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: Aquatic Aerobic Metabolism of lambda-cyhalothrin (MRID 44861506)

FROM: Mark Corbin, Environmental Scientist 7-601
Environmental Risk Branch 1
Environmental Fate and Effects Division (7507C)

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

Attached is the Data Evaluation Record (DER) for the Aerobic Aquatic Metabolism study submitted by the Zeneca Agrochemicals. An aerobic aquatic metabolism half lives (and associated correlation coefficients) were 34.1 days (R^2=0.919) and 21.1days (R^2=0.752). The study is marginally acceptable to EFED.

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

2071394

DATA EVALUATION RECORD

STUDY 3

CHEM 128867 Lambda-cyhalothrin §162-4
CAS No. 68085-85-8
FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 44861506
Marriott, S. H., T. Duley, and U. Hand. 1998. Lambda-cyhalothrin: Degradation in water-sediment systems under laboratory conditions. Laboratory Report No.: RJ 2640B. Unpublished study performed and submitted by Zeneca Agrochemcials, Bracknell Berkshire, UK.

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CONCLUSIONS:

Aquatic Aerobic Metabolism

This study is marginally acceptable in accordance with the Subdivision N Guidelines for the fulfillment of EPA data requirements on aerobic aquatic metabolism. The data are deemed marginally acceptable because material balances were outside the acceptable range (90% to 110%). Other issues with the review were associated with the failure to estimate half lives (DT_{50}'s and DT_{90}'s were estimated by registrant), the test compound adsorbed to the test vessels, 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.

Cyclopropyl ring-labeled [1-^{14}C]lambda-cyhalothrin, at a nominal application rate equivalent to 8 g a.i./ha, degraded with registrant-calculated half-lives (reported as DT_{50}'s; first-order multi-compartment model) of 15 days in flooded sandy loam sediment and 7 days in flooded sand sediment (r^2 values not reported) incubated aerobically in darkness at 20 ± 2°C for up to 98 days. EFED calculated first-order half lives (and associated correlation coefficients) were 34.1 days (R^2=0.919) for the Old Basing Whole system and 21.1days (R^2=0.752) for the Virginia Water Whole System (Registrant calculated DT_{50} and DT_{90} values for the Virginia Water Whole System were 7 and 45 days respectively and 15 and 151 days respectively for the Old Basing Whole System). Two major degradates were identified with each metabolite totaling 22% and 9% of applied radioactivity respectively.

METHODOLOGY:

Samples of sieved (2 mm; p. 13) sandy loam sediment (27 g; Old Basing; collected from Basingstoke, Hampshire, UK; 57% sand, 25% silt, 18% clay, 12.8% organic matter, pH 7.8, CEC 16.3 meq/100 g; Tables 1, 4, pp. 35, 36) OR sand sediment (45 g; Virginia Water; collected from Windsor, Berkshire, UK; 96% sand, 1% silt, 3% clay, 0.85% organic matter, pH 7.1, CEC 1.3 meq/100 g) were measured into glass cylinders and flooded with 200 mL of respective filtered (250 μm) natural water from the Old Basing site (pH 7.8, conductivity 528 μS/cm, hardness 324 mg/L as $CaCO_3$; Table 5, p. 37) or from the Virginia Water site (pH 7.2, conductivity 364 μS/cm, hardness 447 mg/L as $CaCO_3$; Table 6, p. 38). The final sediment:water ratio was 7:1 and 4:1 (w:w) for the sandy loam and sand sediment/water systems, respectively (p. 14). The sediment/water systems were pre-incubated at 20°C for 40-41 days. Following the pre-incubation period, the sediment/water systems were treated with cyclopropyl ring-labeled [1-^{14}C]lambda-cyhalothrin {PP321; (*S*)-cyano-3-phenoxybenzyl (*Z*)-(1*R*,3*R*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethylcyclopropane carboxylate and (*R*)-α-cyano-3-phenoxybenzyl (*Z*)-(1*S*,3*S*)-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethylcyclopropanecarboxylate; radiochemical purity ≥97.5%, specific activity 2.2 GBq/mmol; pp. 12, 20), dissolved

