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OPP OFFICIAL RECORD  
HEALTH EFFECTS DIVISION  
SCIENTIFIC DATA REVIEWS  
EPA SERIES 361

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

OFFICE OF  
PREVENTION, PESTICIDES AND  
TOXIC SUBSTANCES

March 6, 2003

MEMORANDUM

SUBJECT: HED's Review of "Determination of Transferable Turf Residues on Turf Treated with Esfenvalerate"; MRID # 45013501. DP Barcode No. D283183.

FROM: Barry O'Keefe, Occupational and Residential Exposure Assessor  
Reregistration Branch 3  
Health Effects Division (7509C)

*B. O'Keefe*

THRU: Catherine Eiden, Branch Senior Scientist  
Reregistration Branch 3  
Health Effects Division (7509C)

*Cathy Eiden*

TO: George Larocca, Product Manager  
Insecticide Branch  
Registration Division (7505C)

Attached is a review of the turf transferable residue (TTR) study submitted by McLaughlin Gormley King (MRID 45013501). The primary review was completed by Versar, Inc. on June 17, 2002, under supervision of HED. It has undergone secondary review in the branch and has been revised to reflect Agency policies.

**Executive Summary**

The TTR data are acceptable for use in postapplication exposure assessment. The limitations of the study are as follows: 1) TTR data were collected at only one geographic location (California). Data should be collected from at least three geographically distinct locations for each formulation and crop type; 2) Field fortifications were performed as part of the storage stability study. Fortification samples were not analyzed along with the residue samples; and 3) Residue data were reported in  $\mu\text{g}$  rather than  $\mu\text{g}/\text{cm}^2$ . However, although there are some limitations with the data developed to support the reregistration of esfenvalerate, the TTR study contains the best available data to evaluate potential exposures to esfenvalerate from treated turf.

**Study Summary**

Turf transferable residues (TTR) were monitored for a typical end use product, Evercide Esfenvalerate 35% WP (EPA Reg. No. 1021-1636), a wettable powder containing 35% active ingredient (ai), using the Modified California Roller Technique, developed by the Outdoor

Exposure Task Force (ORETF). The product was applied at one site in Porterville, California. Two applications were made during the study at the maximum application rate of 0.188 lb ai/acre, with a seven day interval, using spray equipment consisting of a tractor outfitted with a pump and hydraulic boom. Triplicate TTR samples were collected from each of the three treated and one untreated plots at each sampling interval. The sampling intervals were 0, 1, 2, 5, 7, 14, 21, 28, and 35 days after the final treatment (DAT). Total irrigation between the two applications was 2.5 inches. After the second application plots were irrigated with 1 inch of water on DAT 2 and DAT 4, and 0.5 inch of water on DAT 6, DAT 8, DAT 13, DAT 19, DAT 23, DAT 29, and DAT 34. On DAT 25 0.3 inch of rainfall was measured. The labels do not provide instructions concerning whether irrigation is desirable and/or necessary, although given the dry California climate, irrigation would be necessary maintain turf. The plots were mowed, using a mulching mower, two days before each application, and again on the following days after the second application: DAT 8, DAT 15, DAT 22, and DAT 29.

The Versar review is attached and serves as the detailed review of the QA/QC and results. The results of the TTR data are presented in Table 1.

Table 1. Turf Residue Data for California Site

Sampling Interval (Days after treatment)	Turf Residue Level ( $\mu\text{g}/\text{cm}^2$ )			Statistical Summary of Turf Residue Levels			
	Subplot A	Subplot B	Subplot C	Arithmetic Mean ( $\mu\text{g}/\text{cm}^2$ )	Standard Deviation ( $\mu\text{g}/\text{cm}^2$ )	Coefficient of Variation (%)	Natural Log of Mean ( $\mu\text{g}/\text{cm}^2$ )
0	0.0652	0.0529	0.0835	0.0672	0.0154	22.9	-2.7
1	0.0321	0.0334	0.0348	0.0334	0.0014	4	-3.4
2	0.0294	0.0358	0.0322	0.0325	0.0032	9.9	-3.43
5	0.0139	0.0142	0.0135	0.0139	0.0004	2.5	-4.28
7	0.0145	0.016	0.0152	0.0152	0.0008	4.9	-4.18
14	0.0068	0.0052	0.0054	0.0058	0.0009	15	-5.15
21	0.0042	0.0065	0.0043	0.005	0.0013	26	-5.3
28	0.0016	0.0025	0.002	0.002	0.0005	22.2	-6.2
35	0.001	0.0006	0.0008	0.0008	0.0002	25	-7.13

