Data Evaluation Report on the terrestrial field dissipation of penoxsulam

PMRA Submission Number {.....} EPA MRID Number 46703501

Data Requirement: PMRA Data Code:
EPA DP Barcode: D325783
OECD Data Point:
EPA Guideline: §164-1

Test material: XDE-638

End Use Product name: GF-443 **Concentration of a.i.:** 21.4%
Formulation type: Soluble concentrate

Test material:

Common name:	Penoxsulam.
Chemical name:	
IUPAC name:	3-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluorotoluene-sulfonamide. 2-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide. 6-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluenesulfonamide.
CAS name:	2-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide.
CAS No.:	219714-96-2.
Synonyms:	XDE-638; DE-638; TSN101649; SP1019 (SePRO).
Smiles string:	FC(c1cccc(c1S(=O)(=O)N(c1nn2c(n1)ccnc2))OCC(F)F)(F)F (ISIS v2.3/Universal SMILES). No EPI Suite, v3.12 SMILES String found as of 6/27/06. n1c(nc2n1c(ncc2OC)OC)NS(=O)(=O)c3c(cccc3C(F)(F)F)OCC(F)F.

Primary Reviewer: Dan Hunt
Cambridge Environmental
Signature:
Date: 6/30/06

Secondary Reviewer: Joan Harlin
Cambridge Environmental
Signature:
Date: 6/30/06

QC/QA Manager: Joan Gaidos
Cambridge Environmental
Signature:
Date: 6/30/06

Final Reviewer: Lucy Shanaman
EPA Reviewer
Signature: Lucy Shanaman
Date: 8/07/06

Company Code
Active Code
Use Site Category
EPA PC Code: 119031

CITATION: Roberts, D.W. and G.E. Schelle. 2005. Terrestrial field dissipation of penoxsulam in the U.S.A. Unpublished study performed by Dow AgroSciences LLC, Indianapolis, IN (study director and residue analyst), Dow Agrosciences, Western U.S. Research Center, Fresno, CA (field investigator), Agricultural Chemicals Development Services Research, North Rose, NY (field investigator); and Agvise Laboratories, Inc. Northwood, ND (Soil and Water Characterization Analysis); and submitted by Dow AgroSciences LLC, Indianapolis, IN (p. 6). Laboratory Study ID: 040043. Experiment initiation April 23, 2004 and completion May 17, 2005 (p. 3). Final report issued July 12, 2005.

EXECUTIVE SUMMARY

Soil dissipation of penoxsulam (6-(2,2-difluoroethoxy)-N-(5,8-dimethoxy-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluenesulfonamide) under US field conditions was conducted in three bare plots of loam soil in California (Site 1) and in three bare plots of loamy sand soil in New York (Site 2). The experiment was carried out in accordance with the USEPA Pesticide Assessment Guidelines Subdivision N, §164-1, and in compliance with the USEPA FIFRA (40 CFR, Part 160) standards. Penoxsulam was broadcast once at a target rate of 0.11 kg a.i./ha (0.098 lb a.i./A) to 39 x 7 m and 40 x 8 m replicate plots in California and New York, respectively. The proposed maximum annual use rate was reported to be 0.100 kg a.i./ha (0.089 lb a.i./A). At Site 1, total water input during the 11-month study period was 36.48 inches or 340% of the normal precipitation. At Site 2, total water input during the 5-month study period was 28.74 inches or 173% of the normal precipitation. At each site, a control plot was located 15 m from the treated plots.

The application rate was verified for the test application at both sites using fifteen 24-cm filter paper circles that were randomly placed in the treated plots prior to the test application. Mean recovery of penoxsulam from the application rate monitors was equivalent to an application rate of 109.8 ± 32.5 g a.i./ha or a calculated 99.8% of the 110 g a.i./ha target for Site 1 and 105.6 ± 14.9 g a.i./ha or a calculated 96.0% of the target for Site 2. Field spikes were not prepared to determine the stability of the parent and transformation products during transport and storage.