in acetone, at a nominal application rate equivalent to 8 g a.i./ha, or 10% of the maximum use rate (p. 9). Additional samples were treated with cyclopropyl ring-labeled [1-^{14}C]lambda-cyhalothrin OR uniformly phenoxy ring-labeled [^{14}C]lambda-cyhalothrin (radiochemical purity ≥93.2%, specific activity 2.7 GBq/mmol; pp. 12, 20), at an exaggerated rate of 80 g a.i./ha, or 100% of the maximum use rate, for metabolite identification (p. 22). To measure biomass, pre-equilibrated (36 days) samples were treated with nonradiolabeled parent at a nominal rate equivalent to 8 g a.i./ha (p. 15). The sediment/water systems were incubated in darkness at 20 ± 2°C for up to 98 days (pp. 14, 16; Figure 2, p. 28). A vacuum source was utilized to draw moist air through the systems and into a carbon molecular sieve (Carbosieve S-III), a graphitized carbon trap (Carbotrap 20/40) and two carbon dioxide traps (ethanolamine; Figure 3, p. 29). Duplicate sediment/water samples were removed for analysis at 0, 3, 6, 24, and 48 hours posttreatment; and at 4, 7, 14, 28, 58, and 98 days posttreatment (p. 16). The volatile traps were collected for analysis at each sampling interval from 48 hours to 98 days posttreatment; the traps were replaced with fresh solutions or sieves following each collection. The majority of the sediment and water samples were analyzed within 30 days of the sampling event (p. 19).

At 0, 3, 6, and 24 hours posttreatment, aliquots of the water phase were transferred to volumetric flasks (200 mL), brought to volume with water, and analyzed for total radioactivity by LSC (p. 16); aliquots of the water phase from the remaining samples (48 hours to 98 days) were directly analyzed by LSC. The water phase was acidified (pH 2, HCl) and partitioned four time with ethyl acetate OR the water phase was diluted with acetonitrile:water (5:100, v:v), passed through a pre-conditioned solid phase column (C18 Mega Bond-Elute) eluted with methanol, vacuum-dried, and eluted with ethyl acetate (p. 17). The extracts were concentrated by rotary evaporation and analyzed by LSC and by normal-phase TLC on silica gel plates developed in cyclohexane:diethyl ether:formic acid (60:40:2, v:v:v, p. 18). Samples were co-chromatographed with nonradiolabeled reference standards of the parent and the potential degradates R119890, R041207, R079406, and R211133 (Figure 1, pp. 26-27) which were visualized with UV (unspecified wavelength) light; reference compound R119890 was visualized using iodine crystals. Areas of radioactivity on the TLC plates were quantitated by radioimage scanning (p. 19). To confirm compound identities, selected samples were further analyzed by reverse-phase TLC on Merck RP 18F plates developed in methanol:glacial acetic acid:water (7:1:2) and by normal-phase TLC on silica gel plates developed in toluene:acetone:methanol:water:formic acid (60:40:10:1:1).

Sediment samples were extracted twice by shaking and sonication with acetonitrile, and the supernatant was decanted and vacuum filtered (p. 16). The metabolism vessel was washed with acetonitrile, and the rinsate was added to the sediment extracts. The combined extracts were analyzed for total radioactivity by LSC. The extracts were concentrated by rotary evaporation and analyzed by LSC (p. 17). Aliquots of the concentrated extracts were analyzed by normal- and reverse-phase TLC as previously described for the water phase. Post-extracted sediment samples were air dried,

ground using a mortar and pestle, and triplicate subsamples were analyzed by LSC following combustion.

Aliquots of the ethanolamine volatile trapping solutions were analyzed for total radioactivity by LSC at each sampling interval following 48 hours posttreatment (p. 17). To elute volatiles, the carbon sieves were rinsed with methanol and the eluent was analyzed by LSC.

To confirm the presence of aerobic conditions in the aerobic phase of the study, the redox potential (E_h), pH, and dissolved oxygen content were measured at weekly intervals during the pre-incubation period and at each sampling interval throughout the study period (p. 14). In the water phase of the sandy loam sediment/water system, conditions were strongly oxidizing, with redox potentials of 442-517 mV, dissolved oxygen contents of 32-72%, and pH values of 7.0-7.8 (Table 7, p. 39). Conditions were moderately reducing in the sandy loam sediment, with redox potentials of 91-170 mV. In the water phase of the sand sediment/water system, conditions were strongly oxidizing, with redox potentials of 472-569 mV, dissolved oxygen contents of 34-78%, and pH values of 6.7-7.2 (Table 8, p. 40). Conditions were moderately reducing in the sand sediment, with redox potentials of 117-198 mV (with the exception of 211 mV at day 51).

To confirm the viability of the sediment/water systems, the microbial biomass was measured by substrate-induced respiration (Appendix 1, p. 49); soil samples were reportedly viable.

