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

OFFICE OF PREVENTION,
PESTICIDES AND TOXIC
SUBSTANCES

February 6, 2001

DP Barcode: D257780
PC Code: 128867

MEMORANDUM

SUBJECT: Adsorption/Desorption & "Aged" Leaching of lambda-cyhalothrin (MRID 44861503 & MRID 44861509)

FROM: Mark Corbin, Environmental Scientist
Environmental Risk Branch 1
Environmental Fate and Effects Division (7507C)

TO: William Sproat, Product Manager
Registration Division (7505C)

Attached are Data Evaluation Records (DER) for the Adsorption/Desorption and "Aged" Leaching studies submitted by the Zeneca Agrochemicals. Average simple partitioning coefficients ranged from 1,970 to 7,610. The Adsorption/Desorption study (MRID 44861503) is deemed marginally acceptable to EFED, while the "Aged" Leaching study (MRID 44861509) is deemed supplemental.

Please note that other DERs may be outstanding under the same DP Barcode.

DATA EVALUATION RECORD

STUDY 1

CHEM 128897 Lambda-cyhalothrin §163-1
CAS No. 91465-08-6
FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 44861503
Muller, K., U. Goggin, and M. C. G. Lane. 1996. Lambda-cyhalothrin : Adsorption and desorption properties in soil and sediment. Laboratory Project ID: 94JH243. Unpublished study performed by Zeneca Limited, Bracknell, Berkshire, UK; and submitted by Zeneca Inc., Wilmington, DE.

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CONCLUSIONS:

Adsorption - Desorption Study

The study provides marginally acceptable data on adsorption and desorption of lambda-cyhalothrin on mineral soils. The data are deemed as marginally acceptable because the soil was sterilized and there was incomplete reporting of material balances for all the test soils. Other issues with the review were associated with the inability to differentiate sorption affinity of isomers, identification of degradation products, and the use of foreign soils. Although these issues have been identified in the study review, EFED believes that repeating the study is not likely to alter interpretation of the data.

Radiolabeled lambda-cyhalothrin, at nominal concentrations of 0.019, 0.038, 0.076, 0.152, and 0.306 μg/ml, had Freundlich adsorption coefficients ranging from 1,500 to 33,000 on ten mineral soils. The Freundlich model exponents (1/n) ranged from 0.80 to 1.2. Average simple partitioning coefficients ranged from 1,970 to 7,610. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} *vs.* organic matter, K_{ads} *vs.* pH and K_{ads} *vs.* clay content were 0.04, 0.05 and 0.19, respectively. These data suggest that lambda-cyhalothrin sorption is not dependent on the soil organic matter content.

The reported data indicate that lambda-cyhalothrin is not expected to be mobile in soil and aquatic environments.

MATERIALS AND METHODS

Five soils (Hyde Farm sandy loam, East Anglia loamy sand, Wisborough Green silty clay loam, ERTC loamy sand, and NRTC silty clay loam soils) and five sediments (Virginia Waters sandy loam, Mesocosm sandy loam, Millstream Pond loamy sand, Iron Hatch sand, and Old Basing sandy loam sediments) were air-dried, sieved (2-mm), and sterilized by gamma-irradiation (p.11; Tables 1 and 2, pp.12-14) for use in the study.

Based on the results of a preliminary study of the adsorption of cyclopropane-labeled [^{14}C]lambda-cyhalothrin [(*S*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*R*,3*R*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate and (*R*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*S*,3*S*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate, radiochemical purity >99%; specific activity 1.38 Gbq/mMol, Zeneca Agrochemicals; pp. 15-16) to Hyde Farm sandy loam soil and Iron Hatch sand sediment (0.5 g soil:30 cm^3 solution; lambda-cyhalothrin concentration 0.038 μg/cm^3), adsorption and desorption equilibration periods of 24 hours were chosen (Table 8, p. 35). Based on the results of previous studies, glass centrifuge tubes and a soil/sediment:solution ratio of 1:60 was chosen for use in the definitive study (p. 16).

For the adsorption phase of the definitive study, aliquots (30 cm^3) of a pesticide-free 0.01 M $CaCl_2$ solution were added to glass centrifuge tubes containing subsamples (0.5 g) of soil or sediment and equilibrated for 16 hours on a shaker (Figure 2, p. 17). The slurries were then treated at nominal concentrations of 0.019, 0.038, 0.076, 0.152, and 0.306 $\mu g/cm^3$ with cyclopropane-labeled [^{14}C]lambda-cyhalothrin, dissolved in 100 μL of acetonitrile (pp. 15, 18). Four treated slurries were prepared for each soil type; additional tubes of pesticide-free soil/sediment:solution slurries remained untreated to serve as controls (Figure 2, p. 17). The slurries were equilibrated by shaking in an end-over-end shaker for 24 hours at 20 ± 2 °C; light conditions were not reported (p. 18). Following the equilibration period, the slurries were centrifuged. Triplicate aliquots of the supernatants were removed from each tube by pipette (p. 18). Aliquots of each supernatant were analyzed for total radioactivity by LSC; the detection limit was not reported. The remaining supernatant was poured into a glass vial and weighed. For two of the four replicates for each soil/sediment, the soil pellet was dried under a stream of compressed air and extracted three times by shaking with acetonitrile (30 cm^3) for 2 hours, followed by centrifugation. The extracts were combined, brought to volume with acetonitrile, and aliquots were analyzed by LSC. The extracted soil was dried under compressed air and analyzed by LSC following combustion (p. 21). Combustion efficiency was >94%; results were corrected for combustion efficiencies.

To determine the quantity of applied radioactivity that had adsorbed to the glass centrifuge tubes during the adsorption equilibration period, tubes were extracted twice by shaking with acetonitrile (p. 19; Figure 2, p. 17). The extracts were combined and analyzed by LSC.

For the desorption phase of the definitive study, a volume of pesticide-free 0.01 M $CaCl_2$ solution equivalent to the volume removed following adsorption was added to the soil/sediment pellets of the remaining two samples of each soil/sediment (p.20). The slurries were equilibrated for 24 hours at 20 ± 2 °C as described. Following equilibration, the slurries were centrifuged and the supernatants and the soil pellets analyzed as previously described for the adsorption phase.

To determine the stability of [^{14}C]lambda-cyhalothrin during the adsorption and desorption phases, aliquots of the supernatant and soil/sediment extracts from a single replicate of the slurries treated at the highest rate (0.306 $\mu g/cm^3$) were analyzed by TLC. Aliquots of the supernatant were partitioned twice into n-hexane (p. 19); the organic fractions were combined and concentrated to dryness under a stream of compressed air (p. 19) . Samples were re-suspended in acetonitrile and filtered (Sartorius minisart SRP25 hydrophobic filter). Aliquots were analyzed by TLC on Sorbsil C-30 plates which were developed in n-hexane:diethyl ether (70:30, v:v; p. 21). Samples were co-chromatographed with nonradiolabeled and radiolabeled reference standards of lambda-cyhalothrin; radioactive areas on the TLC plates were quantified using a radioimage analyzer and were autoradiographed. The soil/sediment extracts were concentrated by

evaporation, filtered (Sartorius minisart SRP25 hydrophobic filter), and aliquots were analyzed by TLC as previously described for the supernatants (pp. 19, 21).