Detectable residues were found on turf samples on the day of the second application (DAT 0), i.e. 374.56  $\mu\text{g}$  or 0.0672  $\mu\text{g}/\text{cm}^2$ . Residues declined, but were still detected up to 35 days after treatment (DAT 35), i.e. 5.71  $\mu\text{g}$  or 0.001  $\mu\text{g}/\text{cm}^2$ . Also, the data show that 3.2% of the applied esfenvalerate was detected on Day 0 following the second application. Following the first application the transfer efficiency (percent of application rate) was only 2.7%. A dissipation rate was modeled by the study author assuming first-order kinetics to estimate an esfenvalerate half-life of 6.6 days ( $R^2=0.9479$ ) on turf. In calculating mean residues, the registrant used the limit of quantitation (LOQ) for values below the LOQ. Versar re-ran the dissipation kinetics analysis using the individual data points (not averages) and  $\frac{1}{2}$  LOQ for values below the LOQ. The half-life of 6.1 days ( $R^2=0.902$ ) estimated by Versar was similar to that estimated by the registrant.

**Conclusions**

The study has minor deficiencies and does not fully meet guideline requirements. The limitations of the study are as follows: 1) TTR data were collected at only one geographic location (California). Data should be collected from at least three geographically distinct locations for each formulation and crop type; 2) Field fortifications were performed as part of the storage stability study. Fortification samples were not analyzed along with the residue samples; and 3) Residue data were reported in  $\mu\text{g}$  rather than  $\mu\text{g}/\text{cm}^2$ . However, the study contains the best available data to evaluate potential exposures to esfenvalerate from treated turf.

Detectable residues were found on turf samples on the day of the second application (DAT 0) and up to 35 days after treatment (DAT 35). Assuming first-order kinetics, esfenvalerate residues dissipated at a moderate rate, with an estimated half-life of 6.6 days ( $R^2=0.9479$ ) on turf.

### **Recommendations**

The TTR data are acceptable for use in postapplication exposure assessment. Although there are some minor limitations with the data, the TTR study contains the best available data to evaluate potential exposures to esfenvalerate from treated turf.

### **Attachment**

cc: Wilhelmena Livingston, SRRD (7508C)



MEMORANDUM

TO: Barry O'Keefe

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R. Sandvig

FROM: Kelly McAloon/Marit Espevik

DATE: June 17, 2002

SUBJECT: Study Review for *Determination of Transferable Turf Residues on Turf Treated with Esfenvalerate* (MRID# 450135-01; TAF #2-1-136)

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This attached report reviews *Determination of Transferable Turf Residues on Turf Treated with Esfenvalerate*, submitted by McLaughlin Gormley King in support of reregistration requirements for the insecticide esfenvalerate. This study was submitted and reviewed under EPA's OPPTS Series 875, Occupational and Residential Exposure Test Guidelines Group B: Turf Transferable Residue Dissipation -Postapplication Exposure. Please feel free to contact us if you have any questions.

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Reviewer: Kelly McAloon/Marit EspevikDate June 17, 2002

**STUDY TYPE:** Determination of Turf Transferable Residue on Turf Treated with Evercide® Esfenvalerate 35% WP

**TEST MATERIAL:** Esfenvalerate formulated as a wettable powder in Evercide® Esfenvalerate 35% WP insecticide; (S)-cyano (3-phenoxyphenyl) methyl-(S)-4-chloro-alpha-(1-methylethyl) benzeneacetate

**SYNONYMS:** Esfenvalerate; Evercide® Esfenvalerate 35% WP

**CITATION:**

Study Director/Author: Dr. Wayne N. Harnish  
Landis International, Inc.  
3185 Madison Highway  
Valdosta, GA 31603

Title: Review of *Determination of Transferable Turf Residues on Turf Treated with Esfenvalerate*

Report Date: December 14, 1999

Analytical Laboratory: Biological Test Center  
2525 McGaw Ave.  
Irvine, CA 92713-9791

Field Cooperator: Research for Hire  
1696 South Leggett  
Porterville, CA 93257

Identifying Codes: MRID 450135-01; Landis Trial No. (Location) 1321-98-019-07-24A-06 (CA)

**SPONSOR:** McLaughlin Gormley King  
c/o Frederick J. Preiss  
8810 Tenth Avenue North  
Minneapolis, MN 55427-4372

**EXECUTIVE SUMMARY:**

This study was designed to characterize dissipation of esfenvalerate turf transferable residues when applied at one test site in Porterville, California. A wettable powder formulation of the test product was applied twice using a tractor outfitted with a pump and hydraulic boom to a dwarf turf grass test plot. The maximum application rate of 0.188 lb ai/acre was applied. Turf transferable residues (TTR) were sampled using the modified California Roller Technique and treated cotton cloth samples were collected as soon as the spray dried and 1, 2, 5, 7, 14, 21, 28, and 35 days after the final treatment (DAT). At each sampling interval, three samples were randomly collected from each of the three treated and one untreated turf plots for each sampling period. The application method, rate, and frequency (number and timing) were relevant to the use pattern proposed by the product label.