DATA SUMMARY

Cyclopropyl ring-labeled [1-^{14}C]lambda-cyhalothrin (radiochemical purity ≥97.5%), at a nominal application rate equivalent to 8 g a.i./ha, degraded with registrant-calculated half-lives (reported as DT_{50}'s; first-order multi-compartment model; p. 19) of 15 days in flooded sandy loam sediment and 7 days in flooded sand sediment (r^2 values not reported) incubated aerobically in darkness at 20 ± 2 °C for up to 98 days (p. 21; Appendix 6, pp. 57, 60). All data, designated as percentages of the applied radioactivity, represent percentages of the nominal application.

Sandy loam sediment (Old Basing)

In the total sediment/water system, the parent compound was initially present at 85.9% of the applied radioactivity, decreased to 50.0% by 14 days and 26.5% by 30 days, and was 12.7% of the applied at 98 days posttreatment (Table 11, p. 43). In the water phase, the parent compound was initially present at 71.5% of the applied radioactivity, decreased to 10.2% of the applied by 1 day posttreatment, was 2.4-7.4% of the applied from 4 to 14 days posttreatment, and was last detected at 0.3% of the applied radioactivity at 30 days posttreatment. The major degradate

(1*RS*)-cis-3(*ZE*)-2-chloro-3,3,3-trifluro-1-propenyl)-2,2-dimethylcylopropanecarboxylate (R119890; Compound 1a)

was initially (time 0) detected at 2.1% of the applied radioactivity, was 6.8-9.6% of the applied from 2 to 14 days posttreatment, was a maximum of 11.4% of the applied at 30 days posttreatment, and was 0.6% of the applied at 98 days posttreatment. The minor degradate

(1*R*) *cis* α-(*S*) *cis* α-(*R*) α-cyano-3-(4-hydroxyphenoxy)benzyl 3-(Z-2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate (1:1; Compound XV; R211133)

was detected at 0.1-0.7% of the applied radioactivity from 0 to 14 days posttreatment. Uncharacterized baseline material was detected at 0.2-0.9% of the applied radioactivity throughout the incubation period. Unidentified radioactivity (designated as others; described as a group of minor metabolites, each <10% of the applied; pp. 22-23) was initially (time 0) detected at 2.3% of the applied radioactivity, was 2.1-5.5% of the applied at 1-14 days posttreatment, increased to 10.3% by 30 days and a maximum of 14% by 58 days, and was 13% of the applied at 98 days posttreatment.

In the sediment phase, the parent compound was initially present at 14.4% of the applied radioactivity, increased to 46.9% by 0.25 days and 70.2% by day 1, was 47.6-63.5% of the applied at 2-14 days posttreatment, and was 12.7% of the applied at 98 days posttreatment. The major degradate

Compound 1a (R119890)

was initially (day 1) detected at 0.9% of the applied radioactivity, increased to 6.7% by 14 days and 10.6% by 30 days, and was 2.5% of the applied at 98 days posttreatment. The minor degradate Compound XV (R211133) was initially (day 1) detected at 1.6% of the applied radioactivity, was 4.0-4.4% of the applied at 4-30 days posttreatment, and was 1.6% of the applied at 98 days posttreatment. Uncharacterized baseline material was detected at 0.1-1.9% of the applied radioactivity throughout the incubation period. Unidentified radioactivity (designated as others; described as a group of minor metabolites, each <10% of the applied; pp. 22-23) was initially (time 0) present at 6.3% of the applied radioactivity, increased to 13.3% by 14 days and a maximum of 25.4% by 58 days, and was 21.9% of the applied at 98 days posttreatment. Nonextractable [^{14}C]residues were 0.1-5.1% of the applied radioactivity from 1 to 14 days posttreatment, increased to 12.7% of the applied by 30 days posttreatment, and were 20.0-24.4% of the applied at 58-98 days posttreatment (Table 9, p. 41). Evolved $^{14}CO_2$ accounted for 0.2-2.9% of the applied radioactivity from 4 to 30 days posttreatment, increased to 9.1% of the applied by 58 days posttreatment, and was 15.2% of the applied at 98 days posttreatment; [^{14}C]organic volatiles were negligible (p. 21). Residues increased in the sediment phase over time; the sediment:water distribution ratio (reviewer-calculated using data in Table 9, p. 41)

was approximately 1:4 at time 0, changed to @ 5:1 by 1 day posttreatment, was @ 3:1 at 2-98 days posttreatment.

Material balances (based on LSC analysis) were 81.4-105.8% of the applied radioactivity throughout the incubation period, with no observed clear pattern of decline (Table 9, p. 41).

