DATA EVALUATION RECORD
STUDY 3

CHEM 129034 S-53482 §163-1

Study ID 42684907 and 42684908

Fathulla, R. N. 1992. Column Leaching Characteristics of [Phe-^{14}C]-V-53482 in Typical Agricultural Soils (Unaged Study). Laboratory project ID HLA 6320-102. Unpublished study performed by Hazelton Laboratories America, Inc., WI, and submitted by Valent U.S.A. Corporation, CA

Fathulla, R. N. 1992. Column Leaching Characteristics of [THP-^{14}C]-V-53482 in Typical Agricultural Soils (Unaged Soils). Laboratory project ID HLA 6320-104. Unpublished study performed by Hazelton Laboratories America, Inc., WI, and submitted by Valent U.S.A. Corporation, CA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 7/21/93

Mobility - Column Leaching, Unaged Soils

CONCLUSIONS:

This study is acceptable and can be used to partially satisfy the Mobility in Soils (163-1) data requirement. No additional data on the mobility of parent V-53482 are required.

The mobility of unaged [^{14}C]-V-53482 (uniformly phenyl ring labeled, and labeled in the 1- and 2-positions of the 3,4,5,6-tetrahydrophthalimido moiety) was low to high in 36-cm soil leaching columns, using four soil types. The soils were treated at an application rate of approximately 0.26 µg/g, which is about three times the maximum field application rate.

The material balance was 92.3-102.8% of the applied.

METHODOLOGY:

[Ph-^{14}C]-V-53482 (uniformly phenyl-ring labeled, radiochemical purity 96.7%, specific activity 418 mCi/g) was dissolved in 3 mL of acetonitrile to make a fortification solution with mean total count of 305405 dpm/5μL. [THP-^{14}C]-V-53482 (labeled in the 1- and 2-positions of the 3,4,5,6-tetrahydrophthalimido moiety, radiochemical purity 96.8%, specific activity 310 mCi/g) was dissolved in acetonitrile to make a fortification solution with confirmed homogeneity.

Four soils were sieved (2-mm) and air dried. The soils included a Plainfield sand (97% sand, 1% silt, 2% clay, 0.3% O.M., pH 5.4), a California College sandy loam (67% sand, 29% silt, 4% clay, 1.2% O.M., pH 7.8), a Mississippi silt loam (29% sand, 58% silt, 13% clay, 1.1% O.M., pH 7.0), and a Kewaunee clay loam soil (21% sand, 47% silt, 32% clay, 5.0% O.M., pH 7.0). 100-g portions of each soil types were placed in glass containers. The Plainfield sand and the California College sandy loam soils were fortified with 370 μL of the [Ph-^{14}C]-V-53482 fortification solution, and 170 μL of the [THP-^{14}C]-V-53482 fortification solution. The Mississippi silt loam and the Kewaunee clay loam soils were fortified with 230 μL of the [Ph-^{14}C]-V-53482 fortification solution, and 135 of the [THP-^{14}C]-V-53482 fortification solution. The applied concentration of test material was calculated to be about three times the maximum field application rate (0.256-0.262 μg/g).

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. 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. About 1030 mL of 0.01 N to 0.02 N $CaCl_2$ were applied to the columns. The application rate averaged 0.65-2.9 cm/hr for the California College sandy loam, the Mississippi silt loam, and the Kewaunee clay loam soils. It averaged 51-122 cm/hr for the Plainfield sand.

The amount of radioactivity was determined by LSC for each leachate fraction. Those leachates containing ≥1% of the applied radioactivity plus three selected leachates containing <1% of the applied radiaoctivity were extracted. Portions of leachate were extracted with isopropyl alcohol and partitioned with ammonium sulfate or calcium chloride. The isopropyl alcohol phase was evaporated and redissolved in ethyl acetate, vortexed and sonicated. In the case of the leachates from the Plainfield Sand fortified with [Ph-^{14}C]-V-53482, portions of about 25-mL were extracted three times with 25-mL portions of dichloromethane. The combined extracts and extracted leachate were weighed and counted by LSC. The leachates from the California College sandy loam

fortified with [THP-^{14}C]-V-53482, were extracted three times with ethyl acetate. The combined extracts and extracted leachate were weighed and counted by LSC.

The leachate extracts were cochromatographed with standard solutions of V-53482 by two-dimensional TLC. The following solvent systems were used:

toluene:ethyl formate:formic acid (5:7:1)
hexane:ethyl acetate (4:3)

The V-53482 reference standard was located by UV-fluorescence quenching. The radioactivity was measured by radioanalytical imaging and autoradiography. Selected aliquots of leachate were concentrated and co-injected with a reference standard in an HPLC using a gradient mobile phase of acetonitrile:water and both UV and radioactivity detection.

Duplicate portions of the soil sections were homogenized, oxidized by combustion, and the $^{14}CO_2$ determined by LSC Additionally, those soils containing ≥10% of the applied radioactivity plus four or five sections containing <10% of the applied were extracted with three portions of acetone:water (5:1) (Extract 1), then with three portions of acetone:1 N HCl (9:1) (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 the two-dimensional TLC system described previously. Selected soil extracts were also analyzed by the HPLC system described before.

RESULTS:

The mobility of unaged [^{14}C]-V-53482 (uniformly phenyl ring labeled, and labeled in the 1- and 2-positions of the 3,4,5,6-tetrahydrophthalimido moiety) was low to high in 36-cm soil leaching columns, using four soil types. The soils were treated at an application rate of approximately 0.26 μg/g, which is about three times the maximum field application rate. The average calculated values obtained are as follows:

	[Ph-^{14}C]			[THP-^{14}C]		
Soil	R_f	K_d	K_{oc}	R_f	K_d	K_{oc}
Plainfield sand	0.61	0.465	265	0.59	0.484	277
California College sandy loam	0.56	0.833	118	0.57	0.744	105
Mississippi silt loam	0.15	11.0	1705	0.30	4.37	675
Kewaunee clay loam	0.08	24.0	816	0.11	14.6	497

The material balance was 92.3-102.8% of the applied. The

majority of the radioactivity detected was identified as parent V-53482. Several minor degradation components were present at ≤10% of the applied.