The study author reported that detectable TTR values were found on turf samples on the day of application (374.56  $\mu\text{g}$  or 0.0672  $\mu\text{g}/\text{cm}^2$ ) and up to 35 days after treatment (DAT). TTR values for esfenvalerate declined to 5.71  $\mu\text{g}$  or 0.001  $\mu\text{g}/\text{cm}^2$  by DAT-35. A dissipation rate was modeled by the study author assuming first-order kinetics to estimate an esfenvalerate half-life of 6.6 days ( $R^2=0.9479$ ) in turf. In calculating mean residues, the registrant used the limit of quantitation (LOQ) for values below the LOQ. Versar re-ran the dissipation kinetics analysis using the individual data points (not averages) and  $\frac{1}{2}$

LOQ for values below the LOQ. Versar's estimated half-life was similar to that estimated by the registrant at 6.1 days ( $R^2=0.902$ ).

This study met most of the Series 875.2100 Guidelines. The following issues of concern are noted: (1) Precipitation data were only reported on a per month basis and it is, therefore, not clear if testing was initiated before a precipitation event occurred; (2) Turf transferable residue data were collected at only one location (California). Data should be collected from at least three geographically distinct locations for each formulation and crop type; (3) Field fortifications were only performed as part of the storage stability study. Fortification samples were not analyzed along with the residue samples; and (4) Residue data were reported in  $\mu\text{g}$  rather than  $\mu\text{g}/\text{cm}^2$ .

**COMPLIANCE:** Signed and dated GLP, Quality Assurance, and Data Confidentiality statements were provided. The registrant waived claims of confidentiality within the scope of FIFRA Section 10 (d)1(A), (B), or (C). The registrant stated that the study was conducted under EPA Good Laboratory Practice Standards (40 CFR Part 160), with certain exceptions. None of these GLP deviations compromised the scientific integrity of the study. The deviations identified included: (1) some weather data were not collected under GLP guidelines and (2) test material and carrier water samples were analyzed separately, not as a spray mix as per 40 CFR Part 160.113.

**CONCURRENT EXPOSURE STUDY?:** No

**GUIDELINE OR PROTOCOL FOLLOWED:** Series 875, Occupational and Residential Exposure Test Guidelines Group B: Turf Transferable Residue Dissipation -Postapplication Exposure; Landis Protocol No. 01924A010.

## **I. MATERIALS AND METHODS**

### **A. MATERIALS**

#### **1. Test Material:**

Formulation: Evercide® Esfenvalerate 35% WP- a wettable powder containing 35 percent active ingredient (ai).  
 Lot/Batch # formulation: 13941  
 Formulation guarantee: A certificate of analysis was provided by the sponsor in the study report which verified the purity of the reference standard for Evercide® Esfenvalerate 35% WP as 83.8%. The reference standard expiration date was February 2, 2000.  
 CAS #(s): CAS 66230-04-04  
 Other Relevant Information: EPA Reg. No. 1021-1636

#### **2. Relevance of Test Material to Proposed Formulation(s):**

The test product used in this study was the same proposed formulation which is available for commercial use.

### **B. STUDY DESIGN**

The study report did not mention any amendments or deviations to the study protocol.

#### **1. Site Description**

**Test location:** The field portion of this study was conducted at one location (Porterville, California). This location was said to be a geographic site typical for the intended use of esfenvalerate.

**Areas sprayed and sampled:** The test site consisted of one treated and one untreated plot. The treated plot was divided into three sub-plots, each measuring 20 feet wide by 65 feet long, for a total area of 3,900 square feet. Each subplot was divided into 13 sampling areas which were five feet wide and five feet long. The untreated plot size was 1,300 square feet.

