm. Therefore, the

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intensity of the irradiation used in this study corresponds to 4 - 8x that associated with natural light.

b. Material balances declined slightly but steadily throughout the study. Material balances were somewhat low (84.1 - 86.7%) in the dark control solutions sampled at 166.4 and 213 hours after initiation of irradiation.

D. *Davis, Christopher J. "Phase III Summary of MRID 41221416: Aerobic Degradation of Methyl Isothiocyanate in a Sandy Loam (Schering Soil No. 168)." Original study prepared by Schering AG. MRID #: 92114023. Original study received by EPA on 8/31/89.*

Based upon a review of the summary for this Aerobic Soil Metabolism study and a screening of the study itself, EFGWB concludes that the data warrants a comprehensive review which will be performed in Phase V.

E. *Davis, Christopher J. "Phase III Summary of MRID 40622401: Degradation of Methyl Isothiocyanate in a Loamy Sand Under Anaerobic Conditions (Schering Soil No. 165)." Original study prepared by Schering AG. MRID #: 92114024. Original study received by EPA on 5/12/88.*

This study was reviewed by EFGWB on April 25, 1989 and was found to be scientifically sound, but did not meet Subdivision N guidelines because one extractable degradate (PIII), present in the flooded soil at up to 3.5 ppm, was not identified. It was concluded that in order for the study to fulfill the anaerobic soil metabolism data requirement, the registrant must identify degradate PIII.

F. *Davis, Christopher J. "Phase III Summary of MRID 41221417: Leaching Study of TRAPEX in Three German Standard Soils Under Laboratory Conditions." Original study prepared by Schering AG. MRID #: 92114025. Original study received by EPA on 8/31/89.*

This study is <u>not acceptable</u> in fulfilling the Leaching-Adsorption/Desorption (163-1) data requirement, nor was it designed to satisfy Subdivision N. The study was performed to BBA (West German) registration guidelines. The Phase III Summary as well as a screening of the submitted study established that it does not satisfy Subdivision N requirements for the following reasons:

a. The test substance was not the TGAI or PAIRA, but was a formulated end-use product, (TRAPEX).

b. Only three soils were tested, not the required four.

c. Material balance was poor. Recovery values were reported to average 74%.

d. The elution volume for the soil column was insufficient, apparently because the study followed West German BBA guidelines, not EPA guidelines.

e. The distribution of residues within the column was not determined. Only eluate was measured.

f. Degradates/metabolites were not identified. Only parent was measured.

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G. *Davis, Christopher J. "Phase III Summary of MRID 00158164: Aged Leaching of Methyl Isothiocyanate in a Sandy Loam Soil." Original study performed by Schering AG. MRID #: 92114026. Original study received by EPA 11/86.*

This study is not acceptable in fulfilling the Leaching-Adsorption/Desorption (163-1) data requirement. The Phase III Summary as well as a screening of the submitted study established that it does not satisfy Subdivision N requirements for the following reasons:

a. Residues in the soil were not characterized after aging and immediately prior to leaching.

b. Immediately prior to leaching (2 hours posttreatment), 55-65% of the applied radioactivity had volatilized. It cannot be determined if the remaining radioactivity in the soil was comprised mainly of parent MITC, or if significant degradation had occurred. Since the purpose of the aged leaching study is to determine the mobility of the pesticide and its degradates, it may be preferable to study the mobility of each MITC degradate separately rather than the mobility of aged MITC residues.

c. MITC residues in the leachates and soils were not characterized.

d. Recoveries for the three columns averaged only 84%.

H. *Davis, Christopher J. "Phase III Summary of MRID 41221418: Dissipation of Methyl Isothiocyanate in Soil Following Fumigation of Fields at Several Sites in the USA in 1986." Original study performed by Nor-Am Chemical Company. MRID #: 92114027. Original study received by EPA on 8/31/89.*

This study is not acceptable in fulfilling the Soil Field Dissipation (164-1) data requirement. The Phase III Summary as well as a screening of the submitted study established that it does not satisfy Subdivision N requirements for the following reasons:

a. The soils were analyzed only for MITC.

b. No data were provided to demonstrate that the MITC residues were stable during collection, shipping, and storage. It was noted that some samples were stored for up to one year.

c. In both Florida test plots, the soil was not sampled deep enough to define the extent of movement of MITC to deeper soil depths.

7. RECOMMENDATIONS:

Degussa Corporation is supporting only one product, 54289-2. This fungicide for wood is packaged and applied in a closed delivery system. The methyl isothiocyanate is contained in a glass vial that is placed directly into a hole in a pole, which is then plugged. Hence, Degussa's MITC, "MITC-FUME" will not be in contact with soil, water, or the surrounding environment. Because of the particular way Degussa's MITC product is applied, the only environmental fate data requirement levied for the reregistration of 54289-2 is the 161-1 Hydrolysis data requirement. However, should Degussa apply for other MITC registrations, a close examination of the intended uses of these products should be given to determine whether or not additional environmental fate studies should be required.

Nor-Am Chemical Corporation is supporting the use of MITC as a soil fumigant. The following environmental fate data requirements apply:

Data Requirement		Status
161-1	Hydrolysis	not satisfied
161-2	Photodegradation in Water	not satisfied
161-4	Photodegradation in Air	not satisfied
162-1	Aerobic Soil Metabolism	study to be reviewed in Phase V
162-2	Anaerobic Soil Metabolism	not satisfied
162-3	Anaerobic Aquatic Metabolism	not satisfied
163-1	Leaching-Adsorption/Desorption	not satisfied
163-2	Laboratory Volatility	not satisfied
163-3	Field Volatility	reserved
164-1	Soil Field Dissipation	not satisfied
164-5	Long-Term Soil Field Dissipation	reserved
165-1	Accumulation in Confined Rotational Crops	not satisfied
165-2	Accumulation in Field Rotational Crops	reserved
165-4	Bioaccumulation in Fish	not satisfied
165-5	Accumulation in Aquatic Non-Target Organisms	reserved
166-1	Small-Scale Prospective Ground Water Monitoring	reserved

8. BACKGROUND:

A Ground Water Data Call-In was issued on June 4, 1985. MITC, a Restricted Use Pesticide, is registered as a soil fumigant and a wood preservative. The studies in this package were reviewed as part of the Agency's LIST B Phase IV response.

9. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

Not applicable.

10. COMPLETION OF ONE-LINER:

Amended as applicable.

11. CBI APPENDIX:

Not applicable.