RESULTS/DISCUSSION

The mobility of cyclopropane labeled [^{14}C]lambda-cyhalothrin [(*S*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*R*,3*R*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate and (*R*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*S*,3*S*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate, radiochemical purity >99%], at nominal concentrations of 0.019, 0.038, 0.076, 0.152, and 0.306 μg/cm^3, was determined in five soils (Hyde Farm sandy loam, East Anglia loamy sand, Wisborough Green silty clay loam, ERTC loamy sand, and NRTC silty clay loam soils) and five sediments (Virginia Waters sandy loam, Mesocosm sandy loam, Millstream Pond loamy sand, Iron Hatch sand, and Old Basing sandy loam sediments). The soil/sediment:solution slurries (0.5 μg/30 cm^3) were equilibrated for 24 hours at 20 ± 2°C. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} *vs.* organic matter, K_{ads} *vs.* pH and K_{ads} *vs.* clay content were 0.04, 0.05 and 0.19, respectively.

Following adsorption, the values for the soil:solution slurries were as follows:

Soil Name	Hyde Farm	East Anglia	Wisborough Green	ERTC	NRTC
Textural Classification	Sandy Loam	Loamy Sand	Silty Clay Loam	Loamy Sand	Silty Clay Loam
% Sand	64	87	10	78	12
% Silt	20	5	60	16	52
% Clay	16	8	30	6	36
% Organic Matter	1.9	1.7	3.4	0.5	3.7
CEC (meq/100 g)	11	4.9	15	2.6	28
Soil pH	6.5	8.0	6.0	6.8	6.2
Equilibration Conc. Range ($\mu g/cm^3$)	0.019-0.306	0.019-0.306	0.019-0.306	0.019-0.306	0.019-0.306
Average K_d	3810	1970	5880	2100	4490
Freundlich K_{ads}	1780	2080	5440	1960	2360
1/n	0.89	1.01	0.99	0.99	0.91
K_{oc} (mL/g)	346,000	200,000	298,000	724,000	209,000

Data obtained from pp. 12-13, 24-25, and 28.

Following adsorption, the values for the sediment:solution slurries were as follows:

Sediment Name	Virginia Waters	Mesocosm	Millstream Pond	Iron Hatch	Old Basing
Textural Classification	Sandy Loam	Sandy Loam	Loamy Sand	Sand	Sandy Loam
% Sand	79	53	88	94	74
% Silt	9	18	5	3	11
% Clay	12	29	7	3	15
% Organic Matter	4.4	4.3	1.7	0.8	7.6
CEC (meq/100 g)	16	21	5.7	2.6	14
Soil pH	6.6	7.9	8.3	8.3	7.8
Equilibration Conc. Range ($\mu g/cm^3$)	0.019-0.306	0.019-0.306	0.019-0.306	0.019-0.306	0.019-0.306
Average K_d	6890	7610	3470	2400	4870
Freundlich K_{ads}	1500	33,000	2560	2520	1660
1/n	0.80	1.21	0.96	1.01	0.85
K_{oc} (mL/g)	270,000	305,000	352,000	518,000	110,000

Data obtained from pp. 12-13, 24-25, and 28.

Following a 24-hour desorption equilibration period, the values for the soil:solution slurries were as follows:

Soil Name	Hyde Farm	East Anglia	Wisborough Green	ERTC	NRTC
Textural Classification	Sandy Loam	Loamy Sand	Silty Clay Loam	Loamy Sand	Silty Clay Loam
Equilibration Conc. Range ($\mu g/cm^3$)	0.019-0.306	0.019-0.306	0.019-0.306	0.019-0.306	0.019-0.306
Average K_d	4570	1610	5160	2770	4450
K_{oc} (mL/g)	414,000	164,000	261,000	954,000	208,000

Data obtained from pp. 29-30.

Following a 24-hour desorption equilibration period, the values for the sediment:solution slurries were as follows:

Sediment Name	Virginia Waters	Mesocosm	Millstream Pond	Iron Hatch	Old Basing
Textural Classification	Sandy Loam	Sandy Loam	Loamy Sand	Sand	Sandy Loam
Equilibration Conc. Range ($\mu g/cm^3$)	0.019-0.306	0.019-0.306	0.019-0.306	0.019-0.306	0.019-0.306
Average K_d	10,100	8640	4300	2690	4400
K_{oc} (mL/g)	397,000	346,000	436,000	580,000	99,900

Data obtained from pp. 29-30.

Tabular stability data for the parent compound in the supernatants and soil extracts following the adsorption and desorption equilibration periods were not reported. The study authors stated that >90% of the radioactivity present in the aqueous supernatants was present as lambda-cyhalothrin with the exception of the East Anglia, NRTC, ERTC, and Virginia Water samples in which approximately 60% of the radioactivity was present

as parent (p. 23); the remaining radioactivity was not characterized. Additionally, the study authors stated that >90% of the radioactivity present in the soil extracts was lambda-cyhalothrin.

Mean material balances were 93 ± 6% of the applied radioactivity for samples terminated following adsorption and 89 ± 8% for samples terminated after desorption (p. 23). Sample specific data were reported only for the Wisborough Green soil and Millstream Pond sediment (Tables 9-12, pp. 39-42).

REVIEW COMMENTS

1 Incomplete material balances data were provided for all the test soils. Data for determining material balances were only presented for two of the ten soil/sediments assessed (Wisborough Green soil and Millstream Pond sediment). Additionally, the registrant reports that the data are incomplete for three of the tested soils due to failure of the combustion equipment.

2. The study authors stated that Freundlich values were an inappropriate way of expressing the data generated because of the extremely low concentrations of [^{14}C]residues present in the aqueous phase of the soil/sediment:solution slurries, and that regression analysis was performed far beyond the data set to determine Freundlich K_{ads} values (p. 28). Therefore, the Freundlich equation may not accurately determine the adsorption isotherms for lambda-cyhalothrin. The average Kd values may be a more appropriate adsorption isotherm.

3. The Koc model may be inappropriate because lambda-cyhalothrin sorption was not correlated to the soil organic carbon content. EFED found that regression of the Freundlich coefficient versus %OM (R^2 = 0.04 on non-transformed data and 0.01on transformed data) and Kd versus %OM (R^2 = 0.45 on non-transformed data and 0.51on transformed data) yielded poor correlations. This suggests that the Koc model may not appropriate for evaluation of this chemical.

4. No discussion of degradates was included in the study. The registrant notes that degradates were present at concentrations less than 10% of applied radioactivity. EFED believes , however, that the sterilization of soil coupled with the analysis of lambda-cyhalothrin in test solutions should provide reliable information on lambda cyhalothrin stability during equilibration. In future studies, the registrant should clearly indicate the stability of the parent and the identification and concentration of degradation products.

5. The study was conducted using co-solvents to evaluate the concentration above the water solubility. The water solubility of lambda-cyhalothrin in water was reported as 5 µg/L (pH 6.5; 20°C) in a separate study (MRID 44861509, p. 10). Treatment solutions were prepared in acetonitrile at concentrations between 19 ug/L and 306 ug/L. Because the

use of cosolvent is expected to encourage desorption (or equilibrium between soil, water, and cosolvent), it is anticipated to result in lower adsorption coefficients.