[Ph-^{14}C]-V-53482

[Ph-^{14}C]-V-53482 showed low mobility in a Mississippi silt loam and a Kewaunee clay loam soils. The estimated K_d values are 8.70-13.4 and 18.9-29.0 for the the silt loam and the clay loam soils, respectively. Respective K_{oc} values are 1340-2070 and 644-986. The estimated TLC R_f values are 0.12-0.17 for the silt loam soil, and 0.06-0.09 for the clay loam soil. [Ph-^{14}C]-V-53482 showed moderate mobility in a Plainfield sand. The estimated K_d, K_{oc}, and TLC R_f values are 0.454-0.477, 258-271, and 0.61, respectively. [Ph-^{14}C]-V-53482 showed high mobility in a California College sandy loam soil. The estimated K_d, K_{oc}, and TLC R_f values are 0.783-0.884, 111-125, and 0.54-0.57, respectively.

[^{14}C] residues in the leachate fractions totaled 63.0-71.8%, 48.0-54.1%, 5.5-9.0%, and 2.4-3.6% of the applied for the Plainfield sand, California College sandy loam, Mississippi silt loam, and Kewaunnee clay loam soils, respectively.

[THP-^{14}C]-V-53482

[THP-^{14}C]-V-53482 showed moderate mobility in a Plainfield sand and a Kewaunee clay loam soils. The estimated K_d values are 0.418-0.555 and 13.2-16.0 for the the sand and the clay loam soils, respectively. Respective K_{oc} values are 238-315 and 449-544. The estimated TLC R_f values are 0.55-0.62 for the sand, and 0.10-0.12 for the clay loam soil. [THP-^{14}C]-V-53482 showed low mobility in a Mississippi silt loam soil. The estimated K_d, K_{oc}, and TLC R_f values are 4.36-4.37, 674-675, and 0.30, respectively. [THP-^{14}C]-V-53482 showed high mobility in a California College sandy loam soil. The estimated K_d, K_{oc}, and TLC R_f values are 0.709-0.779, 100-110, and 0.55-0.59, respectively.

[^{14}C] residues in the leachate fractions totaled 58.5-69.1%, 51.9-57.0%, 14.8%, and 4.4-5.4% of the applied for the Plainfield sand, California College sandy loam, Mississippi silt loam, and Kewaunnee clay loam soils, respectively.

COMMENTS:

1. All four soils tested were analyzed for presence of microorganisms prior to study initiation. Results showed that there was a viable microbial population in all soil types.

2. There is a typographical error in one of the study reports (MRID# 42684907). On page 16, the authors cite the Fortification Solution Preparation section as Page 13. It is actually on page 15 of the text.

3. According to the study, in the Mississippi silt loam and Kewaunee clay loam soils, there was a substantial quantity of soil adhered to the columns and containers. Rinses of acetone were collected and counted by LSC. The amount of radioactivity found was ≤4.0% of the applied.

4. In order to determine the recoveries of radioactivity of the two-dimensional TLC procedure, one soil and one leachate extracts were tested. The TLC plate was divided into various areas and scrapings analyzed by LSC. The recoveries were 95.4-102.4%.

5. The efficiency of the soil oxidation procedure was also determined using all four soils, fortified at three levels of radioactivity. The oxidation efficiency factor ranged from 0.950 to 1.07.

6. Less than 0.1% of the radioactivity was found in the traps for volatile components, indicating little volatilization during the process.

7. Leachate samples were extracted and analyzed on the day of collection or stored in a freezer for ≤3 weeks. No storage stability was provided.

8. The registrant used a column leaching protocol to assess the mobility of V-53482 because the rapid hydrolysis of the chemical precluded the use of batch equilibrium methods.