Soil samples were collected from Site 1 at 0, 2, 7, 14, 22, 34, 65, 92, 120, 152, 182, 218, 254, 272, and 327 days, and from Site 2 at 0, 3, 7, 14, 21, 30, 60, 90, 120, and 150 days posttreatment. Soil samples were collected to a depth of 0-90 cm. The soil samples were extracted by shaking with acetonitrile:1.0 N hydrochloric acid (90:10, v:v). An aliquot of the extraction solvent was diluted with 0.1 N hydrochloric acid, purified using an HLB solid phase extraction plate, and analyzed for penoxsulam and the transformation products 5-OH-XDE-638 (6-(2,2-difluoroethoxy)-N-(5,6-dihydro-8-methoxy-5-oxo-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluene sulfonamide); BSTCA (3-[6-(2,2-difluoroethoxy)- α,α,α-trifluoro-o-toluenesulfonamido]-s-triazole-5-carboxylic acid); BSA (2-(2,2-difluoroethoxy)-6-(trifluoromethyl)benzenesulfonic acid); sulfonamide (2-(2,2-difluoroethoxy)-6-(trifluoromethyl)-benzenesulfonamide); and 2-amino-TP (5,8-dimethoxy[1,2,4] triazolo[1,5-c]pyrimidin-2-amine) by LC/MS/MS. The LOD and LOQ were 0.001 ppm and 0.003 ppm, respectively, for all analytes. Soil samples were stored frozen for up to 166 days (CA samples) and 175 days (NY samples) prior to analysis.

In the California test plot, the measured zero-time recovery of penoxsulam in the 0-15 cm soil layer was 0.0373 ppm or 73.1% of the theoretical based on the target application rate (calculated based on a theoretical day-0 recovery of 0.051 mg/kg). Penoxsulam decreased to 0.0165 ppm by 14 days, and was last detected above the LOQ at 0.0050 ppm at 34 days. Penoxsulam was detected below the LOQ from 65 to 272 days posttreatment. Penoxsulam was detected once above the LOQ in soil below the 0-15 cm depth, at 0.0059 ppm (mean of two replicate

detections) in the 15-30 cm depth at 14 days posttreatment. 5-OH-XDE-638 and BSTCA were detected as major transformation products.

5-OH-XDE-638 was detected in the 0-15 cm soil depth at a maximum of 0.0075 ppm at 7 days (14.7% of the theoretical applied penoxsulam, based on the target application rate; without converting to parent equivalents), then decreased to 0.0045 ppm by 22 days, and was less than the LOQ at 34 and 65 days posttreatment. 5-OH-XDE-638 was detected in the 15-30 cm soil depth at levels below the LOQ from 14 to 65 days posttreatment. The calculated half-life of 5-OH-XDE-638 was 23.8 days ($r^2 = 0.628$), calculated using 7-65 day data.

BSTCA was detected in the 0-15 cm soil depth at a maximum of 0.0103 ppm at 22 days (20.2% of the theoretical applied penoxsulam based on the target application rate; without converting to parent equivalents), then decreased to 0.0039-0.0045 ppm by 120-152 days, and was less than the LOQ from 182-327 days posttreatment. BSTCA was detected in the 15-30 cm soil depth at a maximum of 0.0072 ppm at 65 days, then decreased to 0.0033 ppm by 327 days posttreatment. BSTCA was detected at levels below the LOQ in the 30-45 cm soil depth at 14 days and from 65 to 327 days, and in the 45-60, 60-75, and 75-90 cm soil depths from 120 to 327 days posttreatment. The calculated half-life of BSTCA was 110 days ($r^2 = 0.7549$), calculated using 22-327 day data.

In the New York test plot, the measured zero-time recovery of penoxsulam in the 0-15 cm soil layer was 0.0460 ppm or 93.9% of the theoretical based on the target application rate (calculated based on a theoretical day-0 recovery of 0.049 mg/kg). Penoxsulam decreased to 0.0222 ppm by 3 days, and was last detected above the LOQ at 0.0034 ppm at 14 days. Penoxsulam was detected below the LOQ from 21 to 30 days posttreatment. Penoxsulam was not detected above the LOQ in soil below the 0-15 cm depth.

The major transformation product **BSTCA** was detected in the 0-15 cm soil depth at a maximum of 0.0070 ppm at 7 days (14.3% of the theoretical applied penoxsulam based on the target application rate; without converting to parent equivalents), then decreased to 0.0030-0.0033 ppm by 60-90 days, and was less than the LOQ from 120-150 days posttreatment. BSTCA was detected once in the 15-30 cm soil depth above the LOQ, at 0.0049 ppm at 60 days, and was detected below the LOQ at all other sampling intervals from 14 to 150 days posttreatment. BSTCA was detected at levels below the LOQ in the 30-45 and 45-60 cm soil depths. The calculated half-life of BSTCA was 88.9 days ($r^2 = 0.6263$), calculated using 7-150 day data.

Under field conditions in the California test plot, penoxsulam had a calculated half-life value of 48.5 days in soil ($r^2 = 0.6638$; based on all available replicate data, using linear regression and the equation $t_{½} = ln\ 2 / k$, where k is the rate constant). However, dissipation was bi-phasic, with a more rapid decline phase occurring through approximately the 92-day sampling interval. The calculated half-life based on 0-92 day data was 18.8 days ($r^2 = 0.9362$). The calculated DT_{90} value was 53 days for penoxsulam. Carryover of residues was 21.6% of the applied penoxsulam, based on the target application rate following 327 days posttreatment (residues detected as BSTCA).