**Meteorological Data:** At the time of each application, wind direction and speed, air and soil temperature, and relative humidity were recorded. Maximum and minimum air and soil temperatures and rainfall data were collected daily from weather stations located 4.5 miles to the northeast of the plots throughout the duration of the field portion of the study. The study report provides mean maximum and minimum temperatures as well as total rainfall and total irrigation for each month of the study. A total of 0.34 inches of rain fell during the course of the study. Mean temperatures ranged from a low of 43°F to a high of 80°F.

**2. Surface Monitored:**

**Turf Species:** Superior Sod/dwarf fescue

**Residential or Public Area:** The study did not state whether the test site was located in a residential or a public area.

**Other relevant Characteristics:** The grass was planted on December 18, 1997. The turf was mowed to a grass blade length of approximately 2.5 inches two days before each application and the mowed clippings were not removed from the plot area.

**Other products used on turf:** A full maintenance pesticide use history for the period from 1993 to and the time of the study was provided in the Study Report. Table 1 provides the pesticide use information for during and just prior to the study period.

Table 1. Pesticide Use History During and Just Prior to the Study Period

Date	Plot	Pesticide/Fertilizer Applied	Rate
36044	Non-treated and treated	Terrachlor 75 WP	15 lb ai/acre
36058	Non-treated and treated	15-15-15	150 lb/acre
During the test	Non-treated	Topsin M WSB (2 apps)	0.70 lb ai/acre
		Kelthane MF	1.0 lb ai/acre
		Agrimek	0.06 lb ai/acre
During the test	Non-treated and Treated	15-15-15 (2 apps)	150 lb/acre

**3. Physical State of Formulation as Applied :**

**Granular / Liquid:** Liquid

**4. Application Rates and Regimes**

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Residential or Commercial Applicator: The Study Report did not indicate whether the applicator was residential or commercial.

Application rate: The target and actual application rate for the test plot was 0.188 lb ai/acre (1.96 g ai/1000 ft<sup>2</sup>).

Application Regime: Two applications were made during the study with a seven day interval.

Application Equipment: Spray equipment consisted of a tractor outfitted with a pump and hydraulic boom equipped with 12 nozzles spaced 20 inches apart.

Spray Volume: For the first application, the calibrated application volume was 263.94 gal/acre and the actual application volume was 264 gal/acre. For the second application, the calibrated application volume was 262.38 and the actual application volume was 262.15.

Equipment Calibration Procedures: Calibration of the application equipment was done by determining the speed of the tractor and the output of the sprayer determined for a given time for all nozzles combined (i.e., 30 seconds) to determine the gallon per acre output for the entire spray boom.

Was application "watered in"? The study author reported a total irrigation of 8.50 inches, but it is not clear if this was performed to move the chemical into the root zone. The product label does not provide any information on irrigation.

Was total deposition measured? No

**5. Dislodgeable Residue Sampling Procedures**

Method and Equipment: Samples were collected using the Modified California Roller Technique developed by the Outdoor Residential Exposure Task Force (ORETF). The study report references Landis International SOP #4-36-Current Revision, Transferable Turf Residue Sampling Technique, which was based on the Outdoor Residential Exposure Task Force Bulletin "Transferable Turf Residue Sampling Techniques," January, 1998.

Sampling Procedure: At each sampling interval, three samples were randomly collected from each of the three treated and one untreated turf plots for each sampling period. Transferable residue samples were collected by moving the roller back and forth a total of five times within the a-frame guide retaining the cotton cloth with a plastic sheet barrier so the roller did not contact the sampling cloth. In all case, samples were collected after the spray residue had dried.

Surface area(s) sampled: Each cloth sample was 5574 cm<sup>2</sup> in size.

Replicates per surface:

- Replicates per sampling time: Cotton cloth samples were collected in triplicate from each of three subplots for a total of 9 replicates per sampling time.
- Number of sampling times: There were a total of 11 sampling events.

Times of sampling: The treated cotton cloth samples were collected on Day 0 as soon as the spray dried and 1, 2, 5, 7, 14, 21, 28, and 35 days after treatment (DAT).

Other Relevant Information: Three control samples were collected at each sampling interval to be used as field blanks.

**6. Sample Handling**



Samples were shipped from the field site to the analytical laboratory, Biological Test Center, Irvine, CA. All samples were shipped frozen on dry ice, except test substance, test substance mix water and irrigation water samples which were shipped at ambient temperatures.