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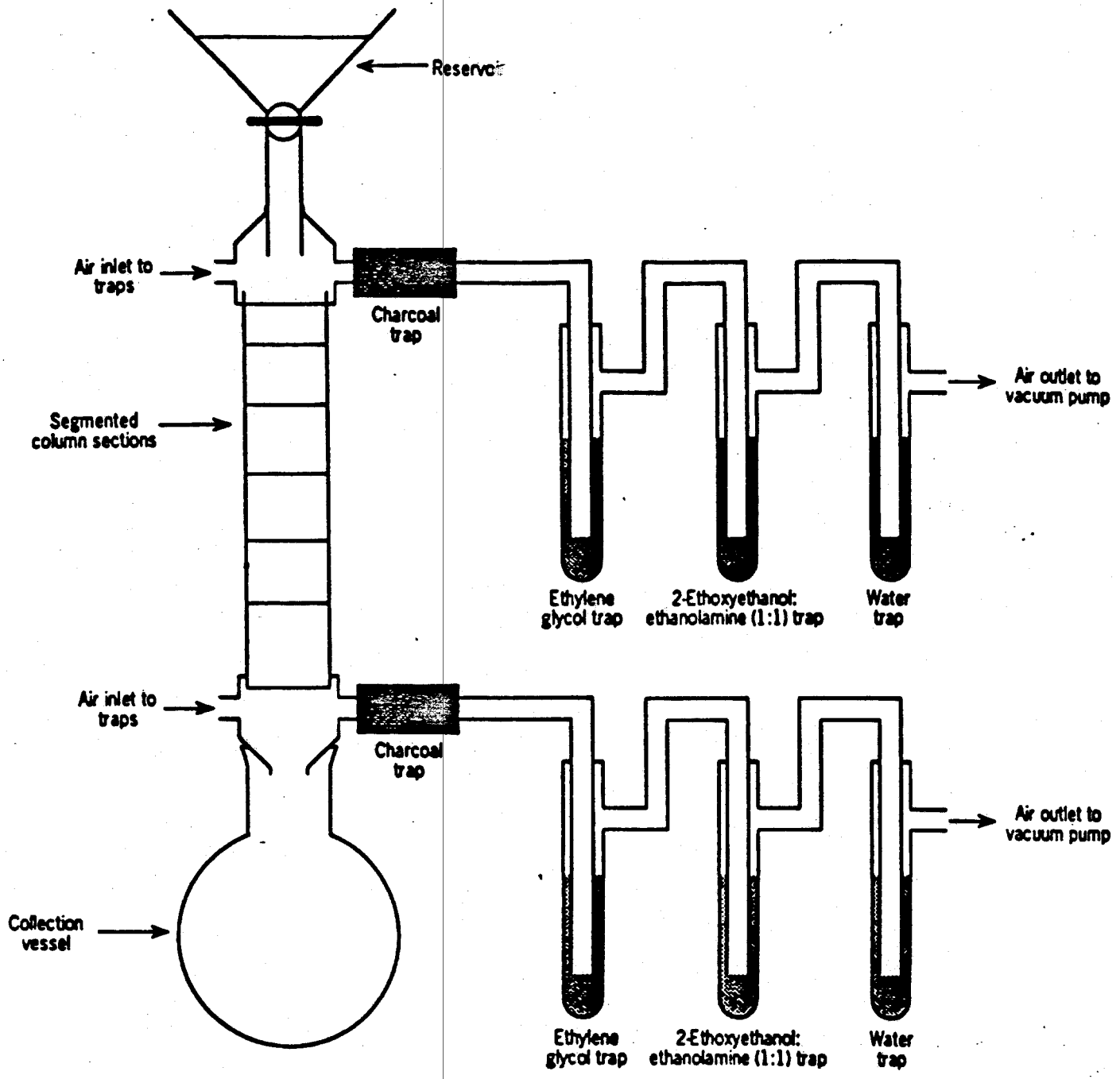

Figure 2. Schematic diagram of the column leaching apparatus.

[Phe-^{14}C]-V-53482

Table I

Summary of the Total Radioactivity Found among the Soil Column Matrices

Column Number	Individual Radioactivity Applied to Column (%)								
	Leachate[a]			Soil[b]			Rinse		
	Leachate Number	Individual	Total	Section Number	Individual	Total	Column	Soil Container	Column Total
					Plainfield Sand				
1	1	37.0	71.8	0	17.8	31.0	NA	NA	102.8
	2	27.3		1	4.2				
	3	6.2		2	1.9				
	4	1.3		3	2.3				
				4	2.6				
				5	2.2				
2	1	31.1	63.0	0	18.6	32.4	NA	NA	95.4
	2	19.1		1	5.5				
	3	9.3		2	1.7				
	4	3.5		3	2.3				
				4	1.6				
				5	2.7				
					California College Sandy Loam				
1	1	0.5	48.0	0	10.0	49.3	NA	NA	97.3
	2	12.9		1	13.4				
	3	19.3		2	8.3				
	4	15.3		3	6.5				
				4	5.3				
				5	5.8				
2	1	0.3	54.1	0	11.3	43.1	NA	NA	97.2
	2	21.6		1	10.9				
	3	19.2		2	7.0				
	4	13.0		3	4.8				
				4	4.3				
				5	4.8				
					Mississippi Silt Loam				
1	1	ND	9.0	0	7.0	79.6	2.6	1.1	92.3
	2	0.7		1	14.3				
	3	2.5		2	26.1				
	4	5.8		3	20.8				
				4	7.5				
				5	3.9				
2	1	0.2	5.5	0	7.2	83.4	2.9	1.1	92.9
	2	0.4		1	16.2				
	3	2.0		2	24.8				
	4	2.9		3	23.9				
				4	7.7				
				5	3.6				
					Kewaunee Clay Loam				
1	1	0.1	3.6	0	40.4	88.6	1.5	1.2	94.9
	2	0.9		1	38.1				
	3	1.5		2	6.3				
	4	1.1		3	1.5				
				4	1.3				
				5	1.0				
2	1	0.1	2.4	0	45.4	89.4	1.1	1.7	94.6
	2	0.6		1	28.8				
	3	1.0		2	11.8				
	4	0.7		3	1.5				
				4	1.1				
				5	0.8				

NA Not applicable (samples not analyzed).
ND Not detected.

a Individual leachate values from Appendix C; Table C-I.
b Individual soil values from Appendix D; Table D-I.

Table II

Mean Summary of Radioactivity Found in the Leachate[a]

Leachate Number	Extracted Leachate	Mean Percent of Applied Radioactivity TLC Distribution found in the Leachate Extract V-53482	Origin	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Unresolved	Total[b]	Total Leachate[b]
Plainfield Sand												
1	0.8	32.5	ND	ND	0.4	ND	0.3	ND	ND	0.2	33.4	34.2
2	1.1	22.0	<0.1	ND	ND	ND	ND	ND	ND	0.2	22.2	23.3
3	0.2	7.5	<0.1	ND	0.2	ND	ND	ND	ND	ND	7.7	7.9
4	0.1	2.3	ND	ND	0.1	ND	ND	ND	ND	ND	2.4	2.5
California College Sandy Loam												
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4[a]
2	ND	11.0	1.2	ND	1.3	0.3	ND	ND	0.3	3.2	17.3	17.3
3	<0.1	13.8	1.7	ND	0.6	0.2	ND	ND	ND	3.1	19.4	19.4
4	<0.1	11.2	1.0	ND	ND	ND	ND	ND	ND	2.1	14.3	14.3
Mississippi Silt Loam												
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1[a]
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6[a]
3	ND	0.8	0.2	0.1	0.5	0.1	0.1	0.1	ND	0.6	2.5	2.5
4	ND	1.7	0.5	0.2	0.5	0.2	0.1	0.2	ND	1.2	4.6	4.6
Kewaunee Clay Loam												
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1[a]
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8[a]
3	ND	0.3	0.1	0.1	0.3	0.1	0.3	ND	ND	0.2	1.4	1.4
4	ND	0.3	0.1	0.1	0.2	0.1	0.2	ND	ND	0.2	1.2	1.2

