DP Barcode: D194593, D194586
Shaughnessy No.: 129034
Date Out of EFGWB:

TO: Joanne I. Miller
Fungicide-Herbicide Branch
Registration Division (H7505)

FROM: Mah Shamim, Ph.D., Acting Chief
Environmental Chemistry Review Section #2
Environmental Fate and Groundwater Branch (H7507C)

APR 13 1994

THROUGH: Henry Jacoby, Chief
Environmental Fate and Groundwater Branch
Environmental Fate and Effects Division (H7507C)

4/14/94

Attached, please find the EFGWB review of:

Reg./File #(s) : N. A.

Common Name : V-53482, S-53482, flumioxazin

Chemical Name : 7-fluoro-6-[(3,4,5,6-tetrahydro)phthalimide]-4-(2-propynyl)-1,4-benzonazine-3(2H)-one

Product Type : Herbicide

Product Name : V-53482 WP, V-53482 WDG Herbicide

Company Name : Valent U.S.A. Corporation

Purpose : Review of data requirements for an Experimental Use Permit for use on soybeans. Review of an Aerobic Soil Metabolism and Mobility of aged V-53482.

Action Code: 710, 240 EFGWB #(s): 93- 0990, 0991

EFGWB Guideline/MRID/Status Summary Table:
The review in this package contains...

161-1			162-4			164-4			166-1		
161-2			163-1	42884010	P	164-5			166-2		
161-3			163-2			165-1			166-3		
161-4			163-3			165-2			167-1		
162-1	42884009	P	164-1			165-3			167-2		
162-2			164-2			165-4			201-1		
162-3			164-3			165-5			202-1		

Y = Acceptable (Study satisfied the Guideline)/Concur P = Partial (Study partially satisfied the Guideline, but additional information is still needed)
S = Supplemental (Study provided useful information, but Guideline was not satisfied) N = Unacceptable (Study was rejected)/Non-Concur

1. CHEMICAL:

Common name:

V-53482, S-53482
Flumioxazin (proposed)

Chemical name(s):

7-fluoro-6[(3,4,5,6-tetrahydro)phthalimide]-4-(2-propynyl)-1,4-benzonazine-3(2H)-one

Trade name(s):

V-53482 WP Herbicide, V-53482 WDG Herbicide

Formulations:

Wettable powder and wettable dispersable granule

Physical/Chemical properties:

Molecular formula:	$C_{19}H_{15}FN_2O_4$
Molecular weight:	354.34 g/mol
Physical state:	Solid
Melting point:	201.8 - 203.8°C
Solubility:	1.79 mg/L in water at 25°C
	1.78 g/100 mL in ethyl acetate
	0.156 g/mL in methanol
	0.00247 g/mL in hexane
	0.0163 g/mL in n-octanol
	1.70 g/mL in acetone
	3.23 g/mL in acetonitrile
	19.1 g/mL in dichloromethane
	5.38 g/mL in tetrahydrofuran
Octanol/Water Part. Coef.:	Log K_{ow} = 2.55 at 20°C
Vapour pressure:	2.41 x 10^{-6} mm Hg at 22°C

2. TEST MATERIAL:

Refer to individual DER's for details.

3. STUDY/ACTION TYPE:

The registrant has submitted a request for an Experimental Use Permit for the use of V-53482 in soybeans; in addition, the registrant has submitted Aerobic Soil Metabolism, and Aged Mobility and Leaching studies to support the EUP.

4. STUDY IDENTIFICATION:

Fathulla, R. N. 1993. Aerobic Soil Metabolism of [THP-^{14}C]-S-53482. Laboratory project ID HLA 6311-156. Unpublished study performed by Hazelton Wisconsin, Inc., WI, and submitted by Valent U.S.A. Corporation, CA (MRID# 42884009)

Fathulla, R. N. 1993. Column Leaching Characteristics of [Phe-^{14}C]-V-53482 on Soil (Part 2). Laboratory project ID HWI 6320-110. Unpublished study performed by Hazelton Wisconsin, Inc., WI, and submitted by Valent U.S.A. Corporation, CA (MRID# 42884010)

5. REVIEWED BY:

José Luis Meléndez
Chemist
EFGWB/EFED/OPP
Review Section #2

Signature: José Luis Meléndez
Date: 3/24/94

6. APPROVED BY:

Mah Shamim, Ph.D.
Acting Chief
EFGWB/EFED/OPP
Review Section #2

Signature: M Shamim
Date: APR 13 1994

7. CONCLUSIONS:

Experimental Use Permit for the Use of V-53482 in Soybeans

EFGWB has no objection to the proposed Experimental Use Permit (EUP) for the use of V-53482 in soybeans. The registrant has satisfied the data requirements for the proposed EUP. The status of the data requirements is as follows:

Data requirement[1]		Status
161-1	Hydrolysis	Satisfied
162-1	Aerobic Soil Metabolism	Satisfied
163-1	Mobility, Leaching and Adsorption/Desorption	Satisfied
165-4	Bioaccumulation in Fish	Waived

1. The intended use pattern for the chemical is Terrestrial Food (use in soybeans).

The registrant, Valent U.S.A. Corporation, is requesting an EUP to allow use of V-53482 WP Herbicide in soybeans. This EUP is for the use of the wettable powder (WP) formulation only. The product contains 50% of active ingredient and is packaged in 6 oz water soluble bags with the purpose to protect workers against exposure. The EUP program will have a two year duration. The proposed start date is April 1, 1994. A maximum of 198.1 lb of active ingredient will be used over 2070 acres in 17 states representing areas where soybeans are grown. The plan includes treatment of not more than 1260 acres during the first year, and 810 acres during the second year. The maximum allowed use per season application is 43.4 grams ai/Acre, applied preemergence to the crop.

All applications will be ground treatments. According to the proposed EUP label for V-53482 WP Herbicide, it is to be applied "with properly calibrated ground equipment..." Since acute human exposure is of concern with this product, EFGWB recommends that the registrant add to the proposed EUP label a restriction indicating that V-53482 WP Herbicide should not be applied aerially.

162-1 Aerobic Soil Metabolism (MRID# 42884009)

This study is scientifically sound and partially satisfies the data requirement by providing information about the aerobic soil metabolism of [THP-^{14}C]-V-53482. This study was conducted using only THP-ring labeled V-53482. The registrant has previously submitted an acceptable aerobic soil metabolism study using phenyl-ring labeled V-53482 (MRID# 42684906. DP Barcode D189768). Taken together, both studies satisfy the Aerobic Soil Metabolism data requirement. No additional data are required.

[^{14}C]-V-53482 (THP-ring labeled), at 0.245 µg/g, degraded with a registrant-calculated half-life of 17.5 days in a California sandy loam soil incubated in the dark at about 25°C.

V-53482 was 97.3% of the applied at day 0 and decreased to 28.9% by day 30 and was 11.8% of the applied at day 91 posttreatment. $^{14}CO_2$ comprised 0.2% of the applied at day 1 and 55.1% of the applied at day 91 posttreatment.

Four degradates were isolated and identified:

- 3,4,5,6-tetrahydrophthalic acid (THPA),
- 3,4,5,6-tetrahydrophthalic anhydride (Δ-TPA),
- 7-fluoro-6-(3,4,5,6-tetrahydrophthalimido)-2H-1,4-benzoxazin-3(4H)-one (IMOXA), and
- 2-[7-fluoro-3-oxo-6-(3,4,5,6-tetrahydrophthalimido)-2H-1,4-benzoxazin-4-yl]propionic acid (482CA).

These compounds were present at concentrations ≤6.6% of the applied. Four unknown areas, at ≤0.6% of the applied, were also observed in the soil extracts.

Soil-bound residues increased from 2.7% of the applied at day 0 to 20.0% by day 30 and 29.0% of the applied by day 91. The humic acid, fulvic acid, and humin fractions in the soil-bound residues ranged from 0.9-7.0%, 3.5-8.0%, and 2.5-13.1% of the applied, respectively.

163-1 Mobility and Column Leaching of Aged V-53482 (MRID# 42884010)

This study is scientifically sound and partially satisfies the data requirement by providing information about the mobility of aged [^{14}C-Ph]-V-53482. The registrant previouly submitted a study using the same radioactive material and two soils. This study provides additional information about the mobility of aged V-53482 in two additional soils. Taken together, both studies satisfy the Mobility of Aged V-53482 data requirement. No additional data are required.