6. The registrant indicated that the test soils were irradiated prior to initiating the study in order to "inhibit the degradation of the compound by microorganisms" (pg. 10). Sterilization of soils can result in altered physical characteristics of the soil. As per Subdivision N guidelines, batch equilibrium studies should be conducted on non-sterile soils. Because lambda-cyhalothrin exhibited low potential mobility on all test soils, EFED believes that repeating the study on non-sterile soil is not expected to yield a different interpretation on mobility.

7. Foreign soils were used in the study. The registrant should attempt to provide soil taxonomic names for the foreign test soils or at a minimum comparable US soil taxonomic names.

8. The registrant used a soil/sediment:solution ratio of 1:60. Higher soil/sediment:solution ratios are expected to encourage desorption and hence result in a lower sorption coefficients. Because adsorption of the pesticide to soil/sediment resulted in over 95% of the applied pesticide at a 1:60 soil:solution ratio, EFED believes that lower soil: solution ratio could result in more sorption. Therefore, EFED believes these data represent a conservative estimate of sorption.

9 The study authors indicate that a portion of the applied pesticide was adsorbed to the glass of the centrifuge tube. The methodology included an extraction step for the portion of the pesticide adsorbed to the glass tube. EFED notes that competitive adsorption of lambda cyhalothrin on glass surfaces is expected to encourage desorption from soil surfaces. The net impact of competitive equilibrium is that lower Kd values would be predicted.

10. It is noted that this study was not conducted in accordance with Good Laboratory Practices (GLP) as required by FIFRA. Instead, the study was conducted in compliance with the GLP Regulations of the United Kingdom Department of Health Compliance Programme.

11. Method detection limits were not reported. Both method detection limits and limits of quantitation should be reported to allow the reviewer to evaluate the adequacy of the method.

12. The study authors stated that the concentrations of [^{14}C]lambda-cyhalothrin in the soil/sediment:solutions were lower than normally would be expected in batch equilibrium studies, and that "the rates were chosen to be closer to 'Expected Environmental concentrations', within the limits of analytical detection" (p. 8). However, because the

amount of soil/sediment in the slurry was very small, the maximum application rate on a soil/sediment basis is 18.36 μg test compound/μg soil).

13. K_{oc} values reported in Tables 5 and 7 (pp. 24, 29) are based on registrant-calculated K_d values.

14. The full chemical name of the parent was not reported in this study. As reported in MRID 44861509, the full name of the parent is (*S*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*R*,3*R*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate and (*R*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*S*,3*S*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate. Lambda cyhalothrin consists of the 4 isomers. The study did not identify which of the isomers is active and the analytical methods were not designed to separate and identify the isomers. It is possible that the different isomers of the chemical may experience preferential sorption and biodegradation.

Linear Regression on Transformed Data
Adsorption-Desorption Study
Lambda Cyhalothrin

Avg Kd versus %OM

[Variables]
x = col(1)
y = col(3)
'Automatic Initial Parameter Estimate Functions
F(q)=ape(x,y,1,0,1)
[Parameters]
y0 = F(0)[1] "Auto {{previous: 7.79351}}
a = F(0)[2] "Auto {{previous: 0.161192}}
[Equation]
f=y0+a*x
fit f to y
[Constraints]
[Options]
tolerance=0.000100
stepsize=100
iterations=100

R = 0.71221158 Rsqr = 0.50724534 Adj Rsqr = 0.44565101

Standard Error of Estimate = 0.3603

	Coefficient	Std. Error	t	P
y0	7.7935	0.2034	38.3142	<0.0001
a	0.1612	0.0562	2.8697	0.0208

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1.0689	1.0689	8.2353	0.0208
Residual	8	1.0384	0.1298		
Total	9	2.1073	0.2341		

PRESS = 2.9185

Durbin-Watson Statistic = 2.0155

Normality Test: Passed (P = 0.7274)

Constant Variance Test: Passed (P = 0.2128)

Power of performed test with alpha = 0.0500: 0.6551

The power of the performed test (0.6551) is below the desired power of 0.8000.
You should interpret the negative findings cautiously.

Regression Diagnostics:

Row	Predicted	Residual	Std. Res.	Stud. Res.	Stud. Del. Res.
1	8.3416	0.3378	0.9375	0.9903	0.9890
2	8.0675	-0.4817	-1.3371	-1.4428	-1.5691
3	8.0675	0.0844	0.2342	0.2527	0.2373

4	8.4866	0.4506	1.2507	1.3495	1.4363
5	8.3899	0.0197	0.0547	0.0580	0.0543
6	7.8741	-0.2244	-0.6229	-0.7202	-0.6966
7	7.9225	-0.1392	-0.3865	-0.4369	-0.4137
8	8.5028	0.3351	0.9300	1.0074	1.0085
9	8.0998	0.1456	0.4042	0.4332	0.4100
10	9.0186	-0.5277	-1.4647	-2.3586	-3.9976

Influence Diagnostics:

Row	**Cook'sDist**	**Leverage**	**DFFITS**
1	0.0569	0.1039	0.3367
2	0.1710	0.1411	-0.6359
3	0.0052	0.1411	0.0962
4	0.1496	0.1411	0.5821
5	0.0002	0.1119	0.0193
6	0.0873	0.2519	-0.4042
7	0.0266	0.2176	-0.2182
8	0.0879	0.1476	0.4197
9	0.0139	0.1294	0.1581
10	4.4310	0.6143	-5.0455

95% Confidence:

Row	**Predicted**	**Regr. 5%**	**Regr. 95%**	**Pop. 5%**	**Pop. 95%**
1	8.3416	8.0738	8.6093	7.4687	9.2144
2	8.0675	7.7555	8.3796	7.1801	8.9550
3	8.0675	7.7555	8.3796	7.1801	8.9550
4	8.4866	8.1746	8.7987	7.5992	9.3741
5	8.3899	8.1120	8.6678	7.5139	9.2660
6	7.8741	7.4571	8.2911	6.9445	8.8037
7	7.9225	7.5349	8.3100	7.0057	8.8392
8	8.5028	8.1835	8.8220	7.6127	9.3928
9	8.0998	7.8009	8.3986	7.2168	8.9827
10	9.0186	8.3674	9.6697	7.9630	10.0742

Linear Regression on Non-Transformed Data
Adsorption-Desorption Study
Lambda Cyhalothrin

Avg Kd versus %OM

[Variables]
x = col(1)
y = col(2)
'Automatic Initial Parameter Estimate Functions
F(q)=ape(x,y,1,0,1)
[Parameters]
y0 = F(0)[1] "Auto {{previous: 2479.07}}
a = F(0)[2] "Auto {{previous: 623.311}}
[Equation]
f=y0+a*x
fit f to y
[Constraints]
[Options]
tolerance=0.000100
stepsize=100
iterations=100

R = 0.67284583 Rsqr = 0.45272151 Adj Rsqr = 0.38431170

Standard Error of Estimate = 1554.1049

	Coefficient	**Std. Error**	**t**	**P**
y0	2479.0681	877.4366	2.8254	0.0223
a	623.3106	242.2971	2.5725	0.0330

Analysis of Variance:

	DF	**SS**	**MS**	**F**	**P**
Regression	1	15983554.9101	15983554.9101	6.6178	0.0330
Residual	8	19321935.0899	2415241.8862		
Total	9	35305490.0000	3922832.2222		

PRESS = 55907852.4753

Durbin-Watson Statistic = 1.9670

Normality Test: Passed (P = 0.5828)

Constant Variance Test: Passed (P = 0.0736)

Power of performed test with alpha = 0.0500: 0.5788

The power of the performed test (0.5788) is below the desired power of 0.8000.
You should interpret the negative findings cautiously.