NA Not applicable (samples not analyzed).
ND Not detected.

a Mean of values in Appendix C; Table C-IV.
b Sum of values in this table. This total may not agree with the total in Table I due to rounding.

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Table III

Mean Summary of Radioactivity Found in the Soil Sections[a]

Section Number	Extracted Soil	Mean Percent of Applied Radioactivity TLC Distribution found in the Soil EXtract										Total Soil[b]
		V-53482	Origin	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Unresolved	Total[b]	
						Plainfield Sand						
0	0.9	12.8	3.2	ND	ND	ND	0.3	ND	ND	1.2	17.5	18.4
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.9[a]
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.8[a]
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.3[a]
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.1[a]
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.5[a]
						California College Sandy Loam						
0	2.8	6.4	0.5	ND	ND	ND	0.6	ND	ND	0.5	8.0	10.8
1	3.3	6.7	1.0	ND	ND	ND	0.8	ND	ND	0.5	9.0	12.3
2	2.7	3.4	0.3	0.2	0.4	0.2	ND	ND	ND	0.7	5.2	7.9
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.7[a]
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.7[a]
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.8[a]
						Mississippi Silt Loam						
0	1.0	5.0	0.1	0.2	0.3	0.2	ND	0.1	ND	0.4	6.3	7.3
1	1.9	10.6	1.4	0.2	0.4	0.1	ND	0.1	0.2	0.6	13.6	15.5
2	2.6	19.5	1.5	0.6	0.2	0.2	<0.1	ND	0.2	0.8	23.0	25.6
3	2.0	15.9	2.0	0.9	0.2	0.2	0.2	ND	0.2	1.0	20.6	22.6
4	1.0	5.6	0.2	0.1	0.3	0.1	ND	ND	0.1	0.3	6.7	7.7
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.6[a]
						Kewaunee Clay Loam						
0	5.0	32.8	1.9	0.6	0.6	ND	ND	ND	ND	2.1	38.0	43.0
1	5.4	24.4	2.1	ND	0.3	ND	ND	ND	ND	1.3	28.1	33.5
2	1.6	6.5	0.4	0.1	0.3	ND	0.1	ND	ND	0.3	7.7	9.3
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.1[a]
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5[a]
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2[a]

NA Not applicable (samples not analyzed).
ND Not detected.

a Mean of values in Appendix D; Table D-IV.
b Sum of values in this table. This total may not agree with the total in Table I due to rounding.

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[Phe-^{14}C]-V-53482

Table IV

Determination of K_d and K_{oc} Values

Column Number	Soil Organic Carbon (%)	Soil Weight in Column Initial (g)	Soil Weight in Column Saturated (g)	Void Volume (g)	V_p (g)	K_d	K_{oc}
			Plainfield Sand				
1	0.176	949.6	1,115.6	166.0	597	0.454	258
2	0.176	950.2	1,165.7	215.5	669	0.477	271
			California College Sandy Loam				
1	0.706	910.6	1,155.3	244.7	1,050	0.884	125
2	0.706	909.9	1,161.9	252.0	964	0.783	111
			Mississippi Silt Loam				
1	0.647	710.0	1,026.8	316.8	6,492	8.70	1,340
2	0.647	710.0	1,040.7	330.7	9,868	13.4	2,070
			Kewaunee Clay Loam				
1	2.94	715.0	982.9	267.9	13,798	18.9	644
2	2.94	715.0	978.4	263.4	20,982	29.0	986

[THP-^{14}C]-V-53482

Table I

Summary of the Total Radioactivity Found among the Soil Column Matrices

Column Number	Individual Radioactivity Applied to Column (%)						
	Leachate[a]			Soil[b]			
	Leachate Number	Individual	Total	Section Number	Individual	Total	Column Total
				Plainfield Sand			
1	1	34.3	69.1	0	11.9	29.6	98.7
	2	24.1		1	5.9		
	3	7.6		2	3.0		
	4	3.1		3	2.6		
				4	3.2		
				5	3.0		
2	1	36.3	58.5	0	17.0	39.1	97.6
	2	12.4		1	10.2		
	3	6.9		2	4.5		
	4	2.9		3	3.4		
				4	2.0		
				5	2.0		
				California College Sandy Loam			
1	1	0.4	57.0	0	5.7	41.5	98.5
	2	25.0		1	11.6		
	3	23.8		2	9.1		
	4	7.8		3	6.6		
				4	4.6		
				5	3.9		
2	1	ND	51.9	0	5.6	45.0	96.9
	2	19.7		1	11.0		
	3	17.3		2	9.7		
	4	14.9		3	7.1		
				4	5.9		
				5	5.7		
				Mississippi Silt Loam			
1	1	0.3	14.8	0	11.8	81.5	96.3
	2	3.0		1	12.8		
	3	8.8		2	15.3		
	4	2.7		3	14.3		
				4	16.5		
				5	10.8		
2	1	1.1	14.8	0	5.3	87.0	101.8
	2	2.2		1	11.3		
	3	7.5		2	17.2		
	4	4.0		3	23.3		
				4	21.9		
				5	8.0		
				Kewaunee Clay Loam			
1	1	0.4	5.4	0	44.0	93.3	98.7
	2	1.8		1	22.7		
	3	1.7		2	19.3		
	4	1.5		3	4.6		
				4	1.8		
				5	0.9		
2	1	0.3	4.4	0	41.6	89.0	93.4
	2	1.8		1	25.4		
	3	1.5		2	12.7		
	4	0.8		3	6.5		
				4	1.9		
				5	0.9		

ND Not detected.

a Individual leachate values from Appendix C; Table C-VI.
b Individual soil values from Appendix D; Table D-V

Values for "a" and "b" may vary slightly in other tables due to rounding.