This study was conducted using only phenyl ring-labeled ^{14}V-53482. However, since the Aerobic Soil Metabolism study using [^{14}C-THP]-V-53482 showed the presence of no major degradates, EFGWB does not require any additional studies using aged [^{14}C-THP]-V-53482 at this time.

In addition, the parent compound was aged in soils for 30 days under aerobic conditions. After this period only 29.2% of the radioactivity remained as parent compound. According to Subdivision N Guidelines, the test substance should have been applied to the soil and incubated aerobically for 30 days or one half-life, whichever is shorter. The registrant indicated that 30 days was the test interval when the largest amount of polar metabolites were produced in the aerobic soil metabolism study.

[Ph-^{14}C]-V-53482 (uniformly ring labeled) residues remain mainly in the soil of leaching columns packed with a Plainfield Sand and a Kewausee clay loam soils. The California sandy loam soil was treated with 0.26 µg/g, then aged for 30 days in the dark at 24-26°C and 75% field moisture capacity.

In the soil columns packed with Plainfield sand 60.5-62.8% of the applied was recovered from the uppermost column section (section number 0), 5.6-6.0% of the applied from section number 1, 5.2-6.1% of the applied from section number 2, 5.1-6.3% of the applied from section number 3, 3.2-3.5% of the applied from section number 4, and 1.5-2.2% of the applied from section number 5. Residues in the leachate totaled 7.7-9.0% of the applied. Most of the leachate radioctivity was located in the second leachate fraction, with 2.7-3.3% of the applied.

In the soil columns packed with Kewaunee clay loam soil 59.8-61.8% of the applied was recovered from the uppermost column section (section number 0), 11.5-12.1% of the applied from section

5

number 1, 5.0-5.1% of the applied from section number 2, 2.4-2.8% of the applied from section number 3, 1.6-1.7% of the applied from section number 4, and 1.0-1.3% of the applied from section number 5. Residues in the leachate totaled 3.6% of the applied. Most of the leachate radioactivity was located in the second leachate fraction, with 1.4% of the applied.

Both the leachate and soil extracts show the presence of various minor components (≤1.3% of the applied) and parent V-53482.

Environmental Fate Characteristics of V-53482

At this time, a complete environmental fate assessment of V-53482 is not possible; however, based on the information provided, V-53482 appears to be nonpersistent (hydrolysis $t_{½}$ 14.6 min - 5.1 days; aerobic soil metabolism $t_{½}$ 11.9-17.5 days) and shows relatively high mobility in soils (up to 71.8% of the applied radioactivity found in the leachate fractions). V-53482 is not likely to bioaccumulate significantly in fish.

Due to the relatively high mobility of V-53482 observed in the sand and sandy loam soils, it appears that there is a potential for leaching in some soils, although the chemical does not appear to be persistent. Results of additional studies conducted on V-53482 for the full registration of the chemical would provide adequate information to determine the chemical's potential for leaching into ground water.

The following is a summary of the studies submitted by the registrant to satisfy the data requirements:

161-1 Hydrolysis (MRID# 42697501, 42684905; Acceptable)

V-53482 degraded in pH 5, 7 and 9 buffered aqueous solutions with average calculated half-lives ranging from 3.4-5.1 days, 21.4-24.6 hours, and 14.6-22.0 min. for the pH 5, 7, and 9 buffered solutions, respectively.

The following degradates were observed:

- 7-Fluoro-6[(2-carboxy-cyclohexenoyl)amino]-4-(2-propynyl)-1,4-benzoxazin-3(2H)-one (482-HA).
- 6-Amino-7-fluoro-4-(2-propynyl)-1,4-benzoxazin-3(2H)-one (APF).
- 3,4,5,6-tetrahydrophthalic acid (THPA).
- 3,4,5,6-Tetrahydrophthalic acid anhydride ($^{1}\Delta$-TPA).

The degradate 482-HA was found at high concentrations (≥58.2% of the applied) in the pH 7 and 9 solutions. APF and THPA were not detected in the pH 9 solutions, but were important components in the other solutions. $^{1}\Delta$-TPA was a minor component (≤8.8% of the applied) in the pH 5 and 7 solutions.

162-1 Aerobic Soil Metabolism (MRID# 42681906, 42884009; Acceptable)

V-53482, at 0.26 µg/g, degraded with a registrant-calculated half-life of 11.9-17.5 days in a California sandy loam soil incubated in the dark at about 25°C.

Four degradates were isolated and identified:

- 3,4,5,6-tetrahydrophthalic acid (THPA),
- 3,4,5,6-tetrahydrophthalic anhydride (Δ-TPA),
- 7-fluoro-6-(3,4,5,6-tetrahydrophthalimido)-2H-1,4-benzoxazin-3(4H)-one (IMOXA), and
- 2-[7-fluoro-3-oxo-6-(3,4,5,6-tetrahydrophthalimido)-2H-1,4-benzoxazin-4-yl]propionic acid (482CA).

These compounds were present at concentrations ≤6.6% of the applied.

Soil-bound residues increased during the studies reaching a maximum of 73.6% of the applied by day 181 in the phenyl ring labeled study, and 29.0% of the applied by day 91 in the THP ring labeled study. $^{14}CO_2$ comprised 55.1% of the applied at day 91 posttreatment in the THP ring labeled study, and 11.5% of the applied in the phenyl ring labeled study.

163-1 Leaching and Adsorption (MRID# 42684907, 42684908, 42684909, 42884010; Acceptable)

The relative instability of V-53482 under hydrolytic conditions precluded the use of Adsorption/Desorption methods to assess the mobility of unaged V-53482. The mobility of unaged V-53482, at 0.26 µg/g, was relatively high in 36 cm soil leaching columns, leached with aproximately 20 inches of 0.01-0.02 N calcium chloride aqueous solutions, using four soil types. The majority of the radioactivity detected was identified as parent [^{14}C]-V-53482. Several minor degradation components were present at ≤10% of the applied. The [^{14}C]-residues in the leachate fractions totaled considerable amounts, specially in the Plainfield sand and the California College sandy loam. [^{14}C]-residues (mostly [^{14}C]-V-53482) totaled 58.5-71.8%, 48.0-57.0%, 5.5-14.8%, and 2.4-5.4% of the applied in the Plainfield sand, California College sandy loam, Mississippi silt loam, and Kewaunne clay loam soils, respectively. It appears that there is a negative correlation between the % clay in the soils and the mobility of unaged V-53482 in the soil columns.

In another study, aged V-53482 residues remained mainly in the soil of leaching columns packed with four soil types. The California sandy loam soil was treated with 0.249-0.260 µg/g, then aged for 30 days in the dark at about 25°C and 75% field moisture capacity. In the soil columns most of the radioactivity was found in the uppermost column section: 52.9-53.3%, 60.5-62.8%, 58.6-61.9%, and 59.8-61.8% of the applied from the uppermost sections of

columns packed with California College sandy loam, Plainfield sand, Mississippi silt loam soil, and Kewaunee clay loam soils, respectively. Significant amounts of residues were found in the leachates of the California College sandy loam column. Residues in the leachate totaled 27.8-28.1%, 7.7-9.0%, 6.1-6.5%, and 3.6% of the applied in the column types mentioned above, respectively. Both the leachate and soil extracts show the presence of various minor components (≤3.2% of the applied) and parent V-53482.

165-4 Bioaccumulation in Fish (Waived)

V-53482 is not likely to bioaccumulate significantly because it degrades rapidly in water (half-life of about 1 day at pH 7 and about 20 min. at pH 9). In addition, the observed octanol/water partition coefficient for V-53482 is smaller than 1000 ($K_{ow,\ V\text{-}53482}$ = 355, log k_{ow} = 2.55, value not confirmed; the estimated partition coefficient for the major hydrolysates of V-53482 range between 1.3 and 7.6). EFGWB concurred with a waiver for the data requirement (DP Barcode D189768, 7/26/93).