Regression Diagnostics:

Row	**Predicted**	**Residual**	**Std. Res.**	**Stud. Res.**	**Stud. Del. Res.**
1	4598.3243	1281.6757	0.8247	0.8712	0.8566
2	3538.6962	-1568.6962	-1.0094	-1.0891	-1.1039
3	3538.6962	-68.6962	-0.0442	-0.0477	-0.0446

4	5159.3038	2450.6962	1.5769	1.7015	1.9925
5	4785.3175	-295.3175	-0.1900	-0.2016	-0.1891
6	2790.7234	-690.7234	-0.4445	-0.5139	-0.4888
7	2977.7166	-577.7166	-0.3717	-0.4203	-0.3975
8	5221.6349	1668.3651	1.0735	1.1628	1.1932
9	3663.3583	146.6417	0.0944	0.1011	0.0947
10	7216.2290	-2346.2290	-1.5097	-2.4310	-4.4489

Influence Diagnostics:

Row	**Cook'sDist**	**Leverage**	**DFFITS**
1	0.0440	0.1039	0.2917
2	0.0974	0.1411	-0.4474
3	0.0002	0.1411	-0.0181
4	0.2378	0.1411	0.8075
5	0.0026	0.1119	-0.0671
6	0.0445	0.2519	-0.2837
7	0.0246	0.2176	-0.2097
8	0.1171	0.1476	0.4966
9	0.0008	0.1294	0.0365
10	4.7071	0.6143	-5.6150

95% Confidence:

Row	**Predicted**	**Regr. 5%**	**Regr. 95%**	**Pop. 5%**	**Pop. 95%**
1	4598.3243	3443.2085	5753.4400	832.9935	8363.6550
2	3538.6962	2192.6128	4884.7795	-289.5363	7366.9286
3	3538.6962	2192.6128	4884.7795	-289.5363	7366.9286
4	5159.3038	3813.2205	6505.3872	1331.0714	8987.5363
5	4785.3175	3586.4369	5984.1980	1006.3311	8564.3038
6	2790.7234	991.9686	4589.4781	-1219.1322	6800.5790
7	2977.7166	1305.7915	4649.6416	-976.8702	6932.3034
8	5221.6349	3844.5978	6598.6720	1382.4091	9060.8607
9	3663.3583	2374.1376	4952.5790	-145.2521	7471.9687
10	7216.2290	4407.2710	10025.1870	2662.8052	11769.6528

Linear Regression
Lambda Cyhalothrin
Adsorbtion/Desorption Study
Freundlich Coefficient vs %OM
Transformed Data

[Variables]
x = col(1)
y = col(3)
'Automatic Initial Parameter Estimate Functions
F(q)=ape(x,y,1,0,1)
[Parameters]
y0 = F(0)[1] "Auto {{previous: 7.82815}}
a = F(0)[2] "Auto {{previous: 0.0534505}}
[Equation]
f=y0+a*x
fit f to y
[Constraints]
[Options]
tolerance=0.000100
stepsize=100
iterations=100

R = 0.12409353 Rsqr = 0.01539920 Adj Rsqr = 0.00000000

Standard Error of Estimate = 0.9692

	Coefficient	Std. Error	t	P
y0	7.8281	0.5472	14.3055	<0.0001
a	0.0535	0.1511	0.3537	0.7327

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.1175	0.1175	0.1251	0.7327
Residual	8	7.5150	0.9394		
Total	9	7.6325	0.8481		

PRESS = 13.7871

Durbin-Watson Statistic = 1.8935

Normality Test: Failed (P = 0.0052)

Constant Variance Test: Failed (P = 0.0069)

Power of performed test with alpha = 0.0500: 0.0516

The power of the performed test (0.0516) is below the desired power of 0.8000.
You should interpret the negative findings cautiously.

Regression Diagnostics:

Row	Predicted	Residual	Std. Res.	Stud. Res.	Stud. Del. Res.
1	8.0099	0.5917	0.6104	0.6449	0.6195
2	7.9190	-0.2789	-0.2877	-0.3105	-0.2922
3	7.9190	-0.0712	-0.0735	-0.0793	-0.0742
4	8.0580	2.3463	2.4208	2.6121	6.3697

5	8.0259	-0.2595	-0.2677	-0.2841	-0.2671
6	7.8549	-0.2742	-0.2829	-0.3271	-0.3080
7	7.8709	-0.0389	-0.0401	-0.0454	-0.0424
8	8.0633	-0.7501	-0.7739	-0.8383	-0.8210
9	7.9297	-0.4453	-0.4595	-0.4924	-0.4678
10	8.2344	-0.8198	-0.8458	-1.3620	-1.4537

Influence Diagnostics:

Row	**Cook'sDist**	**Leverage**	**DFFITS**
1	0.0241	0.1039	0.2109
2	0.0079	0.1411	-0.1184
3	0.0005	0.1411	-0.0301
4	0.5603	0.1411	2.5815
5	0.0051	0.1119	-0.0948
6	0.0180	0.2519	-0.1787
7	0.0003	0.2176	-0.0224
8	0.0609	0.1476	-0.3417
9	0.0180	0.1294	-0.1804
10	1.4776	0.6143	-1.8348

95% Confidence:

Row	**Predicted**	**Regr. 5%**	**Regr. 95%**	**Pop. 5%**	**Pop. 95%**
1	8.0099	7.2895	8.7303	5.6616	10.3581
2	7.9190	7.0795	8.7585	5.5315	10.3065
3	7.9190	7.0795	8.7585	5.5315	10.3065
4	8.0580	7.2185	8.8975	5.6705	10.4455
5	8.0259	7.2782	8.7736	5.6692	10.3827
6	7.8549	6.7331	8.9767	5.3541	10.3556
7	7.8709	6.8282	8.9136	5.4046	10.3372
8	8.0633	7.2045	8.9221	5.6690	10.4577
9	7.9297	7.1257	8.7337	5.5545	10.3049
10	8.2344	6.4826	9.9862	5.3946	11.0741

Linear Regression
Lambda Cyhalothrin
Adsorbtion/Desorption Study
Freundlich Coefficient vs %OM
Non-Transformed Data

[Variables]
x = col(1)
y = col(2)
'Automatic Initial Parameter Estimate Functions
F(q)=ape(x,y,1,0,1)
[Parameters]
y0 = F(0)[1] "Auto {{previous: 2712.79}}
a = F(0)[2] "Auto {{previous: 924.404}}
[Equation]
f=y0+a*x
fit f to y
[Constraints]
[Options]
tolerance=0.000100
stepsize=100
iterations=100

R = 0.20307685 Rsqr = 0.04124021 Adj Rsqr = 0.00000000

Standard Error of Estimate = 10107.4981

	Coefficient	Std. Error	t	P
y0	2712.7866	5706.6221	0.4754	0.6472
a	924.4045	1575.8378	0.5866	0.5736

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	35155102.0904	35155102.0904	0.3441	0.5736
Residual	8	817292137.9096	102161517.2387		
Total	9	852447240.0000	94716360.0000		

PRESS = 1458067036.9887

Durbin-Watson Statistic = 2.1484

Normality Test: Failed (P = <0.0001)

Constant Variance Test: Failed (P = 0.0069)

Power of performed test with alpha = 0.0500: 0.0785

The power of the performed test (0.0785) is below the desired power of 0.8000.
You should interpret the negative findings cautiously.