Table II

Mean Summary of Radioactivity Found in the Leachate[a]

Leachate Number	Extracted Leachate	Mean Percent of Applied Radioactivity TLC Distribution found in the Leachate Extract																Total Leachate[b]
		V-53482	Origin	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Area 11	Area 12	Unresolved	Total[b]	
Plainfield Sand																		
1	3.4	21.6	0.9	0.4	0.6	0.5	0.8	1.4	1.5	0.3	3.8	0.3	ND	ND	ND	ND	32.1	35.5
2	1.3	11.3	0.3	0.2	0.3	0.3	0.3	0.6	0.8	0.2	2.8	0.1	ND	ND	ND	<0.1	17.2	18.5
3	0.6	4.7	0.2	<0.1	0.1	0.1	0.1	0.5	0.4	0.1	0.6	0.1	ND	ND	ND	<0.1	6.9	7.5
4	0.3	2.1	0.1	ND	ND	ND	0.1	0.1	0.1	ND	0.5	ND	ND	ND	ND	<0.1	3.0	3.3
California College Sandy Loam																		
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2[a]
2	7.3	1.9	4.4	0.9	1.0	0.6	2.3	1.3	0.8	0.6	0.7	0.8	ND	0.2	ND	<0.1	15.5	22.8
3	7.4	1.3	1.9	0.6	0.4	0.4	2.5	0.9	0.9	0.5	0.5	2.8	0.1	0.3	0.4	ND	13.5	20.9
4	2.7	0.8	1.2	0.3	0.2	0.8	1.5	0.2	0.4	0.3	0.5	2.0	ND	0.2	0.5	ND	8.9	11.6
Mississippi Silt Loam																		
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.7[a]
2	1.0	0.5	<0.1	ND	ND	ND	0.5	ND	ND	ND	ND	0.7	ND	ND	ND	<0.1	1.7	2.7
3	1.5	1.6	ND	ND	ND	ND	2.1	ND	ND	ND	ND	3.1	ND	ND	ND	<0.1	6.8	8.3
4	0.5	1.0	ND	ND	ND	ND	0.6	ND	ND	ND	ND	1.3	ND	ND	ND	<0.1	2.9	3.4
Kewaunee Clay Loam																		
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4[a]
2	0.9	0.2	<0.1	ND	ND	ND	0.4	ND	ND	ND	ND	0.3	ND	ND	ND	<0.1	0.9	1.8
3	0.7	0.2	ND	ND	ND	ND	0.5	ND	ND	ND	ND	0.3	ND	ND	ND	ND	1.0	1.7
4	0.5	0.2	ND	ND	ND	ND	0.3	ND	ND	ND	ND	0.3	ND	ND	ND	ND	0.8	1.3

NA Not applicable (samples not analyzed).
ND Not detected.

a Mean of values in Appendix C; Table C-VI.
b Sum of values in this table.

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Table III

Mean Summary of Radioactivity Found in the Soil Sections[a]

Section Number	Mean Percent of Applied Radioactivity TLC Distribution found in the Soil Extract											
	Extracted Soil	V-53482	Origin	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Unresolved	Total[b]	Total Soil[b]
						Plainfield Sand						
0	1.3	12.0	ND	ND	0.3	0.1	0.8	0.1	ND	ND	13.3	14.6
1	0.8	8.7	<0.1	ND	0.5	ND	0.2	ND	ND	ND	9.4	10.2
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.8[a]
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0[a]
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6[a]
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.5[a]
						California College Sandy Loam						
0	1.0	3.9	ND	ND	0.1	ND	0.7	ND	0.2	ND	4.9	5.9
1	2.8	7.2	ND	ND	0.4	ND	0.3	ND	0.7	ND	8.6	11.4
2	2.9	5.9	ND	ND	0.3	ND	ND	ND	0.4	ND	6.6	9.5
3	1.1	3.9	ND	ND	0.8	ND	ND	ND	1.3	ND	6.0	7.1
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.3[a]
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.8[a]
						Mississippi Silt Loam						
0	0.7	7.0	ND	0.4	ND	ND	0.5	ND	ND	ND	7.9	8.6
1	1.1	10.0	0.1	0.1	0.5	0.1	0.4	ND	ND	ND	11.2	12.3
2	1.0	13.7	0.1	ND	0.8	ND	0.2	0.6	ND	ND	15.4	16.4
3	0.7	16.5	0.1	ND	0.7	ND	0.6	ND	0.3	ND	18.2	18.9
4	0.7	17.6	0.1	ND	0.8	ND	0.1	0.1	ND	ND	18.7	19.4
5	0.4	8.2	0.1	0.1	0.2	0.3	0.2	ND	ND	0.1	9.2	9.6
						Kewaunee Clay Loam						
0	9.0	32.6	ND	ND	0.4	ND	0.9	ND	ND	ND	33.9	42.9
1	4.8	18.8	ND	ND	0.3	ND	0.2	ND	ND	ND	19.3	24.1
2	1.3	13.0	0.2	ND	0.7	0.2	0.1	0.1	0.7	ND	15.0	16.3
3	0.2	5.6	0.1	ND	0.3	ND	0.2	0.1	ND	<0.1	6.3	6.5
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.9[a]
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.9[a]

NA Not applicable (samples not analyzed).
ND Not detected.

a Mean of values in Appendix D; Table D-V.
b Sum of values in this table.