8. RECOMMENDATIONS:

1. Inform the registrant that EFGWB has no objections to the proposed Experimental Use Permit (EUP) for the use of V-53482 in soybeans. The status of the data requirements for an EUP for V-53482 is as follows:

Data requirement[1]		Status	MRID#'s
161-1	Hydrolysis	Satisfied	42697501, 42684905
162-1	Aerobic Soil Metabolism	Satisfied	42681906, 42884009
163-1	Mobility, Leaching and Adsorption/Desorption	Satisfied	42684907, 42684908, 42684909, 42884010
165-4	Bioaccumulation in Fish	Waived	N/A

1. The intended use pattern for the chemical is Terrestrial Food (use in soybeans).

2. Attached is a table of the status of data requirements that apply for the full registration of the chemical V-53482, for the proposed use pattern.

3. Inform the registrant that since acute human exposure is of concern for this product, EFGWB recommends that a restriction be added to the proposed EUP label, indicating that V-53482 WP Herbicide should not be applied aerially. According to the

proposed EUP label for V-53482 WP Herbicide, it is to be applied "with properly calibrated ground equipment..."

9. BACKGROUND:

S-53482 or V-53482 is a herbicide; the registrant claims it is active and selective for broadleaved weeds by preemergent and preplant application on soybeans. It is manufactured by Valent U.S.A. Corporation. There are two formulations: V-53482 WP Herbicide is a wettable powder and V-53482 WDG Herbicide is a water dispersible granule. Both formulations have the same composition (about 50% active ingredient). The product is packed in water-soluble packages designed to reduce exposure to workers, since acute human exposure is of concern with this product. The proposed use rates range form 21.3 to 42.5 g ai/A (0.047-0.094 lb ai/A).

10. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

Refer to DER's for details.

11. COMPLETION OF ONE-LINER:

EFGWB updated the One-Liner data base for V-53482 with this report.

12. CBI APPENDIX:

The registrant considers all data reviewed here as "company confidential" and must be treated as such.

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Table A. GENERIC DATA REQUIREMENTS FOR THE FULL REGISTRATION OF FLUMIOXAZIN (V-53482)

Data requirement	Use Pattern[1]	Does EPA have data to satisfy this requirement?	Bibliographic Citation	Must additional data be submitted under FIFRA Sec. 3(c)(2)(8)?
DEGRADATION STUDIES - LAB.:				
161-1 Hydrolysis	A[2]	Yes	42697501, 42684905	No[3]
PHOTODEGRADATION:				
161-2 In Water	A	No		Yes
161-3 On Soil	A	No		Yes
161-4 In Air	A	No		Reserved[4]
METABOLISM STUDIES:				
162-1 Aerobic Soil	A[2]	Yes	42681906, 42884009	No[5]
162-2 Anaerobic Soil	N/A	N/A		N/A
162-3 Anaerobic Aquatic	N/A	N/A		N/A
162-4 Aerobic Aquatic	N/A	N/A		N/A
MOBILITY STUDIES:				
163-1 Leaching and Adsorption-Desorption	A[2]	Yes	42684907, 42684908, 42684909, 42884010	No[6]
163-2 Volatility (Lab.)	A	No		Yes
163-3 Volatility (Field)	A	No		Yes
DISSIPATION STUDIES - FIELD:				
164-1 Soil	A	No		Yes
164-2 Aquatic (Sediment)	N/A	N/A		N/A
164-3 Forestry	N/A	N/A		N/A
164-4 Combination and Tank Mixes	N/A	N/A		N/A
164-5 Soil, Long Term	A	No		Reserved[7]
ACCUMULATION STUDIES:				
165-1 Rotational Crops (Confined)	N/A	N/A		N/A[8]
165-2 Rotational Crops (Field)	N/A	N/A		N/A[8]
165-3 Irrigated Crops	N/A	N/A		N/A
165-4 In Fish	A	No		Waived[9]
165-5 Aquatic Non-Target Organisms	N/A	N/A		N/A
GROUNDWATER MONITORING:				
166-1 Small Prospective	A	No		Reserved[7]
166-2 Small Retrospective	A	No		Reserved[7]
166-3 Large Retrospective	A	No		Reserved[7]
SURFACE WATER:				
167-1 Field Runoff	A	No		Reserved[7]

Data requirement	Use Pattern[1]	Does EPA have data to satisfy this requirement?	Bibliographic Citation	Must additional data be submitted under FIFRA Sec 3(c)(2)(8)?
167-2 Surface Water Monitoring	A	No		Reserved[7]
SPRAY DRIFT:				
201-1 Droplet Size Spectrum	A	No		No[10]
202-1 Drift Field Evaluation	A	No		No[10]

Footnotes:

1. Use Patterns N/A = Not Applicable; A = Terrestrial Food Crop.
2. Data requirements that apply for the Experimental Use Permit requested for the use of V-53482 on soybeans. Other data requirements apply for the full registration of the chemical.
3. V-53482 hydrolyzed in pH 5, 7 and 9 buffered aqueous solutions with average calculated half-lives ranging from 3.4-5.1 days, 21.4-24.6 hours, and 14.6-22.0 min. for the pH 5, 7, and 9 buffered solutions, respectively. The following degradates were observed: 482-HA, APF, THPA, and $^{1}\Delta$-TPA.
4. The Photodegradation in Air data requirement is held in reserve pending further evaluation and clarification of guidance for this study by EFGWB.
5. V-53482 degraded under aerobic soil conditions with a registrant-calculated half-life of 11.9-17.5 days in a California sandy loam soil. Four degradates were isolated and identified: THPA, Δ-TPA, IMOXA, and 482CA (were present at $\leq$6.6% of the applied). Soil-bound residues were 73.6% of the applied by day 181 in the phenyl ring labeled study, and 29.0% of the applied by day 91 in the THP ring labeled study. $^{14}CO_2$ comprised 55.1% of the applied at day 91 posttreatment in the THP ring labeled study, and 11.5% of the applied in the phenyl ring labeled study.
6. The mobility of unaged V-53482 was low to high in 36-cm soil leaching columns, using four soil types. The calculated values obtained ranged as follows: K_d 0.465-24.0; K_{oc} 105-1705. In another study, V-53482 residues remain mainly in the soil of leaching columns packed with four soil types. The California sandy loam soil was treated with 0.249-0.260 μg/g, then aged for 30 days in the dark at about 25° C and 75% field moisture capacity.
7. Reserved at this time, pending results of Short Term Terrestrial Field Dissipation studies.
8. Confined and Field Rotational Crops data requirements have been transferred to RCB/HED.
9. EFGWB concurred with a waiver request for the Bioaccumulation in Fish data requirement, based on the short hydrolysis half-life of V-53482, its low Octanol/Water partition coefficient and other properties of the chemical.
10. Not required at this time since V-53482 is not applied aerially.

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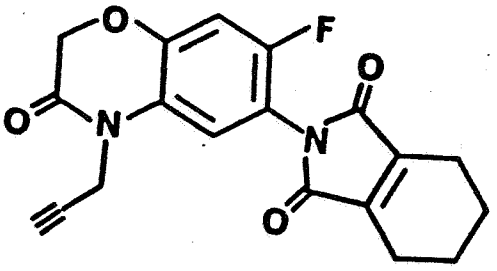
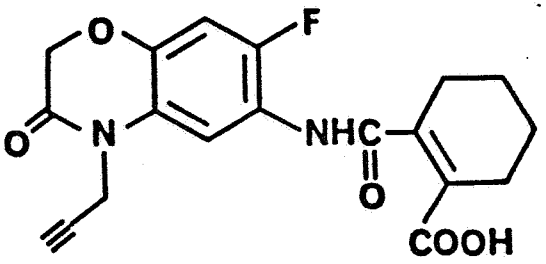
S-53482 and its degradates



S-53482
7-Fluoro-6-[(3,4,5,6-tetrahydro)phthalimido]-4-(2-propynyl)-1,4-benzoxazin-3(2H)-one



482-HA
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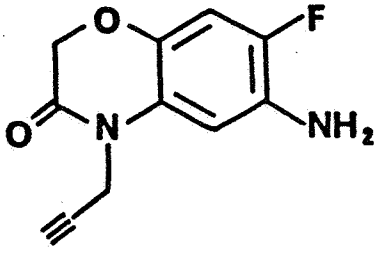
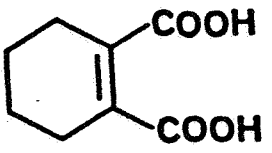
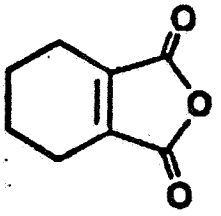