Regression Diagnostics:

Row	Predicted	Residual	Std. Res.	Stud. Res.	Stud. Del. Res.
1	5855.7618	-415.7618	-0.0411	-0.0435	-0.0407
2	4284.2742	-2204.2742	-0.2181	-0.2353	-0.2209
3	4284.2742	-1724.2742	-0.1706	-0.1841	-0.1725
4	6687.7258	26312.2742	2.6032	2.8089	22.4061

5	6133.0831	-3773.0831	-0.3733	-0.3961	-0.3742
6	3174.9888	-1214.9888	-0.1202	-0.1390	-0.1302
7	3452.3102	-932.3102	-0.0922	-0.1043	-0.0976
8	6780.1663	-5280.1663	-0.5224	-0.5658	-0.5402
9	4469.1551	-2689.1551	-0.2661	-0.2851	-0.2681
10	9738.2606	-8078.2606	-0.7992	-1.2870	-1.3519

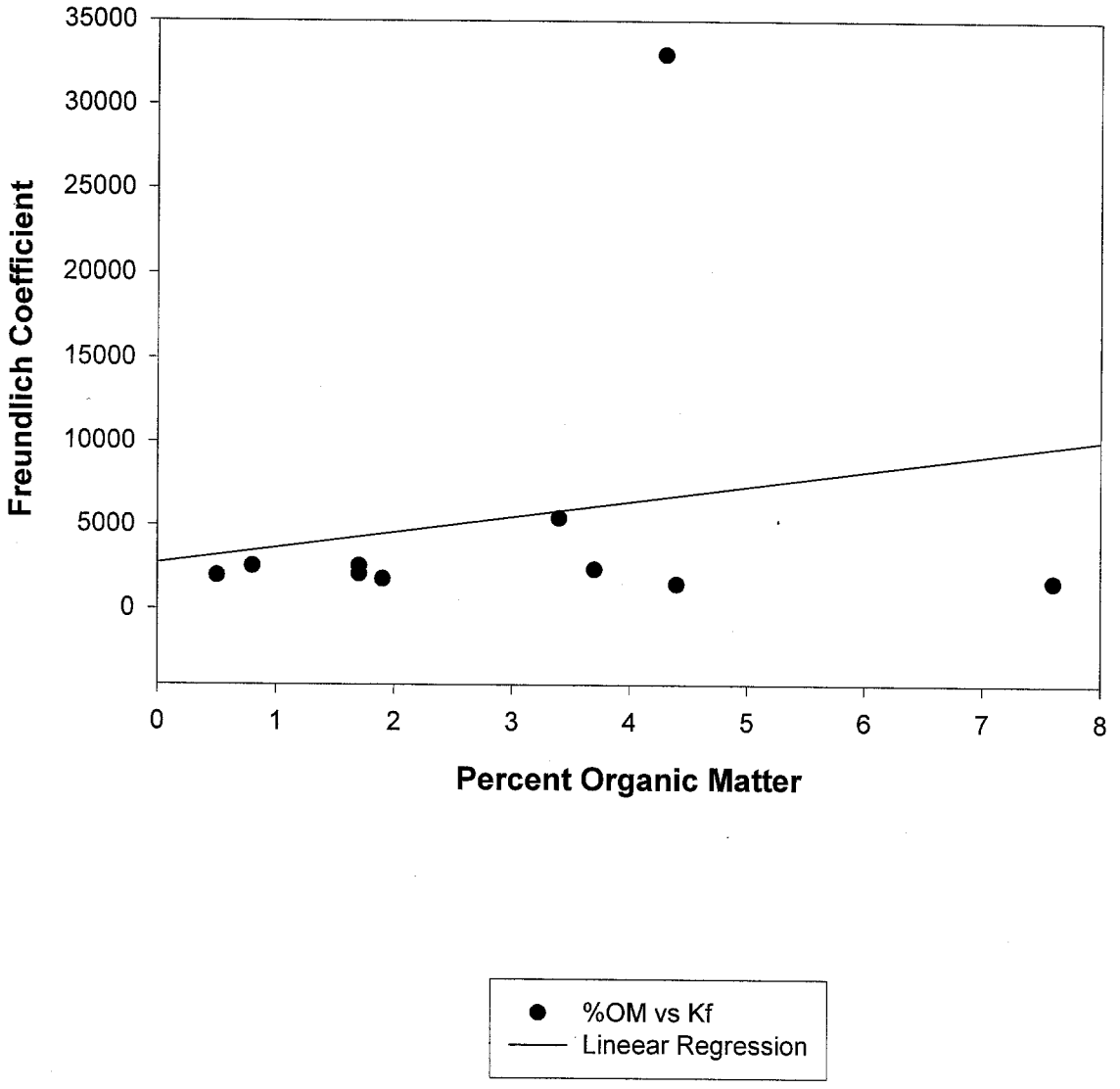
Influence Diagnostics:

Row	**Cook'sDist**	**Leverage**	**DFFITS**
1	0.0001	0.1039	-0.0138
2	0.0045	0.1411	-0.0895
3	0.0028	0.1411	-0.0699
4	0.6480	0.1411	9.0808
5	0.0099	0.1119	-0.1328
6	0.0033	0.2519	-0.0755
7	0.0015	0.2176	-0.0515
8	0.0277	0.1476	-0.2248
9	0.0060	0.1294	-0.1034
10	1.3192	0.6143	-1.7063

95% Confidence:

Row	**Predicted**	**Regr. 5%**	**Regr. 95%**	**Pop. 5%**	**Pop. 95%**
1	5855.7618	-1656.8140	13368.3375	-18632.9806	30344.5042
2	4284.2742	-4470.3056	13038.8540	-20613.5646	29182.1130
3	4284.2742	-4470.3056	13038.8540	-20613.5646	29182.1130
4	6687.7258	-2066.8540	15442.3056	-18210.1130	31585.5646
5	6133.0831	-1664.1274	13930.2937	-18444.4717	30710.6380
6	3174.9888	-8523.6493	14873.6269	-22904.0803	29254.0579
7	3452.3102	-7421.4600	14326.0803	-22267.3047	29171.9250
8	6780.1663	-2175.7289	15736.0614	-18189.1703	31749.5028
9	4469.1551	-3915.6048	12853.9149	-20301.0671	29239.3773
10	9738.2606	-8530.4795	28007.0006	-19876.0362	39352.5573

Lambda Cyhalothrin
Freundlich K vs %OM



Lambda Cyhalothrin
Adsorption/Desorption Study (Batch Equilibrium)
Linear Regression - Non-Transformed Data
Freundlich Coefficient Calculation
Wisborough Green - %OM = 3.4