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Table IV

Determination of K_d and K_{oc} Values

Column Number	Soil Organic Carbon (%)	Soil Weight in Column Initial (g)	Soil Weight in Column Saturated (g)	Void Volume (g)	V_p (g)	K_d	K_{oc}
			Plainfield Sand				
1	0.176	949.8	1,161.9	212.1	609	0.418	238
2	0.176	950.1	1,164.7	214.6	742	0.555	315
			California College Sandy Loam				
1	0.706	909.8	1,146.1	236.3	881	0.709	100
2	0.706	910.1	1,140.4	230.3	939	0.779	110
			Mississippi Silt Loam				
1	0.647	710.5	951.6	241.1	3,346	4.37	675
2	0.647	710.5	951.6	241.1	3,340	4.36	674
			Kewaunee Clay Loam				
1	2.94	715.1	949.2	234.1	9,686	13.2	449
2	2.94	715.1	960.6	245.5	11,688	16.0	544

Study author(s)'s results and/or conclusions

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RESULTS

Material Balance

The values for the total applied radioactivity found among the column matrices are in Table I. The mass balance (recovery of applied radioactivity) for the eight columns was from 92.3% to 102.8% indicating that any amount of test material lost through volatility, adsorption to the column walls, or experimental error was small. The recovered radioactivity ranged from 2.4% to 71.8% of that applied for the leachate and 31.0% to 89.4% for the soil. Less than 0.1% of the applied radioactivity was found in the traps for volatile components. A small amount of the applied radioactivity (2.7% to 4.0%) was found on the column and soil container walls for the Mississippi Silt Loam and Kewaunee Clay Loam soils.

Leachate

Summary of Radioactivity Found in the Leachate. The mean summary values for the applied radioactivity found in the leachate are in Table II. Individual values are found in Appendix C. Detailed data tables and calculation methods for the percentage of applied radioactivity found in the leachate are in Appendix C. Most of the recovered radioactivity in the leachate was found in the extract; the mean extraction efficiency ranged from 95.3% to 100%.

Relative Distribution of Radioactivity Detected on the TLC Plate for the Leachate Extract. Autoradiographs of the TLC plates indicated the presence of at least eight components in the leachate extract: [Phe-^{14}C]-V-53482, material at the origin (Origin), and Areas 1 through 6. A small amount of radioactivity (a mean of 3.2% or less of that applied) not corresponding to any distinct area was also observed (Unresolved) in individual leachate extracts.

Because of the low amount of radioactivity, some areas of radioactivity detected by autoradiography were not visible on radioactivity imaging scans. However, based on the autoradiographs, the areas not visible on the scans were quantified by a radioanalytical imaging system. Representative imaging scans are in Figures 3 through 6. The mean and individual values for the relative distribution of radioactivity detected on the TLC plate are in Appendix C.

TLC Distribution of Radioactivity Expressed as the Percentage of Radioactivity Applied to the Column. The mean values for the TLC distribution of radioactivity expressed as the percentage of radioactivity applied to the column are in Table II; individual values are in Appendix C. The mean total extractable radioactivity in the leachate corresponding to [Phe-^{14}C]-V-53482 was 64.3% (Plainfield Sand), 36.0% (California College Sandy Loam), 2.5% (Mississippi Silt Loam), and 0.6% (Kewaunee Clay Loam) of that applied. The individual mean total applied radioactivity corresponding to Origin and Areas 1 through 6 did not exceed 1.7% (less than 0.01 ppm at the field application rate) for any one area.

Confirmation of [Phe-^{14}C]-V-53482 in the Leachate Extract. The presence of [Phe-^{14}C]-V-53482 in the leachate was confirmed by 2-D TLC and HPLC. A representative chromatogram in Figure 11 shows the coelution of the V-53482 reference standard and radioactive leachate component.

Soil

Summary of Radioactivity Found in the Soil. The mean summary values for the applied radioactivity found in the soil are in Table III; individual values, detailed data tables and calculation methods for the percentage of applied radioactivity found in the soil are in Appendix D. Most of the radioactivity in the soil was extractable and found in the organic extract. The mean extraction efficiency ranged from 65.8% to 95.1%; the mean amount of radioactivity remaining in the extracted soil did not exceed 5.4% of the applied activity.

Relative Distribution of Radioactivity Detected on the TLC Plate for the Soil Extract. Autoradiographs of the TLC plates indicated the presence of at least eight components in the soil extract: [Phe-^{14}C]-V-53482, material at the origin (Origin), and Areas 1 through 6. A small amount of radioactivity (a mean of 2.1% or less of that applied) not corresponding to any distinct area was also observed (Unresolved) in individual soil extracts.

Because of the low amount of radioactivity, some areas of radioactivity detected by autoradiography were not visible on radioactivity imaging scans. However, based on the autoradiographs, the areas not visible on the scans were quantified by a radioanalytical imaging system. Representative imaging scans are in Figures 7 through 10. The mean and individual values for the relative distribution of radioactivity detected on the TLC plate are in Appendix D.

TLC Distribution of Radioactivity Expressed as the Percentage of Radioactivity Applied to the Column. The mean values for the TLC distribution of radioactivity expressed as the percentage of radioactivity applied to the column are in Table III; individual values are in Appendix D. The mean total extractable radioactivity in the soil corresponding to [Phe-^{14}C]-V-53482 was 12.8% (Plainfield Sand), 16.5% (California College Sandy Loam), 56.6% (Mississippi Silt Loam), and 63.7% (Kewaunee Clay Loam) of that applied. The mean applied radioactivity corresponding to Origin and Areas 1 through 6 did not exceed 3.2% (less than 0.01 ppm at the field application rate) for any one section.