APF
6-Amino-7-fluoro-4-(2-propynyl)-1,4-benzoxazin-3(2H)-one



THPA
3,4,5,6-tetrahydrophthalic acid



$^{1}\Delta$-TPA
3,4,5,6-Tetrahydrophthalic acid anhydride

DATA EVALUATION RECORD
STUDY 1

CHEM 129034 S-53482 §162-1

Study ID 42884009

Fathulla, R. N. 1993. Aerobic Soil Metabolism of [THP-^{14}C]-S-53482. Laboratory project ID HLA 6311-156. Unpublished study performed by Hazelton Wisconsin, Inc., WI, and submitted by Valent U.S.A. Corporation, CA

Reviewed by: José Luis Meléndez
Title: Chemist
Org.: EFGWB/EFED/OPP
Tel.: 703-305-7495

Signature: José Luis Meléndez 10/18/93

Aerobic Soil Metabolism

CONCLUSIONS:

This study is scientifically sound and partially satisfies the data requirement by providing information about the aerobic soil metabolism of [THP-^{14}C]-V-53482. This study was conducted using only THP-ring labeled V-53482. The registrant has previously submitted an aerobic soil metabolism study using phenyl-ring labeled V-53482.

[^{14}C]-V-53482 (THP-ring labeled, specific activity 296 mCi/g, radiochemical purity 100.0%), at 0.245 µg/g, degraded with a registrant-calculated half-life of 17.5 days in a California sandy loam soil incubated in the dark at 24-26°C.

V-53482 was 97.3% of the applied at day 0 and decreased to 28.9% by day 30 and was 11.8% of the applied at day 91 posttreatment. $^{14}CO_2$ comprised 0.2% of the applied at day 1 and 55.1% of the applied at day 91 posttreatment.

Four degradates were isolated and identified:

- 3,4,5,6-tetrahydrophthalic acid (THPA),
- 3,4,5,6-tetrahydrophthalic anhydride (Δ-TPA),
- 7-fluoro-6-(3,4,5,6-tetrahydrophthalimido)-2H-1,4-benzoxazin-

3(4H)-one (IMOXA), and

- 2-[7-fluoro-3-oxo-6-(3,4,5,6-tetrahydrophthalimido)-2H-1,4-benzoxazin-4-yl]propionic acid (482CA).

These compounds were present at concentrations ≤6.6% of the applied. Four unknown areas, at ≤0.6% of the applied, were also observed in the soil extracts.

Soil-bound residues increased from 2.7% of the applied at day 0 to 20.0% by day 30 and 29.0% of the applied by day 91. The humic acid, fulvic acid, and humin fractions in the soil-bound residues ranged from 0.9-7.0%, 3.5-8.0%, and 2.5-13.1% of the applied, respectively.

Material balances ranged from 96.4% to 101.3% of the applied throughout the study.

METHODOLOGY:

[THP-^{14}C]-V-53482 (radiolabeled in the 1- and 2- positions of the 3,4,5,6-tetrahydrophthalimido moiety, specific activity 105 mCi/mmol or 296 μCi/mg, radiochemical purity 100.0%), was dissolved in 15 mL of acetonitrile to make a stock solution at 117075 dpm/μL. A portion of a dilution of the stock solution (3 mL plus 2 mL of acetonitrile, resulting in a solution of concentration of 72391 dpm/μL), was applied to a 20 g sample of soil (application rate 0.245 μg/g). The fortification level is approximately 2.6 times the estimated maximum field application rate. The soil used was a California sandy loam (61.2% sand, 30.0% silt, 8.8% clay, 1.44% OM, pH 7.9) obtained from the same location (Tulare County) than the one used in the previously submitted study using phenyl ring labeled material (MRID# 42684906). The soil was sieved through a 2-mm screen. The aerobic samples were adjusted to 75% of 1/3 bar and placed in sealed glass chambers which were connected to five volatile traps with charcoal, ethylene glycol, and two traps with 2-ethoxyethanol:ethanolamine (1:1), and water; there was a continuous flow of humidified air, created by vacuum. The chambers were kept in the dark at 24-26°C (mean ± standard deviation 24.9± 0.61°C). At days 1, 3, 7, 14, 30, 63, and 91 duplicate samples were removed for analysis. Traps were sampled at days 1, 3, 7, 14, 21, 30, 39, 48, 63, 77, and 91. At each test interval, the trapping media was removed and replaced with fresh media. The radioactivity in the traps was measured by LSC.

At each test interval, the soils were extracted three times with 60 mL of acetone: water (5:1, v/v) and three times with 60 mL of acetone: water (5:1, v/v, adjusted to pH 1 with concentrated HCl). All extraction mixtures were stirred for 15 minutes and centrifuged. The acetone:water extracts were combined and weighed. Similarly, the acidified acetone:water extracts were combined and weighed. The extracts were evaporated in a rotoevaporator at about 35°C, redissolved in 20 mL of acetonitrile, filtered, evaporated to dryness, and redissolved in 500 μL to 5 mL of acetonitrile.

The extracts were tested by two dimensional TLC using the following solvent systems:

chloroform:methanol:formic acid (10:1:1)
hexane:ethyl acetate:acetic acid (8:6:1)

The peaks in the plates were located by fluorescence quenching under UV light and a radioanalytic imaging system. Reference standard solutions were cochromatographed with the sample extracts for product identification.

80-g bulk soil samples of California College sandy loam were fortified with [THP-^{14}C]-V-53482 at a rate of 0.26 ppm and incubated under aerobic conditions for 7 days. Samples were extracted as previously described and concentrated. The extract was used to confirm the identity of areas 1 and 3 of the two-dimensional TLC method. The areas were scrapped from the 2-Dimensional TLC plates, extracted, and redissolved in 500 µL of acetonitrile. Using 2 sets of 2-Dimensional TLC solvent systems, the samples were cochromatographed with reference standards of Δ^1-TPA, THPA-2Na, and THPA-Me. The analysis showed the presence of THPA and THPA-Me, which was further confirmed by direct probe fast-atom bombardment mass spectrometry.

A number of selected samples of the soil extracts were analyzed by HPLC in addition to two-dimensional TLC for product identity confirmation. The HPLC method used a gradient mobile phase of acetonitrile:water in a C_{18} column.

Portions of the extracted soils were oxidized by combustion and the levels of $^{14}CO_2$ were determined by LSC. Samples from the extracted soils containing more than 10% of the applied radioactivity were refluxed with portions of acetonitrile: methanol:0.01 N HCl (25:15:10) for 1 hour at 100-110°C. The extracts were analyzed by one-dimensional TLC (chloroform:methanol: formic acid:water; 30:35:2:1) and scanned by a radioanalytical imaging system. The refluxed soils were additionally extracted with 0.5 N NaOH for 24 hours to determine the amounts of fulvic acid, humic acid, and humin components in the soil.

Duplicate samples from the traps were analyzed by LSC after adding water and scintillation cocktail. The charcoal medium was oxidized by combustion and the $^{14}CO_2$ measured.

RESULTS:

[^{14}C]-V-53482 (THP-ring labeled, specific activity 296 mCi/g, radiochemical purity 100.0%), at 0.245 µg/g, degraded with a registrant-calculated half-life of 17.5 days in a California sandy loam soil incubated in the dark at 24-26°C.

V-53482 was 97.3% of the applied at day 0 and decreased to 28.9% by day 30 and was 11.8% of the applied at day 91 posttreatment. $^{14}CO_2$ comprised 0.2% of the applied at day 1 and

comprised 55.1% of the applied at day 91 posttreatment.

Four degradates were isolated and identified:

- 3,4,5,6-tetrahydrophthalic acid (THPA), which was a maximum of 6.6% of the applied at 3 days posttreatment.
- 3,4,5,6-tetrahydrophthalic anhydride (Δ-TPA), which was a maximum of 5.1% of the applied at 7 days posttreatment.
- 7-fluoro-6-(3,4,5,6-tetrahydrophthalimido)-2H-1,4-benzoxazin-3(4H)-one (IMOXA), which was a maximum of 3.0% of the applied at 63 days posttreatment.
- 2-[7-fluoro-3-oxo-6-(3,4,5,6-tetrahydrophthalimido)-2H-1,4-benzoxazin-4-yl]propionic acid (482CA), which was a maximum of 0.7% of the applied at 30 days posttreatment.