Sand sediment (Virginia Water)

In the total sediment/water system, the parent compound was initially present at 78.9% of the applied radioactivity, was a maximum of 84.5% of the applied at 0.25 days posttreatment, was 66.3% at 4 days, decreased to 45.9% by 7 days and 37.7% by 14 days, and was 5.8% of the applied at 98 days posttreatment (Table 12, p. 44). In the water phase, the parent compound was initially present at 49.3% of the applied radioactivity, decreased to 28.1-29.7% of the applied by 0.125-0.25 days posttreatment, decreased to 10.1% of the applied by 2 days posttreatment, was 1.7-5.4% of the applied at 4-14 days posttreatment, and was last detected at 0.2% of the applied at 30 days posttreatment. The major degradate

Compound 1a (R119890)

was initially (time 0) detected at 2.1% of the applied radioactivity, was 1.3-6.9% of the applied from 0.125 to 4 days posttreatment, increased to 11.8% by 7 days and a maximum of 14.4% by 14 days, and was last detected at 8.8% of the applied at 30 days posttreatment. The minor degradate Compound XV (R211133) was detected at 0.4-1.3% of the applied radioactivity from 0.125 to 7 days posttreatment. Uncharacterized baseline material was initially (time 0) 3.2% of the applied radioactivity and was 0.1-1.8% of the applied from 0.125 to 30 days posttreatment. Unidentified radioactivity (designated as others; described as a group of metabolites, each <10% of the applied; pp. 22-23) was initially (time 0) 8.6% of the applied radioactivity, increased with variability to 13.1% of the applied by 4 days posttreatment, was a maximum of 13.7% of the applied at 14 days posttreatment, and was last detected at 10.9% of the applied at 30 days posttreatment.

In the sediment phase, the parent compound was initially present at 29.6% of the applied radioactivity, increased to 56.4% of the applied by 0.25 days, was 30.1% at day 1 then increased to a maximum of 60.9% of the applied by 4 days posttreatment, was 36-43.3% of the applied at 7-14 days posttreatment, and was 5.8% of the applied at 98 days posttreatment (Table 12, p. 44). The minor degradate Compound 1a (R119890) was detected at 0.7-3.3% of the applied radioactivity from 4 to 30 days posttreatment, was not detected at 58 days posttreatment, and was 0.4% of the applied at 98 days posttreatment. The minor degradate Compound XV (R211133) was initially (0.25 to 1 day) 0.6-0.7% of the applied radioactivity, increased to a maximum of 8.7% of the applied by 7 days posttreatment, and was 0.9% of the applied at 98 days posttreatment. Uncharacterized baseline material was detected at 0.5-1.4% of the

applied radioactivity from 0.25 to 98 days posttreatment (with the exception of no detection at day 14). Unidentified radioactivity (designated as others; described as a group of metabolites, each <10% of the applied; pp. 22-23) was 3-8.3% of the applied radioactivity throughout the incubation period (with the exception of 34.3% at day 1). Nonextractable [^{14}C]residues were 0.2-0.8% of the applied radioactivity from 0 to 1 day posttreatment, increased to 7.7% of the applied by 7 days posttreatment, were a maximum of 33.2% of the applied by 30 days posttreatment, and were 17.4% of the applied at 98 days posttreatment (Table 9, p. 41). Evolved $^{14}CO_2$ accounted for 0.1-0.9% of the applied radioactivity from 1 to 4 days posttreatment, increased to 9.7% by 14 days and 20.2% by 30 days, and was 47.8% of the applied radioactivity at 98 days posttreatment; [^{14}C]organic volatiles were negligible (p. 21). Residues increased in the sediment phase over time; the sediment:water distribution ratio (reviewer-calculated using data in Table 9, p. 41) was approximately 1:3 at time 0, changed to @ 4:1 by 14 days posttreatment, was >2:1 at 30 days, and was approximately 15:1 at 98 days posttreatment.

Material balances (based on LSC analysis) were 94.3-104.4% of the applied radioactivity at 0-30 days posttreatment, with no clear pattern of decrease through 30 days, and then decreased to 72.5-77.8% of the applied by 58-98 days posttreatment (Table 9, p. 41).

COMMENTS:

1 This study is marginally acceptable in accordance with the Subdivision N Guidelines for the fulfillment of EPA data requirements on aerobic aquatic metabolism. The following issues were identified as concerns.

The pesticide appears to be a racemic mixture. There are a total of 16 different isomers which are possible with the structure of the chemical. However, the mixture referred to as cyhalothrin consists of four isomers. Lambda cyhalothrin consists of the enantiomeric pair with the αC and the cyclopropane C's in opposite configurations, either [(1R, 3R), αS] or [(1S, 3S), αR]. 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 bio-degradation.