Confirmation of [Phe-^{14}C]-V-53482 in the Soil Extract. The presence of [Phe-^{14}C]-V-53482 in the soil was confirmed by 2-D TLC and HPLC. A representative chromatogram in Figure 12 shows the coelution of the V-53482 reference standard and radioactive soil component.

Relative Mobility of the Test Material in Soil

The calculated K_d and K_{oc} values are in Table IV. The calculated soil TLC R_f values are summarized below.

Column Number	Plainfield Sand	California College Sandy Loam	Mississippi Silt Loam	Kewaunee Clay Loam
1	0.61	0.54	0.17	0.09
2	0.61	0.57	0.12	0.06
Mean	0.61	0.56	0.15	0.08

A mobility class based on mean estimated soil TLC R_f value was assigned to the soils used in this study.

Soil	Mobility Class	Mobility Class Description
Plainfield Sand	3	Intermediate
California College Sandy Loam	3	Intermediate
Mississippi Silt Loam	2	Low
Kewaunee Clay Loam	1	Immobile

For comparison, the mobility class of [Phe-^{14}C]-V-53482 was also determined using the scheme for K_{oc} values. The calculated K_{oc} values are summarized below:

Soil	Koc	Mobility Class
Plainfield Sand	265	Medium
California College Sandy Loam	118	High
Mississippi Silt Loam	1,705	Low
Kewaunee Clay Loam	816	Low

The mean R_f value (0.35) for [Phe-^{14}C]-V-53482 corresponds to the mobility class 3 (Intermediate). This is in close comparison with the mobility class (Low) of the test material based on its mean K_{oc} value (726).

CONCLUSIONS

Generally [Phe-^{14}C]-V-53482 leached at different rates in the typical agricultural soils used in this study. The mean amount of total applied radioactivity leached from the soil columns for Mississippi Silt Loam and Kewaunee Clay Loam (7.3% and 3.0%, respectively) was less than that leached from Plainfield Sand and California Sandy Loam (67.4% and 51.1%, respectively), and it was vice versa for the amount of radioactivity retained in the soil columns.

The mobility classification of V-53482 was low to intermediate and low to high using calculated R_f and K_{oc} values, respectively.

The amount of soil and leachate radioactivity corresponding to [Phe-^{14}C]-V-53482 at the end of the leaching phase ranged from 52.5% to 77.1%. Several minor degradation components were observed at levels less than 0.01 ppm when converted to the normal field application rate. Volatile components were not detected above 0.1% of the applied radioactivity.

Based on the results of this study, which are in good agreement with the results of the column leaching of [THP-^{14}C]-V-53482 study[5] and based on the aerobic degradation half-life of the test material in the soil metabolism study[6], the potential for V-53482 to leach in soil is low.

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RESULTS

Material Balance

The values for the total applied radioactivity found among the column matrices are in Table I. The mass balance (recovery of applied radioactivity) for the eight columns was from 93.4% to 101.8% indicating that any amount of test material lost through volatility, adsorption to the column walls, or experimental error was small. The recovered radioactivity ranged from 4.4% to 69.1% of that applied for the leachate and 29.6% to 93.3% for the soil. Less than 0.1% of the applied radioactivity was found in the traps for volatile components. A small amount of radioactivity (no more than 0.4% of that applied for any one soil column) was found on the column and soil container walls.

The total amount of leachate and the distribution of radioactivity across the leachates and soil sections for Plainfield Sand and California College Sandy Loam were similar (Table I). The mean total amount of leachate for Plainfield Sand and California College Sandy Loam was 63.8% and 54.5%, respectively. However, as shown by the mean amount of applied radioactivity in Leachate No. 1 (35.3% for Plainfield Sand and 0.2% for California College Sandy Loam), the test material leached more readily in Plainfield sand.

The distribution of radioactivity across the leachates and soil sections for Mississippi Silt Loam and Kewaunee Clay Loam were also similar (Table I). The mean total amount of leachate for Mississippi Silt Loam and Kewaunee Clay Loam was 14.8% and 4.9%, respectively. However, most of the radioactivity remained in the first three sections for Kewaunee Clay Loam, whereas, the radioactivity across the soil sections was more evenly distributed for Mississippi Silt Loam indicating that the test material leached less readily in Kewaunee Clay Loam.

Leachate

Summary of Radioactivity Found in the Leachate. The mean summary values for the applied radioactivity found in the leachate are in Table II; individual values are found in Appendix C. Detailed data tables and calculation methods for the percentage of applied radioactivity found in the leachate are in Appendix C. Most of the radioactivity in the leachate was extractable and found in the extract. Except for California College Sandy Loam, no more than 3.4% of the applied radioactivity remained in any one leachate fraction after the isopropyl alcohol extraction.

Extracted leachates from California College Sandy Loam were further extracted with ethyl acetate, no more than 2.0% of the applied radioactivity remained in any one leachate (Appendix C).

Relative Distribution of Radioactivity Detected on the TLC Plate for the Leachate Extract. Autoradiographs of the TLC plates indicated the presence of at least fourteen components in the leachate extract: [THP-^{14}C]-V-53482, material at the origin (Origin), and Areas 1 through 12. A small amount of radioactivity (less than 0.1% of that applied) not corresponding to any distinct area was also observed (Unresolved) in individual leachate extracts.

Because of the low amount of radioactivity, some areas of radioactivity detected by autoradiography were not visible on radioactivity imaging scans. However, based on the autoradiographs, the areas not visible on the scans were quantified by an imaging scanner. Representative imaging scans are in Figures 3 through 6. The mean and individual values for the relative distribution of radioactivity detected on the TLC plate are in Appendix C.