## 7. Analytical Methodology:

**Extraction method:** The Biological Test Center analytical method entitled "Determination of Transferable Turf Residues on Turf Treated with Esfenvalerate" was used for the analysis and was provided in Appendix I of the Study Report. The entire sample was cut into 4 inch squares and placed in a one liter glass jar with a teflon-lined lid. Five grams of Celite 545 was added and the sample was extracted by shaking with 750 mL of hexane. The extract was filtered and 250 mL of the filtrate was transferred to a separatory funnel and extracted two times with 125 mL of hexane saturated acetonitrile. The combined acetonitrile extracts were concentrated to dryness using a rotary evaporator followed by nitrogen gas. The residues were dissolved in 3 mL hexane, dried over sodium sulfate, and applied to a silica Sep-Pak. The Sep-Pak was eluted with 2% ethyl acetate in hexane and the eluent volume was adjusted, as appropriate, for GC-analysis.

**Detection methods:** See Table 2.

Table 2. Summary of GC Chromatographic Condition

GC Column	Hewlett-Packard Model 5890 Series II Plus
Injector	Hewlett-Packard Model 18593B Automatic Injector
Column	J&W Scientific Model DB-5 capillary column, 30-m x 0.25 mm i.d., 0.25 $\mu$ m film thickness
Carrier Gas	Ultra-high purity helium
Flow rate	1.0 mL/min
Temperatures	Inlet: 280 °C Oven: 200 °C, hold 1 min. 200 °C to 290 °C over 5 min. Hold at 290 °C for 7 min.
ECD Detector Temperature	300 °C
Injection Volume	1 $\mu$ L

**Method validation:** A method validation was performed as part of this study (see Table 3). Samples included 2 unfortified controls, 7 fortifications at 5  $\mu$ g, and 7 fortifications at 50  $\mu$ g. Following the analysis of the field samples, the method was re-validated with 7 fortifications at 610  $\mu$ g to encompass the maximum residue levels detected in the treated samples. The limit of quantification (LOQ) was reported as 5  $\mu$ g.

Table 3. Method Validation Results

Fortification Level ( $\mu\text{g}$ )	Percent Recovery (%)							Average Percent Recovery (%)
	Rep. 1	Rep. 2	Rep. 3	Rep. 4	Rep. 5	Rep. 6	Rep. 7	
5	107.6	109.4	86.9	74.8	94.4	90.8	83.2	92.4 $\pm$ 12.6
50	101.4	94	91.1	87.9	101	93.4	97	95.1 $\pm$ 5.0
610	67.2	74	81.2	77.5	75.8	77.1	66.8	74.2 $\pm$ 5.4

Instrument performance and calibration: Calibration standards were prepared by weighing out an appropriate amount of esfenvalerate into a volumetric flask and filling to volume with hexane. This step was repeated, and serial dilutions were performed in order to prepare five calibration standards with concentrations ranging from ~175 ng/mL to ~700 ng/mL.

Quantification: Residue concentrations were quantified using Hewlett Packard Model G1701BA MSD Productivity ChemStation software (version B.01.00). Using the results from the standard curve, the amount of esfenvalerate found in the sample was calculated as follows:

(1) ng found = (peak area - standard curve y-intercept)/standard curve slope

(2)  $\mu\text{g}$  found = (ng found/vol injected  $\mu\text{L}$ ) x (1  $\mu\text{g}$ /1000 ng) x (1000  $\mu\text{L}$ /mL) x (total vol hexane/ethyl acetate mL) x (sample vol/vol analyzed)

**8. Quality Control:**

Lab Recovery: One unfortified control, one 5  $\mu\text{g}$  fortified control, and one 50  $\mu\text{g}$  fortified control sample were analyzed with each set of samples (see Table 4). No esfenvalerate residues were detected in any of the control samples. Recoveries from the fortified controls ranged from 72.4% to 109.2%. The average recovery at the 5  $\mu\text{g}$  level was 94.1  $\pm$  10.2% and at the 50  $\mu\text{g}$  level was 91.0  $\pm$  12.6%.

Table 4. Laboratory Fortification Results

Fortification Level ( $\mu\text{g}$ )	Percent Recoveries (%)			Average Percent Recovery (%)
5	104.0	84.9	92.0	94.1 $\pm$ 10.2
	105.0	105.3	99.5	
	72.4	99.7	86.5	
	95.0	90.7		
50	80.8	87.8	95.7	91.0 $\pm$ 12.6
	72.7	81.8	84.0	
	101.5	104.8	104.6	
	109.2	78.4		

Field blanks: One control sample from the untreated plot was taken at each sampling interval.

Field recovery: Field fortification samples were not analyzed as part of the sample analysis. Samples were fortified in the field only as part of a storage stability study and were not analyzed along with the residue samples.