[Variables]
x = col(1)
y = col(2)
'Automatic Initial Parameter Estimate Functions
F(q)=ape(x,y,1,0,1)
[Parameters]
y0 = F(0)[1] "Auto {{previous: 0.287472}}
a = F(0)[2] "Auto {{previous: 5530.93}}
[Equation]
f=y0+a*x
fit f to y
[Constraints]
[Options]
tolerance=0.000100
stepsize=100
iterations=100

R = 0.99861232 Rsqr = 0.99722656 Adj Rsqr = 0.99630208

Standard Error of Estimate = 0.4391

	Coefficient	**Std. Error**	**t**	**P**
y0	0.2875	0.2914	0.9867	0.3966
a	5530.9300	168.4030	32.8434	<0.0001

Analysis of Variance:

	DF	**SS**	**MS**	**F**	**P**
Regression	1	208.0164	208.0164	1078.6904	<0.0001
Residual	3	0.5785	0.1928		
Total	4	208.5949	52.1487		

PRESS = 5.6070

Durbin-Watson Statistic = 2.1878

Normality Test: Passed (P = 0.1465)

Constant Variance Test: Passed (P = 0.0500)

Power of performed test with alpha = 0.0500: 0.9993

Regression Diagnostics:

Row	**Predicted**	**Residual**	**Std. Res.**	**Stud. Res.**	**Stud. Del. Res.**
1	1.4490	-0.2190	-0.4986	-0.6271	-0.5493
2	2.6105	-0.2005	-0.4565	-0.5489	-0.4725
3	4.7122	0.0278	0.0633	0.0723	0.0591
4	8.7498	0.6502	1.4806	1.6652	4.9399
5	19.2586	-0.2586	-0.5888	-1.7072	-8.2643

Influence Diagnostics:

Row	Cook'sDist	Leverage	DFFITS
1	0.1144	0.3677	-0.4189
2	0.0671	0.3083	-0.3154
3	0.0008	0.2336	0.0326
4	0.3671	0.2093	2.5418
5	10.7949	0.8811	-22.4924

95% Confidence:

Row	Predicted	Regr. 5%	Regr. 95%	Pop. 5%	Pop. 95%
1	1.4490	0.6015	2.2965	-0.1854	3.0834
2	2.6105	1.8345	3.3864	1.0120	4.2089
3	4.7122	4.0368	5.3877	3.1600	6.2644
4	8.7498	8.1104	9.3892	7.2129	10.2867
5	19.2586	17.9468	20.5703	17.3418	21.1753

Lambda Cyhalothrin
Adsorption/Desorption Study (Batch Equilibrium)
Linear Regression - Log Transformed Data
Freundlich Coefficient Calculation
Wisborough Green - %OM = 3.4

[Variables]
x = col(3)
y = col(4)
'Automatic Initial Parameter Estimate Functions
F(q)=ape(x,y,1,0,1)
[Parameters]
y0 = F(0)[1] "Auto {{previous: 3.7424}}
a = F(0)[2] "Auto {{previous: 0.992285}}
[Equation]
f=y0+a*x
fit f to y
[Constraints]
[Options]
tolerance=0.000100
stepsize=100
iterations=100

R = 0.99939973 Rsqr = 0.99879981 Adj Rsqr = 0.99839975

Standard Error of Estimate = 0.0188

	Coefficient	Std. Error	t	P
y0	3.7424	0.0619	60.4940	<0.0001
a	0.9923	0.0199	49.9660	<0.0001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.8804	0.8804	2496.6054	<0.0001
Residual	3	0.0011	0.0004		
Total	4	0.8815	0.2204		

PRESS = 0.0038

Durbin-Watson Statistic = 2.2782

Normality Test: Passed (P = 0.6920)

Constant Variance Test: Passed (P = 0.0500)

Power of performed test with alpha = 0.0500: 0.9999

Regression Diagnostics:

Row	Predicted	Residual	Std. Res.	Stud. Res.	Stud. Del. Res.
1	0.0930	-0.0031	-0.1643	-0.2570	-0.2122
2	0.3917	-0.0097	-0.5155	-0.6137	-0.5358
3	0.6694	0.0064	0.3408	0.3810	0.3189
4	0.9488	0.0243	1.2951	1.5285	2.6534
5	1.2967	-0.0180	-0.9560	-1.5762	-3.1040

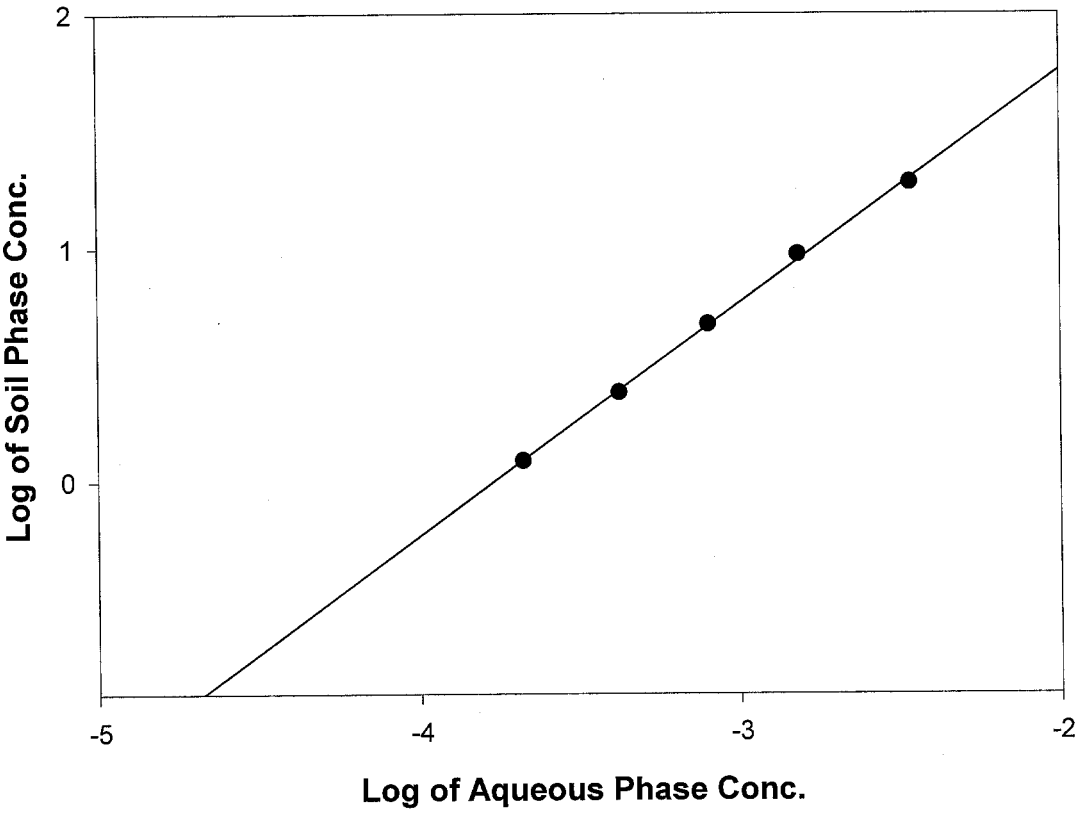
Influence Diagnostics:

Row	Cook'sDist	Leverage	DFFITS
1	0.0478	0.5913	-0.2552
2	0.0786	0.2944	-0.3461
3	0.0182	0.2001	0.1595
4	0.4591	0.2821	1.6634
5	2.1343	0.6321	-4.0687

95% Confidence:

Row	Predicted	Regr. 5%	Regr. 95%	Pop. 5%	Pop. 95%
1	0.0930	0.0470	0.1389	0.0176	0.1684
2	0.3917	0.3593	0.4241	0.3237	0.4597
3	0.6694	0.6426	0.6961	0.6039	0.7348
4	0.9488	0.9171	0.9806	0.8811	1.0165
5	1.2967	1.2492	1.3442	1.2204	1.3731

Lambda Cyhalothrin
Freundlich Coefficient
Wisborough Green Silty Clay Loam



DATA EVALUATION RECORD

STUDY 2

CHEM 128897 Lambda-cyhalothrin §163-1
CAS No. 91465-08-6
FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 44861509
Kuet, S. F. and M. C. G. Lane. 1999. Lambda-cyhalothrin "Aged" desorption in soil. Laboratory Project ID: 98JH135. Unpublished study performed by Zeneca Limited, Bracknell, Berkshire, UK; and submitted by Zeneca Inc., Wilmington, DE.

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SIGNATURE: 2-5-01

CONCLUSIONS:

"Aged" Desorption Study

This study does not meet Subdivision N Guidelines for the fulfillment of EPA data requirements on adsorption/desorption studies and is therefore considered supplemental. The study authors indicate (pg 10) that the study was designed to "investigate whether the desorption properties of lambda-cyhalothrin bound to soil change as the chemical/soil interaction extends over time (referred to as ageing)" and to assess if bioavailability changes over time. EFED prefers either "aged" soil column studies on four different soil types, or individual Batch Equilibrium studies on each major degradate (US EPA. 1993. *Pesticide Reregistration Rejection Rate Analysis: Environmental Fate*. EPA 738-R-93-010, p. 127) . This study presents the results of a batch equilibrium study of aged parent applied to a single soil at one concentration. EFED considers batch equilibrium studies on characterized aged soil as inappropriate (US EPA. 1993. *Pesticide Reregistration Rejection Rate Analysis: Environmental Fate*. EPA 738-R-93-010, p. 128). The data in this study are deemed supplemental because the registrant did not evaluate degradates as part of this study, but the data does provide some information on the absorption/desorption properties of lambda-cyhalothrin.

Other issues with the review were associated with incomplete reporting of material balances, differing test conditions from the Batch Equilibrium study, possible adsorption of test material to glass surfaces, sterilization of test soils, failure to incubate the treated soils for one half life (lambda-cyhalothrin remained as 80 to 98 % of radioactivity at the conclusion of all three test systems), the use of foreign soils, and insufficient information to evaluate storage stability.

The mobility of [^{14}C]lambda-cyhalothrin, at a nominal concentration of 1.06 μg/g, was determined in Hyde Farm sandy loam equilibrated for up to 8 weeks under three different conditions: (i) using irradiated soil incubated at 20 ± 2°C in darkness; (ii) using non-irradiated soil incubated at approximately 4°C in darkness; and (iii) using irradiated soil stored under ambient light conditions and subjected to wet/dry cycles. K_d values were determined following a desorption equilibration period of 24 hours. For condition (i), K_d values were 11,216 and 10,880 at 0 and 4 weeks posttreatment, respectively with corresponding K_{oc} values of 1,000,000 and 990,000 mL/g. For condition (ii), K_d values were initially (time 0) 7,403 and were 6,367-15,550 at 1-8 weeks posttreatment; corresponding K_{oc} values were 670,000 and 580,000-1,400,000 mL/g. For condition (iii), K_d and K_{oc} values were 9,236 and 840,000 mL/g, respectively, at 4 weeks posttreatment (the only sampling interval). Following the 24-hour desorption equilibration period, ≥97.6% of the applied radioactivity was adsorbed to the soil (across all conditions) and >80% of the radioactivity adsorbed to the soil [96% for incubation conditions (i) and (ii)] was parent.

The reported data indicate that lambda-cyhalothrin is not expected to be mobile in soil and aquatic environments

MATERIALS AND METHODS

Based on the results of the adsorption and desorption of cyclopropane-labeled [^{14}C]lambda-cyhalothrin to ten soils/sediments (MRID 44861503), Hyde Farm sandy loam soil (64% sand, 20% silt, 16% clay, 1.9% organic matter, pH 6.5, CEC 11.1 meq/100 g, collected from Pinkneys Green, Berkshire, UK; Tables 1 and 2; pp. 11-12) was chosen for use in this study (p. 14). The soil was air-dried and sieved (2-mm), and a portion was sterilized by gamma irradiation.

Portions of the soil were weighed (1.04 g; equivalent to 1 g oven-dried weight; p. 16) into glass tubes and treated with [^{14}C]lambda-cyhalothrin [(*S*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*R*,3*R*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate and (*R*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*S*,3*S*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate; radiochemical purity >98%; specific activity 2.20 Gbq/mMol; Zeneca Agrochemicals, Batch No. 95-J23; pp. 10, 19], dissolved in acetonitrile, at a nominal concentration of 1.06 μg/g (pp. 16, 19; Figure 2, p.15). The soil was moistened with 200 μL of sterilized water. Three soil test systems were fortified for each sampling interval; control samples were prepared without soil. The treated soils were then incubated following three different conditions:

(i) tubes of irradiated soil were stoppered and incubated at 20 ± 2°C in darkness;
(ii) tubes of non-irradiated soil were stoppered and incubated at approximately 4°C in darkness; and
(iii) tubes of irradiated soil were placed unstoppered inside a laminar flow air cabinet under ambient light conditions; the soil was moistened with 200 μL of water every 3-4 days.

Sampling intervals for condition (i) were 0 and 4 weeks posttreatment; sampling intervals for condition (ii) were 0, 1, 2, 4, and 8 weeks posttreatment; and the single sampling interval for condition (iii) was 4 weeks posttreatment. At each sampling interval, 20 mL of sterilized 0.01 M $CaCl_2$ solution was added to three tubes of soil and the soil:solution slurries were equilibrated on an end-over-end shaker for 24 hours at 20 ± 2°C. Following the equilibration period (described by the study authors as "desorption"), soil:solution slurries were centrifuged, and aliquots of the supernatants were analyzed for total radioactivity by LSC; the detection limit was not reported. The remaining supernatants and the soil pellets were then frozen (p.17, unspecified duration).

To determine whether [14C]lambda-cyhalothrin had degraded during aging and equilibration, the frozen supernatant and soil pellets were analyzed using TLC. The

supernatant from one replicate at each incubation regime/sampling interval was partitioned twice with acidified (pH 2) methylene chloride (approximately 25 mL). An aliquot of the organic fraction was analyzed by LSC. The remaining organic fraction was concentrated and analyzed by normal phase TLC on silica gel plates developed using hexane:diethyl ether (4:1, v:v; p. 13). Samples were co-chromatographed with a nonradiolabeled reference standard of the parent; the reference standard was detected on developed chromatograms under short-wave UV light.