Four unknown areas, at ≤0.6% of the applied, were also observed in the soil extracts.

Soil-bound residues increased from 2.7% of the applied at day 0 to 20.0% by day 30 and 29.0% of the applied by day 91. The humic acid, fulvic acid, and humin fractions in the soil-bound residues ranged from 0.9-7.0%, 3.5-8.0%, and 2.5-13.1% of the applied, respectively.

Material balances ranged from 96.4% to 101.3% of the applied throughout the study.

COMMENTS:

1 The study was conducted using only material radiolabeled in the tethrahydrophthalimide ring. The structure of V-53482 consists of two major moieties; one of them was radiolabeled in this study (the 3,4,5,6-tetrahydrophthalimide or THPA moiety). The other one is the phenyl ring. A previously submitted study provided acceptable information about the aerobic soil degradation of the phenyl ring labeled radioactive material (MRID# 42684906).

2. The application rate 0.25 μg/g is approximately 2.6 times the maximum proposed field application rate (0.094 lb ai/A). The registrant assumes that 1 lb/acre or 453.6 g/acre is equal to 1 ppm in the surface 3 inches; therefore, the maximum proposed application rate is equivalent to 0.096 ppm. It was used to allow measurement of parent and metabolites at the levels required by Subdivision N Guidelines.

3. According to the study, all samples were extracted and tested immediately after collection. Samples were stored in a freezer (temperature not specified) for possible additional analysis.

4. The soil used in the study was tested to determine the availability of microorganisms. Results showed that the soils contained a viable microbial count when the study started.

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5. The authors defined as "unresolved" any unresolved radioactivity detected by the scanner. The "unresolved" radioactivity represents a maximum of 8.4% of the applied at the sample interval 63 days.

6. Only data from day 0 to 30 posttreatment was used to calculate the degradation half-life. The authors indicate that the data after day 30 "were not well described by first order kinetics."

7. In order to determine the recoveries of radioactivity of the two-dimensional TLC procedure, selected aliquots of sample extracts of acetone:water (5:1) were analyzed by the method. The TLC plate was divided into various areas and scrapings analyzed by LSC. Recoveries ranged from 100.7% to 105.3%.

8. To determine the efficiency of the soil oxidation procedure, a number of samples of untreated soils were spiked with known amounts of ^{14}C-V-53482. The samples were oxidized by combustion and the $^{14}CO_2$ determined. The recoveries ranged from 95.9% to 97.3%.

9. The California sandy loam used in this study was somewhat alkaline (pH 7.9). The Hydrolysis study (MRID# 42684906) demonstrated that higher pH's favor degradation of parent V-53482.

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Table II

Total Percentage Radioactivity Recovered from Sample Matrices (Material Balance) - Mean[a]

Sample Interval (Day)	Soil Extracts 1 & 2											Extracted Soil	Ethylene Glycol Trap	2-E:E Trap (First)	2-E:E Trap (Second)	Charcoal Trap	Material Balance[b]
	S-53482	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Unresolved	Total						
0	97.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	97.3	2.7	NA	NA	NA	NA	100.0
1	93.3	1.1	0.3	1.2	ND	ND	ND	ND	ND	1.0	96.9	1.6	ND	0.2	ND	ND	98.7
3	78.4	6.6	0.4	4.6	ND	ND	ND	ND	ND	4.2	94.2	3.9	ND	1.5	ND	ND	99.6
7	63.6	5.7	ND	5.1	ND	ND	ND	ND	ND	7.1	81.5	12.1	ND	7.7	<0.1	ND	101.3
14	51.4	1.0	0.6	4.8	1.6	0.6	0.4	0.2	ND	2.4	63.0	16.5	ND	18.4	<0.1	ND	97.9
30	28.9	ND	ND	2.1	2.7	0.7	ND	0.4	0.5	7.0	42.3	20.0	ND	33.9	0.2	<0.1	96.4
63	12.3	0.7	ND	0.3	3.0	ND	ND	ND	ND	8.4	24.7	23.7	ND	48.9	0.2	<0.1	97.5
91	11.8	ND	ND	ND	2.0	0.1	0.2	0.2	ND	1.7	16.0	29.0	ND	54.9	0.2	<0.1	100.1

ND Not detected.
NA Not applicable.
2E:E 2-Ethoxyethanol:ethanolamine (1:1).

a Mean of duplicate values in Table C-XII.
b Sum of mean values in this table.

Area 1 = THPA
Area 3 = A'-TPA
Area 4 = IMOXA
Area 5 = 482-CA
Areas 2, 6, 7, and 8 = Unknowns

Table III

Mean Summary Radioactivity from Sample Matrices Expressed as S-53482 ppm Equivalents Relative to the Field Application Rate[a]

Sample Interval (Day)	Soil Extracts 1 and 2											Extracted Soil	Ethylene Glycol Trap	2-E:E Trap (First)	2-E:E Trap (Second)	Charcoal Trap	Material Balance
	S-53482	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Unresolved	Total						
0	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.093	0.003	NA	NA	NA	NA	0.096
1	0.090	0.001	<0.001	0.001	ND	ND	ND	ND	ND	0.001	0.093	0.002	ND	<0.001	ND	ND	0.095
3	0.075	0.006	<0.001	0.004	ND	ND	ND	ND	ND	0.004	0.090	0.004	ND	0.001	ND	ND	0.095
7	0.061	0.005	ND	0.005	ND	ND	ND	ND	ND	0.007	0.078	0.012	ND	0.007	<0.001	ND	0.097
14	0.049	0.001	<0.001	0.005	0.002	<0.001	<0.001	<0.001	ND	0.002	0.060	0.016	ND	0.018	<0.001	ND	0.094
30	0.028	ND	ND	0.002	0.003	0.001	ND	<0.001	<0.001	0.007	0.040	0.019	ND	0.033	<0.001	<0.001	0.092
63	0.012	<0.001	ND	<0.001	0.003	ND	ND	ND	ND	0.008	0.024	0.023	ND	0.047	<0.001	<0.001	0.093
91	0.011	ND	ND	ND	0.002	<0.001	ND	<0.001	ND	0.002	0.015	0.028	ND	0.053	<0.001	<0.001	0.096

ND Not detected.
NA Not applicable.
2-E:E 2-Ethoxyethanol:Ethanolamine (1:1).

a All values calculated by multiplying the percentage of applied radioactivity (percent component divided by 100) of corresponding values in Table II by the nominal study application rate (0.25 µg S-53482/g soil) and dividing the results by 2.6 (the nominal study application rate was 2.6 times the maximum proposed label rate).

Area 1 = THPA
Area 3 = Δ'-TPA
Area 4 = IMOXA
Area 5 = 482-CA
Areas 2, 6, 7, and 8 = Unknowns

Table IV

Data for Calculation of Degradation Half-Life of [THP-^{14}C]-S-53482 as Measured in the Sample Extracts

Sample Interval (Day)	Sample Number	^{14}C-S-53482 Percent of Applied Radioactivity[a]	^{14}C-S-53482 Natural Log Percent of Applied Radioactivity[b]
0	D-A	97.4	4.579
0	D-B	97.2	4.577
1	D-AE10	94.2	4.545
1	D-AE19	92.4	4.526
3	D-AE09	79.2	4.372
3	D-AE08	77.5	4.350
7	D-AE13	68.2	4.222
7	D-AE11	59.0	4.078
14	D-AE06	49.8	3.908
14	D-AE16	52.9	3.968
30	D-AE12	27.0	3.296
30	D-AE01	30.8	3.428

a Values from Table C-XII.

b Results of the linear regression analysis of the natural log percentage of applied radioactivity recovered as ^{14}C-S-53482 over time:

Correlation coefficient	=	-0.986
Regression coefficient (slope)	=	-0.0397
Constant (y-intercept)	=	4.52
Degradation half-life (days)	=	17.5

Table V

Individual Distribution of Radioactivity among the Fractions of the Extracted Soil of Selected Samples

Sample Interval (Day)	Sample Number	Percent of Radioactivity Applied to Sample: Total Extracted Soil[a]	Extracted Soil Fractions: Reflux Extract[b]	Humic Acid[c]	Fulvic Acid[c]	Humin[d]
7	D-AE13	12.3	5.7	NA	NA	NA
7	D-AE11	11.8	5.5	NA	NA	NA
14	D-AE06	16.7	4.4	2.3	3.6	6.4
14	D-AE16	16.2	4.5	2.1	3.8	5.8
30	D-AE12	18.9	4.3	0.9	4.0	9.7
30	D-AE01	21.0	4.7	1.2	3.5	11.6
63	D-AE14	24.4	5.5	1.0	4.8	13.1
63	D-AE04	23.0	4.9	1.1	4.7	12.3
91	D-AE23	30.2	13.3	6.2	8.0	2.7
91	D-AE21	27.8	11.4	7.0	6.9	2.5

a Values from Appendix C, Table C-III.
b Values from Appendix D, Table D-I.
c Values from Appendix D, Table D-II.
d The percent of applied radioactivity in the extracted soil minus the sum of the percent of applied radioactivity in the reflux extract, fulvic acid, and humic acid fractions.