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- Formulation:** A certificate of analysis was provided to the analytical laboratory by the sponsor which verified the purity of the reference standard at 83.8%.
- Tank mix:** The test substance and mixing water were analyzed separately by the analytical laboratory. Analysis of the test substance found 30.8 mg of esfenvalerate in a 0.0975 g sample. Analysis of the mixing water showed no detectable residues of esfenvalerate.
- Travel Recovery:** Travel recovery was not discussed in the Study Report.
- Storage Stability:** Storage stability samples were prepared at the field site by fortifying control samples with 5 and 50  $\mu\text{g}$  of esfenvalerate. These samples were extracted and analyzed after 202-223 days of storage. This storage interval was sufficient to encompass the longest storage interval of the field samples (187 days). Storage stability recoveries ranged from 81.5% to 106.2% with an overall average of  $95.4\% \pm 8.4$ .

**II. RESULTS AND CALCULATIONS:**

Table 5 summarizes the sampling intervals, number of replicates, and surface area sampled at the field site. Table 6 presents a summary of the TTR values at the California site in  $\mu\text{g}/\text{cm}^2$ , with corresponding statistical summaries. The Registrant only provided residue values in  $\mu\text{g}$ , rather than  $\mu\text{g}/\text{cm}^2$ . Versar divided those values by the surface area of the samples (5,574  $\text{cm}^2$ ) to obtain residue values in  $\mu\text{g}/\text{cm}^2$ .

The study author reported that detectable TTR values were found on turf samples on the day of application (374.56  $\mu\text{g}$  or  $0.0672 \mu\text{g}/\text{cm}^2$ ) and up to 35 days after treatment (DAT). TTR values for esfenvalerate declined to 5.71  $\mu\text{g}$  or  $0.001 \mu\text{g}/\text{cm}^2$  by DAT-35. A dissipation rate was modeled by the study author assuming first-order kinetics to estimate an esfenvalerate half-life of 6.6 days ( $R^2=0.9479$ ) in turf. In calculating mean residues, the registrant used the limit of quantitation (LOQ) for values below the LOQ. Versar re-ran the dissipation kinetics analysis using the individual data points (not averages) and one-half the LOQ ( $0.00045 \mu\text{g}/\text{cm}^2$ ) for samples with TTR values below the LOQ. Versar's estimated half-life was similar to that estimated by the registrant at 6.1 days ( $R^2=0.902$ )

**III DISCUSSION**

**A. LIMITATIONS OF THE STUDY:**

This study met most of the Series 875.2100 Guidelines. The following issues of concern are noted: (1) Precipitation data were only reported on a per month basis and it is, therefore, not clear if testing was initiated before a precipitation event occurred; (2) Turf transferable residue data were collected at only one location (California). Data should be collected from at least three geographically distinct locations for each formulation and crop type; (3) Field fortifications were only performed as part of the storage stability study. Fortification samples were not analyzed along with the residue samples; and (4) Residue data were reported in  $\mu\text{g}$  rather than  $\mu\text{g}/\text{cm}^2$ .

**B. CONCLUSIONS:**

Versar used TTR values from immediately after application through DAT-35 for the regression analysis (see Appendix B). The linear regression was conducted using the natural logarithms of TTR values processed by Microsoft's® Excel 1997. A comparison of the half-lives, as estimated by the study author and by Versar, is presented below:

	<u>Study Author</u>	<u>Versar</u>
<u>Esfenvalerate</u>	6.6 days ( $R^2=0.9479$ )	6.1 days ( $R^2=0.902$ )

Versar also examined data variability as part of the linear regression analysis. The coefficient of variation for the triplicate samples of turf residues collected at the same time interval ranged from 2.5% to 26.0%.

Table 5. Turf Residue Sampling Times

Criteria	Interval								
Time from last application (days)	0	1	2	4	7	14	21	28	35
Number of replicates	9	9	9	9	9	9	9	9	9
Area (cm <sup>2</sup> )	5,574	5,574	5,574	5,574	5,574	5,574	5,574	5,574	5,574

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Table 6. Turf Residue Data for California Site