The soil pellet from one replicate at each incubation regime/sampling interval was extracted twice by shaking with acetonitrile (25 mL); the duration of the first and second extractions was 18 and 4-5 hours, respectively (p. 18). Following each extraction, the mixtures were centrifuged. The extracts were combined and brought to volume, and aliquots were analyzed by LSC. The extracts were stored frozen (unspecified duration) until analysis by normal phase TLC as previously described. Subsamples of the extracted soil pellets were analyzed by LSC following combustion (p. 13). Combustion efficiency ranged from 95.7% to 97.6%; results were corrected for combustion efficiencies.

RESULTS/DISCUSSION

The mobility of [^{14}C]lambda-cyhalothrin [(*S*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*R*,3*R*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate and (*R*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*S*,3*S*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropanecarboxylate; radiochemical purity >98%], at a nominal concentration of 1.06 μg/g soil, was determined in Hyde Farm sandy loam soil:solution slurries that were aged for up to 8 weeks under three different conditions: (i) using irradiated soil incubated at 20 ± 2°C in darkness; (ii) using non-irradiated soil incubated at approximately 4°C in darkness; and (iii) using irradiated soil stored under ambient light conditions and subjected to wet/dry cycles of 3-4 days. K_d values were determined following an equilibration period (described by the study authors as "desorption") of 24 hours. For condition (i), K_d values were 11,216 and 10,880 at 0 and 4 weeks posttreatment, respectively (Table 6, p. 28); corresponding Koc values were 1,000,000 and 990,000 mL/g (Table 4, p. 21). For condition (ii), K_d values were initially (time 0) 7,403 and were 6,367-15,550 at 1-8 weeks posttreatment; corresponding Koc values were 670,000 and 580,000-1,400,000 mL/g. For condition (iii), K_d and K_{oc} values were 9,236 and 840,000 mL/g, respectively, at 4 weeks posttreatment (the only sampling interval).

Following a 24-hour equilibration period, ≥97.6% of the applied radioactivity was adsorbed to the soil regardless of incubation regime or sampling interval (Table 6, p. 28).

Based on TLC analysis, [^{14}C]lambda-cyhalothrin accounted for 35.7 and 43.7% of the radioactivity present in the aqueous phase of soil:solution slurries that were equilibrated immediately following treatment and decreased to 6.8-19.7% in soils aged for 4-8 weeks (

Table 7, p. 33). Example chromatograms of the aqueous phase indicated the presence of a single degradate (not identified) and origin material (Figures 3-5, pp. 30-33). For incubation conditions (i) and (ii), the [^{14}C]lambda-cyhalothrin comprised 96.8-98.8% of the radioactivity adsorbed to the soil (Table 8, p. 33). However, for incubation condition (iii), the [^{14}C]lambda-cyhalothrin comprised only 80.8% of the radioactivity adsorbed to the soil.

Material balances (across all conditions) were 91-100% (Table 5, p. 26).

DEFICIENCIES/DEVIATIONS

1. In this study, three incubation regimes were used. For two of those, the soil was sterilized prior to use to reduce microbial activity, was not "re-inoculated", and was stoppered throughout the incubation period. The third regime resulted in non-sterilized soil being incubated at 4°C with continuous airflow. None of these incubation regimes were consistent with the test conditions under which the adsorption/desorption study was conducted (MRID 44861503). In addition, the "aged" study was conducted at a soil:solution ration of 1:20 which is very different from the "unaged" Batch Equilibrium study. The study authors does not offer an explanation why the "aged" study was conducted under different conditions than the Batch Equilibrium study. The author does state that "most work was carried out on the non-sterilized soil system @ 4°C in the dark was considered likely to have the least impact on the soil adsorptive properties". No explanation of how this determination was made was provided.

2. Based on the [^{14}C]characterization done at the completion of the study, none of the treated soils was incubated for one half-life; at most, approximately 80% of the applied remained as parent material. Different sampling intervals were used for each of the tested conditions. The sampling intervals were also different from MRID 44861503 and the test duration did not exceed the half-life of the parent compound. The study appears to have had an inadequate incubation period to form degradation products.

3. [^{14}C]Residues in the aged soil were not characterized prior to a 24-hour equilibration. Subdivision N Guidelines specify that, for aging, the parent material should be applied to the soil and incubated under conditions similar to those used in an aerobic soil metabolism study for one-half life (aerobic soil metabolism half life was 33 days in MRID 40052407).

4. Freundlich K_{ads} and K_{des} values were not determined. Instead, the study was conducted at a single concentration of 0.053 mg/L in acetonitrile and K_d values were determined. This concentration exceeds the solubility of the pesticide (0.005 mg/L) by an order of magnitude.

5. Recoveries from the aqueous phase of control samples (without soil) were only 20-38% of the applied radioactivity (p. 20). The study authors stated that, in a previous study (MRID 44861503), only small amounts of [^{14}C]lambda-cyhalothrin was observed to adsorb to the glass when soil was present (p. 20). The study authors further stated that adsorption of the parent to the glass tubes was not taken into consideration when calculating the adsorption coefficients. The data presented suggest that the glass surface may be an important sorption surface.

6. At least one [^{14}C]degradate was isolated from the aqueous phase following equilibration (Figures 3-5, pp. 30-32). No attempt was made to identify this compound.

7. Material balances were only reported for selected samples (Table 5, p. 26). It is necessary that complete material balances be reported for all test systems to allow the reviewer to account for all residues throughout the study and to aid in determining the validity of the study.

8. The study authors stated that the aqueous phase (all conditions) and the soil extracts (condition iii) were corrected for the observed degradation of the parent for the purpose of determining the desorption coefficients (p. 20).

9. Samples were not collected at time 0 for condition (iii). Samples were only collected at 4 weeks posttreatment. Samples should be analyzed at time 0 to allow for time-series analysis. Time zero data is necessary to confirm application of the pesticide.

10. A single foreign soil (collected from the UK) was utilized in the study. Based on the USDA classification scheme, the soil was characterized as a sandy loam (Table 2, p. 12) and was similar to soils found in the US. The soil particle size distribution was classified as a sandy loam. However, the registrant did not classify the soil using current USDA taxonomy.

11. The study authors stated that, following desorption, the supernatants and post-extracted soil samples were stored frozen prior to determining the degradation of the test compound during the study (p. 17); however, the duration of storage was not reported. A storage stability study was not conducted.

12. It is noted that this study was not conducted in accordance with Good Laboratory Practices (GLP) as required by FIFRA. Instead, the study was conducted in compliance with the United Kingdom GLP Regulations of 1997.

13. Method detection limits were not reported. Both method detection limits and limits of quantitation should be reported to allow the reviewer to evaluate the adequacy of the method.

14. The reviewer noted that the soil utilized was collected in December 1993 and that the study was completed in February 1999.

15. The solubility of the test compound in water was reported as 0.005 mg/L (pH 6.5; 20°C; p. 10). The amount of pesticide applied in this study (0.053 mg/L) exceeded the solubility by an order of magnitude.

16. Two of the three soil systems were sterilized.

17. Soil solutions ratios were 1:20 while the ratio was 1:60 in the Batch Equilibrium study.