STUDY (AUTHOR'S) CONCLUSION

CONCLUSIONS

Radiolabeled S-53482 degraded on soil under the study conditions. The calculated degradation half-life of [THP-^{14}C]-S-53482 under aerobic conditions was 17.5 days. The radioactivity was distributed primarily among unchanged S-53482, CO_2, and soil-bound residues. Several minor components, not exceeding 6.6% of the total applied, in the sample extracts of the soil were: 482-CA, IMOXA, Δ′-TPA, THPA, and unknown components of Areas 2, 6, 7, and 8. Radioactivity recovered as CO_2 accounted for 55.1% of the total amount of radioactivity applied to the sample by Day 91. At Day 91, a mean of 16.0% of the applied radioactivity was extractable; a mean of 11.8% of the extractable radioactivity corresponded to [THP-^{14}C]-S-53482. The applied radioactivity remaining in the soil at Day 91 after initial extraction was 29.0% of that applied; approximately 4.5% to 12.4% of the soil-bound radioactivity was released by reflux extraction.

Of considerable importance is the formation of $^{14}CO_2$ (55.1% of total applied by Day 91) and a corresponding cumulative rise in "bound" unextracted ^{14}C (29.0% of total applied by Day 91). The formation of bound residues and the concomitant formation of significant levels of CO_2 strongly suggests that the degradation pathway is largely governed by biological catalysis by soil microorganisms and to a lesser degree by a chemical route. Based on the study results, and the results of the aerobic soil metabolism of [Phe-^{14}C]-S-53482 study, a metabolic pathway of the aerobic degradation of S-53482 is proposed (Figure 27).

The study results indicate that [THP-^{14}C]-S-53482 will degrade on soil under aerobic conditions with a half-life of approximately 17.5 days. Results indicate that when S-53482 is applied at a maximum proposed label rate, degradates appear at rates less than 0.01 ppm, or as CO_2 or soil-bound residues. Therefore, S-53482 does not appear to be an environmental hazard or have potential to leach in soil.

DATA EVALUATION RECORD
STUDY 2

CHEM 129034 S-53482 §163-1

Study ID 42884010

Fathulla, R. N. 1993. Column Leaching Characteristics of [Phe-^{14}C]-V-53482 on Soils (Part 2). Unpublished study performed by Hazelton Wisconsin, Inc., WI, and submitted by Valent U.S.A. Corporation, CA

Reviewed by: José Luis Meléndez
Title: Chemist
Org.: EFGWB/EFED/OPP
Tel.: 703-305-7495

Signature:
José Luis Meléndez
10/18/93

CONCLUSIONS:

This study is scientifically sound and partially satisfies the data requirement by providing information about the mobility of aged [^{14}C-Ph]-V-53482. The registrant submitted previously a study using the same radioactive material and only two soils. This study provides additional information about the mobility of V-53482 in two additional soils. Taken together, both studies satisfy the Mobility of Aged V-53482 data requirement. No additional data are required.

This study was conducted using only phenyl ring-labeled V-53482. However, since the Aerobic Soil Metabolism study using [^{14}C-THP]-V-53482 showed the presence of no major degradates, EFGWB does not require any additional studies using aged [^{14}C-THP]-V-53482 at this time.

The parent compound was aged in soils for 30 days under aerobic conditions. After this period only 29.2% of the radioactivity remained as parent compound. According to Subdivision N Guidelines, the test substance should be applied to the soil and incubated aerobically for 30 days or one half-life, whichever is shorter. The registrant indicated that 30 days was the test interval when the largest amount of polar metabolites were produced in the aerobic soil metabolism study.

[Ph-^{14}C]-V-53482 (uniformly ring labeled) residues remain mainly in the soil of leaching columns packed with a Plainfield Sand and a Kewausee clay loam soils. The California sandy loam soil was treated with 0.26 µg/g, then aged for 30 days in the dark at 24-26°C and 75% field moisture capacity.

In the soil columns packed with Plainfield sand 60.5-62.8% of the applied was recovered from the uppermost column section (section number 0), 5.6-6.0% of the applied from section number 1, 5.2-6.1% of the applied from section number 2, 5.1-6.3% of the applied from section number 3, 3.2-3.5% of the applied from section number 4, and 1.5-2.2% of the applied from section number 5. Residues in the leachate totaled 7.7-9.0% of the applied. Most of the leachate radioctivity was located in the second leachate fraction, with 2.7-3.3% of the applied.

In the soil columns packed with Kewaunee clay loam soil 59.8-61.8% of the applied was recovered from the uppermost column section (section number 0), 11.5-12.1% of the applied from section number 1, 5.0-5.1% of the applied from section number 2, 2.4-2.8% of the applied from section number 3, 1.6-1.7% of the applied from section number 4, and 1.0-1.3% of the applied from section number 5. Residues in the leachate totaled 3.6% of the applied. Most of the leachate radioactivity was located in the second leachate fraction, with 1.4% of the applied.

METHODOLOGY:

Aging of V-53482:

[Ph-^{14}C]-V-53482 (uniformly phenyl-ring labeled, radiochemical purity 100%, specific activity 551 mCi/g) was purified, then diluted (1.5 mL to 2.5 mL of acetonitrile). The resulting fortification solution averaged 561,778 dpm/10 µL.

A California sandy loam soil (61.2% sand, 30.0% silt, 8.8% clay, 1.44% O.M., pH 7.9) was sieved (2 mm) and divided in 20-gram portions. The soils were fortified with 109 µL of fortification solutions. Also, 1.70 g of water were added to adjust soil moisture to 75% of field moisture capacity. The applied concentration of test material (0.26 µg/g) was estimated to be about three times the maximum application rate.

The treated soils were then aged in the dark for 30 days in a sealed glass chamber connected to three traps for volatiles as follows: charcoal, ethylene glycol, 2-ethoxyethanol:ethanolamine (1:1), and water. Volatile traps were sampled at days 7, 14, 21, and 30. A continuous flow of humidified air was created by vacuum. The system was maintained at 24-26°C.

After 30 days the test samples were removed and analyzed. The soils were extracted three times with portions of acetone: water

(5:1, v/v) and three times with portions of acetone:water (5:1, v/v, adjusted to pH 1 with concentrated HCl). The amount of radioactivity in the two types of extracts was determined by LSC. Each of the combined extracts were analyzed by two-dimensional TLC using the following solvent systems:

ethyl ether (100%)
dichloromethane:acetic acid (10:1, v:v)

The areas in the plates were located by fluorescence quenching under UV light and an image scanner to measure radioactivity. Reference standard solutions were cochromatographed with the sample extracts for product identification.

Portions of the extracted soils were oxidized by combustion and the levels of $^{14}CO_2$ were determined by LSC.