Sampling Interval (Days after treatment)	Turf Residue Level ( $\mu\text{g}/\text{cm}^2$ )			Statistical Summary of Turf Residue Levels			
	Subplot A	Subplot B	Subplot C	Arithmetic Mean ( $\mu\text{g}/\text{cm}^2$ )	Standard Deviation ( $\mu\text{g}/\text{cm}^2$ )	Coefficient of Variation (%)	Natural Log of Mean ( $\mu\text{g}/\text{cm}^2$ )
0	0.0652	0.0529	0.0835	0.0672	0.0154	22.9	-2.7
1	0.0321	0.0334	0.0348	0.0334	0.0014	4	-3.4
2	0.0294	0.0358	0.0322	0.0325	0.0032	9.9	-3.43
5	0.0139	0.0142	0.0135	0.0139	0.0004	2.5	-4.28
7	0.0145	0.016	0.0152	0.0152	0.0008	4.9	-4.18
14	0.0068	0.0052	0.0054	0.0058	0.0009	15	-5.15
21	0.0042	0.0065	0.0043	0.005	0.0013	26	-5.3
28	0.0016	0.0025	0.002	0.002	0.0005	22.2	-6.2
35	0.001	0.0006	0.0008	0.0008	0.0002	25	-7.13

\_\_\_\_\_  
Name:  
Evaluator  
Occupational Exposure Assessment Section

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name:  
Peer Reviewer  
Occupational Exposure Assessment Section

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name:  
Head,  
Occupational Exposure Assessment Section

\_\_\_\_\_  
Date

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**APPENDIX A**

**Compliance Checklist for "Determination of Turf Transferable Residue on Turf Treated with Evercide®  
Esfenvalerate 35% WP"**

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*Compliance Checklist*

Compliance with OPPTS Series 875, Occupational and Residential Exposure Test Guidelines, Group B: Postapplication Exposure Monitoring Test Guidelines, 875.2100, Transferable Residue Dissipation, Lawn and Turf, is critical. The itemized checklist below describes compliance with the major technical aspects of OPPTS 875.2100.

- *The test substance must be the typical end use product of the active ingredient.* This criteria was met.
- *The production of metabolites, breakdown products, or the presence of contaminants of potential toxicologic concern, should be considered on a case-by-case basis.* It is unclear whether this criterion was met. There was no mention of metabolites, breakdown products or the presence of contaminants of potential toxicological concern for esfenvalerate.
- *Applications should occur at the time of season that the end-use product is normally applied to achieve intended pest control.* It is unclear if this criterion was met. The product label did not mention a time or season at which application should be made. In this study, applications were made in the fall.
- *Initiating testing immediately before a precipitation event should be avoided. Applications should be made after mowing and watering.* This criterion was partially met. Precipitation data were only reported on a monthly basis and it is, therefore, not clear if testing was initiated before a precipitation event occurred. The second application occurred after the test site was mowed.
- *The end use product should be applied by the application method recommended. Formulations which can be applied in a minimal amount of water and do not require "watering in" should be used. Information that verifies that the application equipment (e.g., sprayer) was properly calibrated should be included.* This criterion was met. The end use product was applied by the application method recommended and the minimal amount of water was used. Calibration information for the application equipment was provided in Appendix II of the Study Report.
- *The application rate used in the study should be provided and should be the maximum rate specified on the label. However, monitoring following application at a typical application rate is more appropriate in certain cases.* This criterion was met. The application rate used was the maximum suggested by the Evercide® Esfenvalerate 35 WP label (0.188 lb ai/acre or 1.96 g ai /1000 ft<sup>2</sup>).
- *If multiple applications are made, the minimum allowable interval between applications should be used.* This criterion was met. Two applications were made at a 7 day interval, which was specified as the minimum allowable interval on the product label.
- *Turf transferable residue (TTR) data should be collected from at least three geographically distinct locations for each formulation. The sites should be representative of the regions (and turf types) where the chemical is used.* This criterion was not met. Turf transferable residue data were collected at only one location (California). This test site was representative of where esfenvalerate is used on dwarf turf grass.
- *The site(s) treated should be representative of reasonable worst-case climatic conditions expected in intended use areas. Meteorological conditions including temperature, wind speed, daily rainfall, and humidity should be provided for the duration of the study.* This criterion was partially met. The site was within the major use area of the product. Whether or not reasonable "worst-case" climatic conditions were captured is unknown. Meteorological conditions (i.e., air and soil temperature, relative humidity, wind speed, and wind direction) were provided for both days of application. Only rainfall and the minimum and maximum air temperatures were provided for the duration of the study.
- *Sampling should be sufficient to characterize the dissipation mechanisms of the compound (e.g., three half-lives or 72 hours after application, unless the compound has been found to fully dissipate in less time; for more persistent pesticides, longer sampling periods may be necessary). Sampling intervals may be relatively short in the beginning and lengthen as the study progresses. Background samples should be collected before application of the test substance occurs.* This criterion was met. Samples were collected until Day 35 after the application. The

esfenvalerate half-life calculated by the registrant was 6.6 days. Background samples were collected prior to the application of the test product.