The registrant only identified the parent compound and degradates by one-dimensional TLC. Additionally, no attempt was made to identify the non-extractable compounds. Given the high partition coefficient, it is possible that the pesticide will bind to the soil and glass which in turn may have a bearing on the degradation rate. The parent compound and metabolites were measured using Liquid Scintillation Counting (LSC) and characterized in sediment and water extracts with Thin Layer Chromatography (TLC) using reference standards. EFED prefers to see compound identification by two-dimensional TLC or GC/MS

2 Half lives were not calculated by the registrant in this study. The registrant calculated DT_{50} and DT_{90} values for each whole system (water-sediment) and for the surface water phase. EFED calculated first-order half lives (and associated correlation coefficients) were 34.1 days (R^2=0.919) for the Old Basing Whole system and 21.1days (R^2=0.752) for the Virginia Water Whole System. Registrant calculated DT_{50} and DT_{90} values for the Old Basing Whole System were 15 and 151 days respectively. Registrant calculated DT_{50} and DT_{90} values for the Virginia Water Whole System were 7 and 45 days respectively.

3 Three major degradates were identified. Carbon dioxide was the principal degradation compound and accounted for a maximum of 48% of the applied radioactivity. Two additional degradates were identified as compound 1a and compound XV. The major degradates were identified as (1RS)-cis-3(ZE)-2-chloro-3,3,3-trifluro-1-propenyl)-2,2-dimethylcylopropanecarboxylate (compound 1a) and (1R) cis α-(S) and (1S) cis α-(R) α-cyano-3-(4-hydroxyphenoxy) benzyl 3-(Z-2-chloro-3,3,3-trifluoroprop -1enyl)-2,2-dimethylcyclopropanecarboxylate (1:1) (compound XV). The maximum amount of each metabolite was 22% and 9% of applied radioactivity respectively. Two minor degradates were compounds V , and compound VI, were reported at concentrations less than 10%. The registrant did not evaluate these compounds due to the low concentrations detected.

4 Pesticide was applied at 8 gai/ha (10% of the maximum use rate) and at 80 gai/ha (100% of the maximum use rate). The registrant determined that 100% application rate exceeded the solubility of the pesticide and was therefore used to characterize the parent compound and metabolites. The results of the study using the 10% application rate were used to calculate material balances. The results from the 10% application rate were also used to estimate the degradation rates.