Soil Column Leaching:

Each glass column was cut into six 6-cm segments. The inner diameter was 2-inches (5.1-cm). Two columns per soil type were filled with untreated soil to a uniform density. Two soils were used: a Plainfield sand (92% sand, 3.6% silt, 4.4% clay, 0.22% O.M., pH 6), and a Kewaunee clay loam (33.2% sand, 28% silt, 38.8% clay, 2.13% O.M., pH 7.9). Series of traps for volatiles were located at the top and the bottom of the column. Each series had traps of charcoal, ethylene glycol, 2-ethoxyethanol:ethanolamine (1:1), and water media in that order. The radioactivity in each of the traps was determined by LSC. Three 30-day aged soil samples were combined and added to each column (total of about 60 g of aged soil per column). The total material applied to each column was 13.08-13.20 μg. The aged soil was covered with about 10 g of unfortified sandy loam soil. Approximately 20 inches of 0.01 N to 0.02 N $CaCl_2$ solution were applied to the columns. The application rate was about 0.2 cm/hour.

The amount of radioactivity was determined by LSC for each leachate fraction. Those leachates containing ≥1% of the applied radioactivity were extracted by filtration of a portion through C_{18} extraction columns. The organic extracts were eluted with methanol. The amount of radioactivity in the organic and aqueous phase was determined by LSC.

The leachate extracts were cochromatographed with standard solutions by two-dimensional TLC using the following solvent system:

ethyl acetate (100%)
toluene:ethyl formate:formic acid (5:7:1, v:v:v)

The areas in the plates were located by fluorescence quenching under UV light and an image scanner to measure radioactivity. Reference standard solutions were cochromatographed with the sample extracts for product identification. Selected plates were confirmed by autoradiography.

Duplicate portions of the soil sections were homogenized, oxidized by combustion, and the $^{14}CO_2$ determined by LSC. The soil sections containing ≥10% of the applied radioactivity plus two sections containing <10% of the applied radioactivity were extracted with three portions of acetone:water (5:1) (Extract 1), then with three portions of acetone:water (5:1, v:v, adjusted to pH 1 with concentrated HCl) (Extract 2). The extracts were counted by LSC; portions of the soils were combusted and the resulting $^{14}CO_2$ measured by LSC. Extracts 1 and 2 above were analyzed by two-dimensional TLC system using the same solvent system used for leachate extracts.

Extracts 1 and 2 for section 0 were combined and analyzed by TLC separately using the same system described for the leachate extracts. The presence of V-53482 in the soil extracts was confirmed by analysis by HPLC using a mobile phase of acetonitrile and water, and both UV and radioactivity detection.

One representative extracted soil containing the highest radioactivity was refluxed three times with acetonitrile:methanol: 0.1 N HCl (25:15:10, v:v:v) for 1 hour. The reflux extracts were combined, counted by LSC, concentrated by evaporation and filtered. The filtrates were analyzed by one-dimensional TLC using chloroform:methanol:formic acid:water (30:35:2:1). A diffused region was observed from the origin to the center of the plate. The refluxed soil was further extracted for humic and fulvic acids determination.

RESULTS:

Radioactivity in the aged soil:

After 30 days aging, 29.2% of the radioactivity remained as V-53482. About 6.5% of the applied radioactivity was found in the 2-ethoxyethanol:ethanolamine (1:1) trap. Several components (≤6.3% of the applied) were detected in the TLC plates of the organic extracts of the soil. About 41.6% of the applied radioactivity was found in the extracted soils. The recoveries after 30 days were 101.0% of the applied.

Radioactivity in the soil columns and leachate:

The recoveries of radioactivity of the soil and leachates ranged from 89.5-95.8%. The radioactivity found in the traps was ≤1.9% of the applied. The radioactivity found in the walls of the columns was ≤0.2% of the applied.

The soils of the Plainfield sand columns contained 83.4-84.6% of the applied radioactivity. Most of this radioactivity (60.5-62.8% of the applied) remained in the uppermost column section. The corresponding leachates contained 7.7-9.0% of the applied radioactivity.

In contrast, the soils from the Kewaunee clay loam soil columns contained 81.6-84.5% of the applied radioactivity. Most of this radioactivity (59.8-61.8% of the applied) remained in the uppermost column section. Leachates contained a smaller fraction (3.6%) of the applied radioactivity.

TLC autoradiographs show the presence of several (at least 6) minor components in the leachate extracts at ≤0.3% of the applied. V-53482 was a maximum of 0.1% of the applied in the Plainfield sand leachate. The following degradates were identified by TLC: 482-CA, IMOXA, 482-HA, and APF. The presence of V-53482 was confirmed by TLC.

TLC autoradiographs of the soil extracts show the presence of V-53482 and various (at least 3) other minor components at ≤1.1% of the applied. V-53482 comprised a total of 7.5% of the applied in the Plainfield sand, and 11.0% of the applied in the Kewaunee clay loam soil. Other minor components identified in the soil extracts were: 482-CA, IMOXA, 482-HA, and APF. The presence of V-53482 was confirmed by TLC.

Further analysis of the extracted soils of the uppermost section of the Plainfield sand column shows the presence of 2.4% of humic acid, 12.4% of fulvic acid, and 25.5% of humin.

COMMENTS:

1. This study provides information about the mobility of aged [^{14}C-Ph]-V-53482. The registrant submitted previously a study using the same radioactive material and only two soils. This study provides additional information about the mobility of V-53482 in two additional soils. Taken together, both studies satisfy the Mobility of Aged V-53482 data requirement. No additional data are required.

2. This study was conducted using only phenyl ring-labeled V-53482. However, since the Aerobic Soil Metabolism study using [^{14}C-THP]-V-53482 showed the presence of no major degradates, EFGWB does not require any additional studies using aged [^{14}C-THP]-V-53482 at this time.

3. The parent compound was aged in soils for 30 days under aerobic conditions. After this period only 29.2% of the radioactivity remained as parent compound. According to Subdivision N Guidelines, the test substance should be applied to the soil and incubated aerobically for 30 days or one half-life, whichever is shorter. The registrant indicated that 30 days was the test interval when the largest amount of polar metabolites were produced in the aerobic soil metabolism study.

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4. A continuous flow of humidified air in the aerobic aging system was created by vacuum. The flow was measured four times during the process (days 0, 7, 14, and 21). The flow rates ranged as follows: 163-183 mL/min.

5. The efficiency of the soil oxidation procedure was determined using the two soil types, fortified at three levels of radioactivity. The oxidation efficiency ranged from 96 to 110%.

6. In order to determine the recoveries of radioactivity of the two dimensional TLC procedure, one representative soil and one representative leachate extract were tested. The TLC plate was divided into various areas and scrapings analyzed by LSC. The recoveries were 94.0 to 108.9%.

7. The registrant used two-dimensional TLC to determine the identity of some of the metabolites present in the soil and leachate samples. HPLC was used to confirm the identity of parent V-53482. EFGWB prefers that samples be identified by a chromatographic technique such as LSC or LC, and positive identification confirmation be performed with a diferent technique such as MS.

8. The California College sandy loam used for the aerobic aging process had a pH of 7.9. The Kewaunee clay loam had a pH of 7.9. The Hydrolysis study (MRID# 42684906) demonstrated that higher pH's favor degradation of parent V-53482.

9. The applied concentration of test material (0.26 μg/g) was calculated to be about three times the maximum application rate.

10. Three soil types were used in this study: a California College sandy loam, a Plainfield sand, and a Kewaunee clay loam. The California College sandy loam, used for the aging of V-53482, is the soil that was used in the aerobic soil metabolism study.

11. The registrant did not attempt to calculate K_d values for V-53482 residues.

der83b
jlm

Table I

Mean Summary of Radioactivity Found in Soil Matrices and Volatile Traps During Aging Process

Sample Interval (Day)	Mean Radioactivity Applied to Sample (%)														
	Radioactivity Detected on the TLC Plates for Soil Extracts 1 and 2[a]														
	V-53482	Origin	Area 1	482-CA	482-HA	Area 4	IMOXA	Area 6	Unresolved	Total	Extracted Soil[b]	Ethylene Glycol Trap[b]	2-E:E Trap[b]	Charcoal Trap[b]	Material Balance[c]
0	96.0	<0.1	ND	ND	0.8	ND	ND	ND	0.4	97.2	2.9	NA	NA	NA	100.1
30	29.2	6.3	2.1	1.6	1.4	0.2	2.6	2.4	7.1	52.9	41.6	ND	6.5	<0.1	101.0

ND Not detected.
NA Not applicable.
2-E:E 2-Ethoxyethanol:ethanolamine (1:1).

a TLC plates were developed in ethyl ether (100%) (Dimension 1) and dichloromethane:acetic acid (10:1) (Dimension 2).
b Values from Appendix C.
c Sum of mean values.