- *Triplicate, randomly collected samples should be collected at each sampling interval. This criterion was met. Triplicate turf sample replicates were collected from each of three subplots at each sampling interval.*
- *Samples should be collected using a suitable methodology (e.g., California Cloth Roller, Polyurethane Roller, Drag Sled, etc.) for turf. This criterion was met. Turf residue samples were collected using the modified California Cloth Roller methodology.*
- *Control plots should be established from which sufficient control samples can be collected. Control sites should be upwind and a reasonable distance from the treatment site. This criterion was met. One sample from the control plot was taken at each sampling interval. The control plot was situated upwind and upslope of the control plot and was separated by a 7500 foot buffer to prevent any cross contamination.*
- *Residues should be dislodged from turf within a reasonable time period (i.e., EPA recommends that dislodging occur within 4 hours). Other transferable method samples should be handled in a manner that is appropriate to the method used. This criterion was met. Turf residue samples were not collected. The modified California cloth roller was used. Extraction of the residues from the cloth sample occurred just prior to analysis of the samples.*
- *Samples should be stored in a manner that will minimize deterioration and loss of analytes between collection and analysis. Information on storage stability should be provided. This criterion was met. The samples were stored frozen shortly after collection and remained frozen until analysis. A storage stability study was conducted and verified that samples were stable for at least 223 days.*
- *Validated analytical methods of sufficient sensitivity are needed. Information on method efficiency (residue recovery), and limit of quantitation (LOQ) should be provided. This criterion was met. Method validation recovery, and laboratory recovery values were provided in the report. The LOQ was 5  $\mu\text{g}$  (0.0009  $\mu\text{g}/\text{cm}^2$ ) for esfenvalerate.*
- *Information on recovery samples must be included in the study report. A complete set of field recoveries should consist of at least one blank control sample and three or more each of a low-level and high-level fortification. These fortifications should be in the range of anticipated residue levels in the field study. This criterion was not met. Field fortifications were only performed as part of the storage stability study. Fortification samples were not analyzed along with the residue samples.*
- *Raw residue data must be corrected if appropriate recovery values are less than 90 percent. Distributional data should be reported, to the extent possible. This criterion does not apply since laboratory recoveries were greater than 90 percent.*
- *Foliar residue data expressed as  $\mu\text{g}/\text{cm}^2$  turf leaf surface area. This criterion was not met. Residue data were reported in  $\mu\text{g}$ , rather than  $\mu\text{g}/\text{cm}^2$ .*

**Appendix B**

**Versar's Regression Analysis for Esfenvalerate  
Turf Transfer Residue Data**

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General Information

Trial 1

Trial 2

MQL (in DFR Units): 0.0009  
 DFR Units: ug/cm2

Name of Trial: Esfenvalerate--CA  
 Output Sheet Name: Esfenvalerate--CA

Name of Trial:  
 Output Sheet Name:

Type of Regression: Standard ▼

DFR or TTR: TTR ▼

Days after  
 Application

Residue Conc.

Days after  
 Application

Days after Application	Residue Conc.
0	0.037000
0	0.057100
0	0.101500
0	0.064600
0	0.046500
0	0.047500
0	0.087700
0	0.087700
0	0.075200
1	0.043600
1	0.030900
1	0.021900
1	0.023100
1	0.041400
1	0.035500
1	0.045600
1	0.024200
1	0.034300
2	0.034300
2	0.028500
2	0.025500
2	0.036100
2	0.037000
2	0.034300
2	0.034300
2	0.028700
2	0.033500
5	0.013900
5	0.012600
5	0.015300
5	0.013900
5	0.014100
5	0.014400
5	0.013900
5	0.014100
5	0.012600
7	0.015800
7	0.013600
7	0.014200
7	0.015700
7	0.016300

7	0.015800
7	0.018200
7	0.013900
7	0.013400
14	0.007100
14	0.008100
14	0.005400
14	0.006300
14	0.006000
14	0.003400
14	0.006000
14	0.006200
14	0.004000
21	0.002500
21	0.005400
21	0.004700
21	0.007000
21	0.008900
21	0.003600
21	0.004600
21	0.006700
21	0.001600
28	0.001100
28	0.003200
28	0.000450
28	0.003200
28	0.001300
28	0.002900
28	0.003000
28	0.001400
28	0.001600
35	0.001800
35	0.000450
35	0.000900
35	0.000450
35	0.001000
35	0.000450
35	0.000900
35	0.001100
35	0.000450