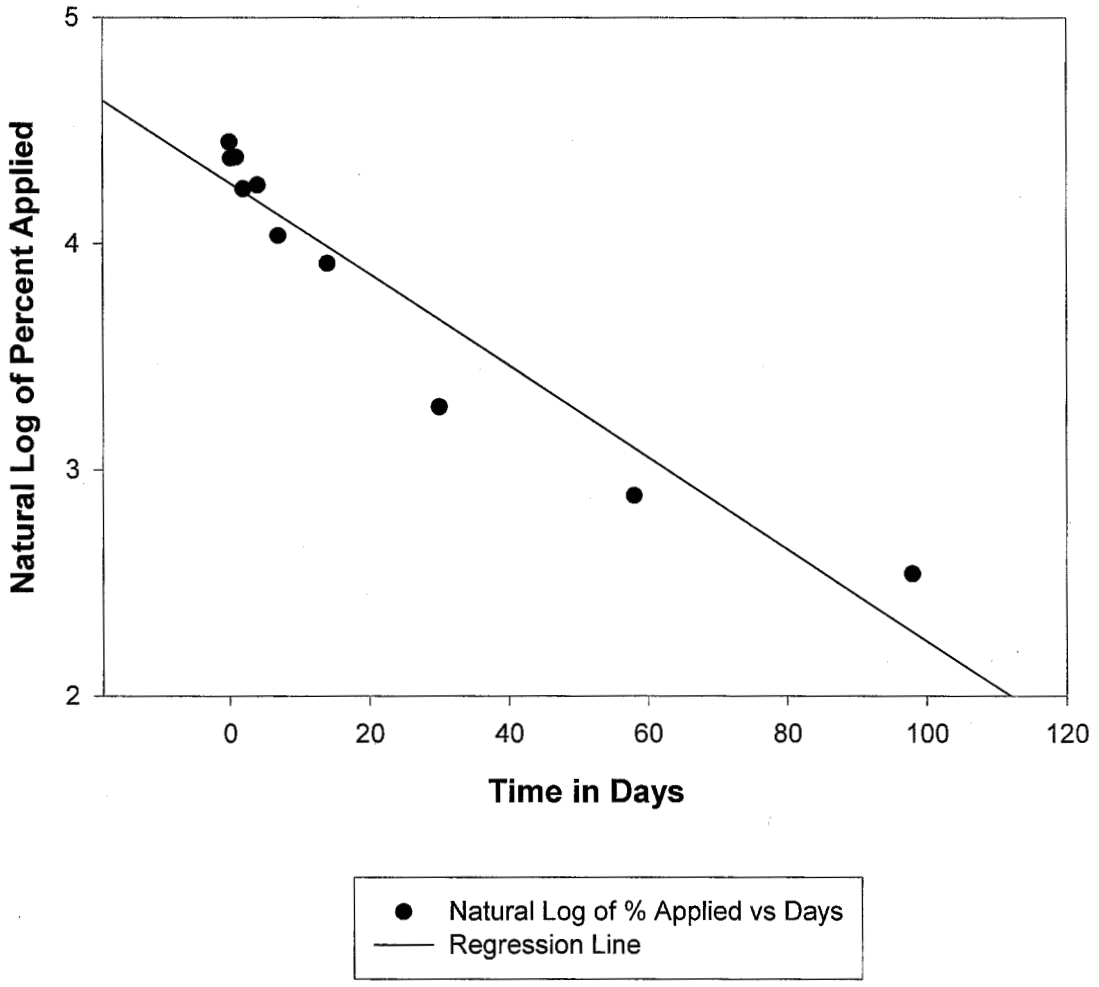
5 Material balances were between 81.4% and 105.8% for the 10% application and between 79.9% and 97.3% for the 100% application in the Old Basing System. Material balances were between 72.5% and 104.4% for the 10% application and between 76.8% and 95.5% for the 100% application in the Virginia Water System. The material balances are outside of the reasonable range of 90% to 110%. It is noted that the lower recoveries were generally encountered at the end of the study (58 and 98 days). Unextracted residues reached a peak of 24.4% in the Old Basing system and 33.2% in the Virginia Water system at the 10% application rate. Unextracted residues reached a peak of 18.9% in the Old Basing system and 13.6% in the Virginia Water system at the 100% application rate. The registrant reports that solvent washing of the glassware was performed to release any absorbed pesticide. No data are available to document the amount of absorbed material. It should be noted that absorption of the test compound would limit the amount available for degradation in the test systems

6 All study samples were stored at approximately -20°C. All LSC samples were analyzed on the same day as sample collection. TLC was normally performed within 30

days of sample collection. Selected extracts were re-analyzed throughout the study and showed no significant differences to the original analysis.

7 The sediment samples used were not U.S. samples. No correlation was made between the sediments used and similar soils proposed for US usage. The soils were sufficiently characterized by pH, texture/classification, percent organic carbon, total nitrogen, available phosphorous, and cation exchange capacity to compare to US soils.

Lambda Cyhalothrin
Aerobic Aquatic Metabolism
Old Basing Whole System



Linear Regression on Transformed Data
Aerobic Aquatic Metabolism Study
Lamda-Cyhalothrin
Old Basing Whole System

Half-Life = 34.1 days

[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: 4.27259}}
a = F(0)[2] "Auto {{previous: -0.0202811}}
[Equation]
f=y0+a*x
fit f to y
[Constraints]
[Options]
tolerance=0.000100
stepsize=100
iterations=100

R = 0.95885982 Rsqr = 0.91941216 Adj Rsqr = 0.90933868

Standard Error of Estimate = 0.2074

	Coefficient	**Std. Error**	**t**	**P**
y0	4.2726	0.0798	53.5343	<0.0001
a	-0.0203	0.0021	-9.5536	<0.0001

Analysis of Variance:

	DF	**SS**	**MS**	**F**	**P**
Regression	1	3.9256	3.9256	91.2706	<0.0001
Residual	8	0.3441	0.0430		
Total	9	4.2696	0.4744		

PRESS = 1.1859

Durbin-Watson Statistic = 1.1514

Normality Test: Passed (P = 0.7196)

Constant Variance Test: Passed (P = 0.2274)

Power of performed test with alpha = 0.0500: 0.9992

Regression Diagnostics:

Row	**Predicted**	**Residual**	**Std. Res.**	**Stud. Res.**	**Stud. Del. Res.**
1	4.2726	0.1806	0.8708	0.9434	0.9361
2	4.2675	0.1145	0.5521	0.5978	0.5721
3	4.2523	0.1347	0.6495	0.7019	0.6778
4	4.2320	0.0136	0.0656	0.0707	0.0662
5	4.1915	0.0698	0.3366	0.3612	0.3407
6	4.1306	-0.0946	-0.4562	-0.4868	-0.4623
7	3.9887	-0.0766	-0.3695	-0.3908	-0.3691

8	3.6642	-0.3870	-1.8661	-1.9756	-2.5822
9	3.0963	-0.2115	-1.0198	-1.1699	-1.2020
10	2.2850	0.2566	1.2371	2.3148	3.7682

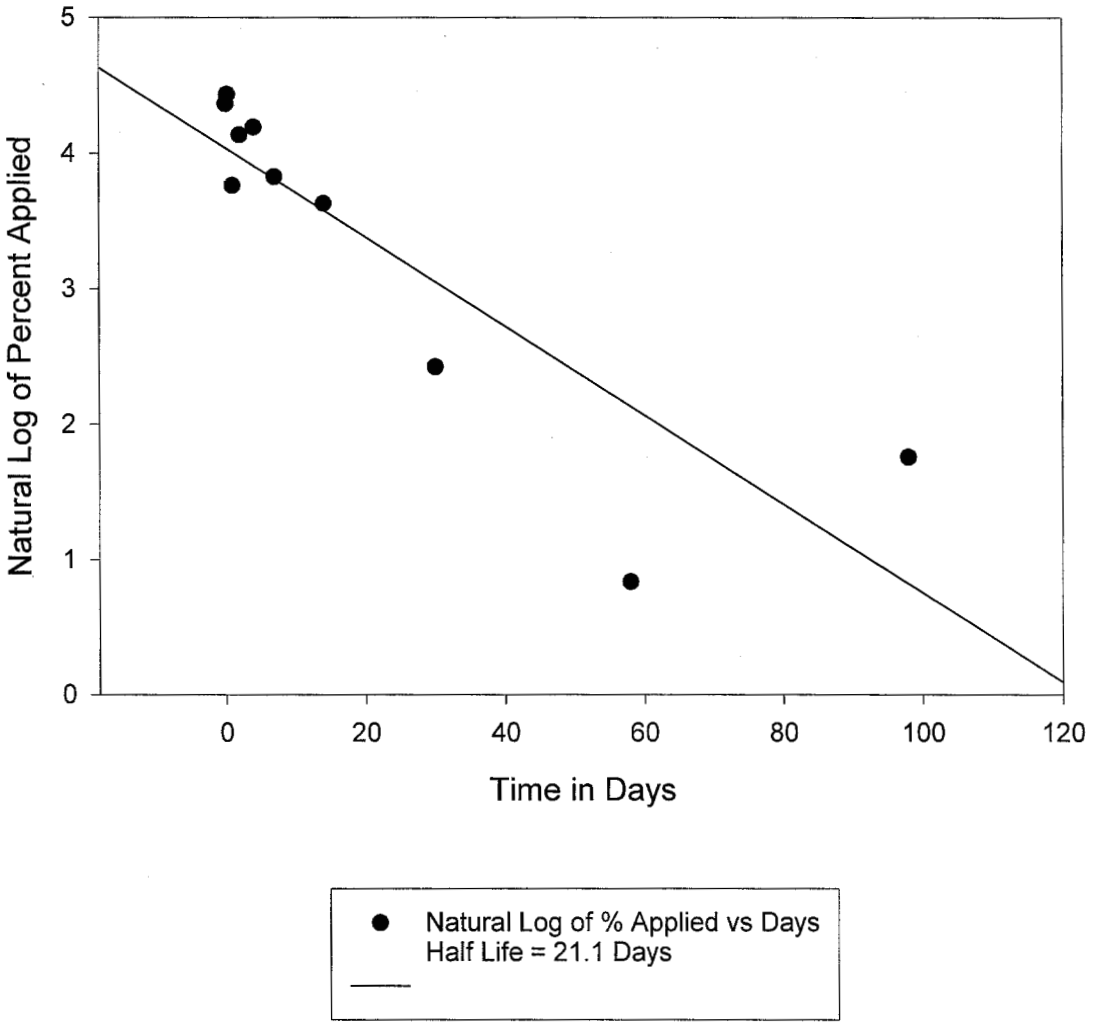
Influence Diagnostics:

Row	**Cook'sDist**	**Leverage**	**DFFITS**
1	0.0774	0.1481	0.3903
2	0.0308	0.1470	0.2375
3	0.0413	0.1437	0.2777
4	0.0004	0.1395	0.0266
5	0.0099	0.1318	0.1327
6	0.0164	0.1218	-0.1722
7	0.0090	0.1058	-0.1269
8	0.2355	0.1077	-0.8971
9	0.2163	0.2402	-0.6758
10	6.7020	0.7144	5.9598

95% Confidence:

Row	**Predicted**	**Regr. 5%**	**Regr. 95%**	**Pop. 5%**	**Pop. 95%**
1	4.2726	4.0885	4.4566	3.7602	4.7850
2	4.2675	4.0842	4.4509	3.7553	4.7797
3	4.2523	4.0710	4.4336	3.7409	4.7638
4	4.2320	4.0534	4.4107	3.7215	4.7425
5	4.1915	4.0178	4.3651	3.6827	4.7003
6	4.1306	3.9637	4.2975	3.6241	4.6372
7	3.9887	3.8331	4.1442	3.4858	4.4916
8	3.6642	3.5072	3.8211	3.1608	4.1675
9	3.0963	2.8619	3.3307	2.5637	3.6289
10	2.2850	1.8808	2.6893	1.6589	2.9112

Lamda Cyhalothrin
Aerobic Aquatic Metabolism
Virginia Water Whole System



Linear Regression on Transformed Data
Aerobic Aquatic Metabolism Study
Lamda-Cyhalothrin
Virginia Water Whole System

Half-Life = 21.1 days

[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: 4.04231}}
a = F(0)[2] "Auto {{previous: -0.0329147}}
[Equation]
f=y0+a*x
fit f to y
[Constraints]
[Options]
tolerance=0.000100
stepsize=100
iterations=100

R = 0.86713820 Rsqr = 0.75192865 Adj Rsqr = 0.72091973

Standard Error of Estimate = 0.6530

	Coefficient	Std. Error	t	P
y0	4.0423	0.2513	16.0861	<0.0001
a	-0.0329	0.0067	-4.9243	0.0012

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	10.3395	10.3395	24.2488	0.0012
Residual	8	3.4111	0.4264		
Total	9	13.7506	1.5278		

PRESS = 14.8840

Durbin-Watson Statistic = 1.9389

Normality Test: Passed (P = 0.2382)

Constant Variance Test: Passed (P = 0.2746)

Power of performed test with alpha = 0.0500: 0.9378

Regression Diagnostics:

Row	Predicted	Residual	Std. Res.	Stud. Res.	Stud. Del. Res.
1	4.0423	0.3259	0.4991	0.5407	0.5153
2	4.0341	0.4027	0.6167	0.6677	0.6427
3	4.0094	-0.2459	-0.3765	-0.4069	-0.3846
4	3.9765	0.1603	0.2455	0.2646	0.2486
5	3.9106	0.2835	0.4342	0.4660	0.4420
6	3.8119	0.0146	0.0223	0.0238	0.0223
7	3.5815	0.0482	0.0738	0.0780	0.0730

8	3.0549	-0.6301	-0.9649	-1.0215	-1.0247
9	2.1333	-1.3003	-1.9914	-2.2845	-3.6245
10	0.8167	0.9412	1.4414	2.6971	8.3768

Influence Diagnostics:

Row	**Cook'sDist**	**Leverage**	**DFFITS**
1	0.0254	0.1481	0.2148
2	0.0384	0.1470	0.2668
3	0.0139	0.1437	-0.1576
4	0.0057	0.1395	0.1001
5	0.0165	0.1318	0.1722
6	0.0000	0.1218	0.0083
7	0.0004	0.1058	0.0251
8	0.0630	0.1077	-0.3560
9	0.8248	0.2402	-2.0377
10	9.0982	0.7144	13.2488

95% Confidence:

Row	**Predicted**	**Regr. 5%**	**Regr. 95%**	**Pop. 5%**	**Pop. 95%**
1	4.0423	3.4628	4.6218	2.4289	5.6558
2	4.0341	3.4568	4.6114	2.4214	5.6467
3	4.0094	3.4386	4.5802	2.3990	5.6198
4	3.9765	3.4140	4.5390	2.3691	5.5839
5	3.9106	3.3640	4.4573	2.3087	5.5126
6	3.8119	3.2864	4.3374	2.2170	5.4068
7	3.5815	3.0918	4.0712	1.9981	5.1649
8	3.0549	2.5607	3.5490	1.4701	4.6397
9	2.1333	1.3953	2.8712	0.4564	3.8101
10	0.8167	-0.4561	2.0894	-1.1549	2.7883