Areas 1, 4, and 6 = Unknown

Table II

Summary of Total Radioactivity Found among the Soil Column Matrices

Column Number	Radioactivity Applied to Column (%)											
	Leachate[a]			Soil[b]			Traps			Rinses		
	Leachate Number	Individual	Total	Section Number	Individual	Total	Charcoal (%)	Ethylene Glycol (%)	2E:E (1:1) (%)	Fortification Container (%)	Soil Column (%)	Column Total (%)
					Plainfield Sand							
1	1	0.8	9.0	0	62.8	83.4	ND	ND	1.5	1.8	0.1	95.8
	2	3.3		1	5.6							
	3	2.7		2	5.2							
	4	2.2		3	5.1							
				4	3.2							
				5	1.5							
2	1	0.7	7.7	0	60.5	84.6	ND	ND	1.1	1.7	0.2	95.3
	2	2.7		1	6.0							
	3	2.4		2	6.1							
	4	1.9		3	6.3							
				4	3.5							
				5	2.2							
					Kewaunee Clay Loam							
1	1	0.2	3.6	0	61.8	84.5	ND	ND	1.9	1.5	0.1	91.6
	2	1.4		1	12.1							
	3	1.1		2	5.1							
	4	0.9		3	2.8							
				4	1.7							
				5	1.0							
2	1	0.2	3.6	0	59.8	81.6	ND	ND	1.9	2.4	ND	89.5
	2	1.4		1	11.5							
	3	1.1		2	5.0							
	4	0.9		3	2.4							
				4	1.6							
				5	1.3							

ND Not detected (less than 34 dpm).

a Individual values from Table D-I.
b Individual values from Table E-I.

Table III

Mean Summary of Radioactivity Found in the Leachate[a]

Leachate Number	Mean Radioactivity Applied to Soil Column (%)									
	Extracted Leachate	Leachate Extract								Total Leachate[c]
		V-53482	Origin	482-CA	482-HA	IMOXA	APF	Unresolved	Total[b]	
					Plainfield Sand[d]					
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8[f]
2	1.3	0.1	0.5	0.3	0.3	<0.1	0.1	0.6	1.9	3.2
3	0.8	0.1	0.4	0.3	0.3	0.1	0.2	0.6	2.0	2.8
4	1.0	0.1	0.2	0.2	0.3	<0.1	0.1	0.4	1.3	2.3
					Kewaunee Clay Loam[e]					
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2[f]
2	0.9	ND	0.3	ND	ND	ND	ND	0.2	0.5	1.4
3	0.7	ND	0.2	0.1	<0.1	ND	ND	0.2	0.5	1.2
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.9

NA Not applicable.
ND Not detected.

a Mean of values in Table D-IV.
b Sum of values for leachate extract in this table.
c Sum of values for extracted leachate and leachate extract in this table.
d Leachate contained a total of 8.4% of the applied radioactivity.
e Leachate contained a total of 3.6% of the applied radioactivity.
f Values from Table II.

Table IV

Mean Distribution of Radioactivity Detected on the TLC Plate (Leachate Extract)[a]

Leachate Number	Radioactivity Detected on TLC Plate (%)						
	V-53482	Origin	482-CA	482-HA	IMOXA	APF	Unresolved
			Plainfield Sand				
1	NA	NA	NA	NA	NA	NA	NA
2	2.2	30.0	19.0	12.4	2.5	3.7	30.4
3	5.0	19.6	13.8	16.1	2.3	9.9	33.5
4	3.9	15.8	11.7	25.7	1.6	9.4	32.1
			Kewaunee Clay Soil				
1	NA	NA	NA	NA	NA	NA	NA
2	ND	56.5	ND	ND	ND	ND	43.5
3	ND	37.8	20.9	7.0	ND	ND	34.4
4	NA	NA	NA	NA	NA	NA	NA

NA Not applicable.
ND Not detected.

a Mean of values in Table D-V.

Table V

Mean Summary of Radioactivity Found in the Soil[a]

Section Number	Mean Radioactivity Applied to Soil Column (%)							
	Extracted Soil	Combined Soil Extracts						Total Soil
		V-53482	482-CA	IMOXA	APF	Unresolved	Total[b]	
				Plainfield Sand[d]				
0	49.1	6.4	0.8	0.9	0.3	4.5	12.9	62.0[c]
1	2.2	1.1	ND	0.4	ND	2.3	3.8	6.0[c]
2	NA	NA	NA	NA	NA	NA	NA	5.7
3	NA	NA	NA	NA	NA	NA	NA	5.7
4	NA	NA	NA	NA	NA	NA	NA	3.4
5	NA	NA	NA	NA	NA	NA	NA	1.9
				Kewaunee Clay Loam[e]				
0	46.1	10.3	0.7	1.0	0.9	1.9	14.8	60.9[c]
1	9.2	0.7	ND	1.1	ND	1.0	2.8	12.0[c]
2	NA	NA	NA	NA	NA	NA	NA	5.1
3	NA	NA	NA	NA	NA	NA	NA	2.6
4	NA	NA	NA	NA	NA	NA	NA	1.7
5	NA	NA	NA	NA	NA	NA	NA	1.2

ND Not detected.
NA Not applicable.

a Mean of values in Table E-V.
b Sum of values for soil extracts in this table.
c Sum of values for soil extracts and extracted soil in this table.
d Soil contained a total of 84.0% of applied radioactivity.
e Soil contained a total of 83.1% of applied radioactivity.

Table VI

Mean Distribution of Radioactivity Detected on the TLC Plate for Soil Extracts 1 and 2[a]

Section Number	Radioactivity Detected on TLC Plate (%)									
	Extract 1 V-53482	Extract 2 V-53482	Extract 1 482-CA	Extract 2 482-CA	Extract 1 IMOXA	Extract 2 IMOXA	Extract 1 APF	Extract 2 APF	Extract 1 Unresolved	Extract 2 Unresolved
					Plainfield Sand					
0	75.5	26.7	ND	12.0	4.5	8.7	ND	3.3	20.1	49.3
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
					Kewaunee Clay Loam					
0	92.1	52.2	ND	8.3	4.4	8.4	ND	11.1	3.5	20.2
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

ND Not detected.
NA Not applicable.

a Mean values in Table E-VI.

Table VII

Percentage of Applied Radioactivity in Humin Fraction

Soil Type	Column Number	Section Number	Total Extracted Soil[a]	Extracted Soil Fractions			
				Reflux Extract[b]	Humic Acid[b]	Fulvic Acid[b]	Humin Fraction[c]
Plainfield Sand	1	0	49.7	9.4	2.4	12.4	25.5

a Values from Table E-V.
b Values from Appendix F.
c The percent of applied radioactivity in the extracted soil minus the sum of the percent of applied radioactivity in the reflux extract, fulvic acid, and humic acid fractions.

STUDY (AUTHOR'S) CONCLUSION

CONCLUSIONS

Under aged leaching conditions, most of the radioactivity applied as V-53482 and its metabolites remained in the soil matrix after leaching (83.1% and 84.0% for the clay loam and sand, respectively), and most of that stayed at the applied aged-soil layer and the first section of soil column (average of 72.6% for Kewaunee clay loam and 67.5% for Plainfield sand). It leached, however, more readily in the sand than the clay loam (8.4% and 3.6%, respectively).

Radiolabeled V-53482 degraded on soil under aged leaching conditions. The majority of the radioactivity was incorporated in the soil organic matter. About 7.5% to 11.0% of the soil radioactivity was [Phe-^{14}C]-V-53482. Several minor components were observed: 482-CA, APF, and IMOXA. All these components were less than 0.01 ppm (parent equivalent). The mean amount of radioactivity corresponding to [Phe-^{14}C]-V-53482 in the leachate at the end of the leaching phase ranged from not detected to 0.3%. Several minor components were observed: 482-CA, 482-HA, and IMOXA. All of these components were less than 0.01 ppm (parent equivalent). Volatile components were not detected above 2.0% of the applied radioactivity. Based on the results of this study, and the short degradation half-life of the test material in a soil metabolism study (11.9 days), the potential for [Phe-^{14}C]-V-53482 and its metabolites to leach in the soil is low.