TLC Distribution of Radioactivity Expressed as the Percentage of Radioactivity Applied to the Column. The mean values for the TLC distribution of radioactivity expressed as the percentage of radioactivity applied to the column are in Table II; individual values are in Appendix C. The mean total extractable radioactivity in the leachate corresponding to [THP-^{14}C]-V-53482 was 39.7% (Plainfield Sand), 4.0% (California College Sandy Loam), 3.1% (Mississippi Silt Loam), and 0.6% (Kewaunee Clay Loam) of that applied. The individual mean total applied radioactivity corresponding to Origin and Areas 1 through 12 did not exceed 4.4% (less than 0.01 ppm when converted to the normal field application rate) for any one leachate.

Confirmation of [THP-^{14}C]-V-53482 in the Leachate Extract. The presence of [THP-^{14}C]-V-53482 in the leachate was confirmed by 2-D TLC and HPLC. A representative chromatogram in Figure 11 shows the coelution of the V-53482 reference standard and radioactive leachate component.

Soil

Summary of Radioactivity Found in the Soil. The mean summary values for the applied radioactivity found in the soil are in Table III; individual values and detailed data tables and calculation methods for the percentage of applied radioactivity found in the soil are in Appendix D. Most of the radioactivity in the soil was extractable and found in the organic extract. The mean extraction efficiency ranged from 69.5% to 96.9%; the mean amount of radioactivity remaining in the extracted soil did not exceed 9.0% of the applied radioactivity.

Relative Distribution of Radioactivity Detected on the TLC Plate for the Soil Extract. Autoradiographs of the TLC plates indicated the presence of at least eight components in the soil extract: [THP-^{14}C]-V-53482, material at the origin (Origin), and Areas 1 through 6. A small amount of radioactivity (a mean of 0.1% or less of that applied) not corresponding to any distinct area was also observed (Unresolved) in individual soil extracts.

Because of the low amount of radioactivity, some areas of radioactivity detected by autoradiography were not visible on radioactivity imaging scans. However, based on the autoradiographs, the areas not visible on the scans were quantified by a radioanalytical imaging system. Representative imaging scans are in Figures 7 through 10. The mean and individual values for the relative distribution of radioactivity detected on the TLC plate are in Appendix D.

TLC Distribution of Radioactivity Expressed as the Percentage of Radioactivity Applied to the Column. The mean values for the TLC distribution of radioactivity expressed as the percentage of radioactivity applied to the column are in Table III; individual values are in Appendix D. The mean total extractable radioactivity in the soil corresponding to [THP-^{14}C]-V-53482 was 20.7% (Plainfield Sand), 20.9% (California College Sandy Loam), 73.0% (Mississippi Silt Loam), and

70.0% (Kewaunee Clay Loam) of that applied. The individual applied radioactivity corresponding to Origin and Areas 1 through 6 did not exceed a total of 3.0% (less than 0.01 ppm when converted to the normal field application rate) for any one area or 1.3% for any one section.

Confirmation of [THP-^{14}C]-V-53482 in the Soil Extract. The presence of [THP-^{14}C]-V-53482 in the soil was confirmed by 2-D TLC and HPLC. A representative chromatogram in Figure 12 shows the coelution of the V-53482 reference standard and radioactive soil component.

Relative Mobility of the Test Material in Soil

The calculated K_d and K_{oc} values are in Table IV. The calculated soil TLC R_f values are summarized below.

Column Number	Plainfield Sand	California College Sandy Loam	Mississippi Silt Loam	Kewaunee Clay Loam
1	0.62	0.59	0.30	0.12
2	0.55	0.55	0.30	0.10
Mean	0.59	0.57	0.30	0.11

A mobility class based on mean estimated soil TLC R_f value was assigned to the soils used in this study.

Soil	Mobility Class	Mobility Class Description
Plainfield Sand	3	Intermediate
California College Sandy Loam	3	Intermediate
Mississippi Silt Loam	2	Low
Kewaunee Clay Loam	2	Low

For comparison, the mobility class of [THP-^{14}C]-V-53482 was also determined using the scheme for K_{oc} values described in the Classification of Relative Mobility section. The calculated K_{oc} values are summarized below:

Soil	K_{oc}	Mobility Class
Plainfield Sand	277	Medium
California College Sandy Loam	105	High
Mississippi Silt Loam	675	Low
Kewaunee Clay Loam	497	Medium

The mean R_f value (0.39) for [THP-^{14}C]-V-53482 corresponds to the mobility class 3 (Intermediate). This is in close comparison with the mobility class (Medium) of the test material based on its mean K_{oc} value (388).

CONCLUSIONS

Generally [THP-^{14}C]-V-53482 leached at different rates in the typical agricultural soils used in this study. The mean amount of total applied radioactivity leached from the soil columns for Mississippi Silt Loam and Kewaunee Clay Loam (14.8% and 4.9%, respectively) was lower than that leached from Plainfield Sand and California Sandy Loam (63.8% and 54.5%, respectively), and it was vice versa for the amount of radioactivity retained in soil columns.

The mobility classification of V-53482 was low to intermediate and low to high using calculated R_f and K_{oc} values, repectively.

The amount of radioactivity at the end of the leaching phase in each soil section or leachate fraction, corresponding to [THP-^{14}C]-V-53482 ranged from 24.9% to 76.1%. Several minor degradation components were observed at levels less than 0.01 ppm when converted to the normal field application rate. Volatile components were not detected above 0.1% of the applied radioactivity.

Based on the results of this study, which is in good agreement with the results of the column leaching of [Phe-^{14}C]-V-53482 study[5] and based on the aerobic degradation half-life of the soil metabolism study[6], the potential for V-53482 to leach in soil is low.