Under field conditions in the New York test plot, penoxsulam had a calculated half-life value of 5.9 days in soil (r^2 = 0.8907; based on all available replicate data, using linear regression and the equation $t_{½} = ln\ 2 / k$, where k is the rate constant). The calculated DT_{90} value was 12 days for penoxsulam. Carryover of residues was 8.8% of the applied penoxsulam based on the target application rate following 150 days posttreatment (residues detected as BSTCA).

The major route of dissipation of penoxsulam under terrestrial field conditions at both test sites was transformation.

RESULTS SYNOPSIS

Site 1
Location/soil type: Fresno County, California/Loam (0-60 cm) over sandy loam (60-90 cm).
Half-life: 48.5 days (r^2 = 0.6638; calculated based on all replicate detections).
18.8 days (r^2 = 0.9362; calculated based on 0-92 day data).
DT_{90}: 53 days (calculated).
Major transformation products detected: 5-OH-XDE-638 and BSTCA.
Dissipation routes: Transformation.

Site 2
Location/soil type: Wayne County, New York/Loamy sand (0-75 cm).
Half-life: 5.9 days (r^2 = 0.8907; calculated based on all replicate detections).
DT_{90}: 12 days (calculated).
Major transformation products detected: BSTCA.
Dissipation routes: Transformation.

Study Acceptability: This study is classified as acceptable for fulfilling the guideline requirements for terrestrial field dissipation. No significant deviations from good scientific practices were noted.

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED:	The study was conducted according to USEPA Pesticide Assessment Guidelines Subdivision N, §164-1 (pp. 1, 12). There were no deviations from guideline §164-1.
COMPLIANCE:	The study was conducted in compliance with USEPA FIFRA (40 CFR Part 160) and OECD Good Laboratory Practice standards (p. 3). Signed and dated Data Confidentiality, GLP compliance and Quality Assurance statements were provided (pp. 2-4).

A. MATERIALS:

1. Test Material XDE-638 (p. 12).

Chemical Structure of the active ingredient: See DER Attachment 1.

Description: Formulation: Soluble concentrate (p. 12).

Storage conditions of test chemicals: The test substance was stored under normal ambient conditions (p. 13).

Physico-chemical properties of the active ingredient:

Parameter	Value	Comment
Chemical formula		
Molecular mass	483 g/mol	
Water Solubility	0.4 g/L	At 20°C, pH 7 buffer
Vapor Pressure/Volatility	2.49×10^{-14} Pa	At 20°C
UV Absorption		
Pka	5.1	At 25°C
K_{ow}/log K_{ow}	-0.602	Octanol/water at 25°C
Stability of compound at room temperature, if provided		

Data were obtained from p. 12 and Appendix A, Tables 1-2, pp. 67-68 of the study report.

2. Test site: Site 1 was located in Fresno County, California about 4 miles west of Fresno, on a loam soil (0-60 cm), and Site 2 was located in Wayne County, New York about 25 miles east of Rochester, on a loamy sand soil (0-75 cm; pp. 13-14; Figure 2, p. 61). The sites were chosen to represent target turfgrass use market areas and worst-case conditions in regards to persistence and mobility (p. 12). A three-year crop and pesticide use history for each test site is reported below in Table 2.

Table 1: Geographic location, site description and climatic data at the study sites.

Details		Site 1: California	Site 2: New York
Geographic coordinates	Latitude	N 36.71°	43° 11.30' N
	Longitude	W 119.93°	76° 55.30' W
	Province/State	California	New York
	Country	USA	USA
	Ecoregion	Not reported	Not reported
Slope Gradient		≤1%	≤1%
Depth to ground water (m)		18.2 m[1]	>1.8 m[1]
Distance from weather station used for climatic measurements		486 m[2]	201 m
Indicate whether the meteorological conditions before starting or during the study were within 30 year normal levels (Yes/No). If no, provide details.		Total water input (rainfall plus irrigation) during the 11-month study period was 36.48 inches or 340% of the normal precipitation.	Total water input (rainfall plus irrigation) during the 5-month study period was 28.74 inches or 173% of the normal precipitation.

Data were obtained from pp. 13-14, 16-17, 24-25 and Tables 3-4, pp. 35-36 of the study report.
1 Historic depth to groundwater.
2 Rainfall and air temperature was measured at the Fresno Yosemite International Airport weather station located 10 miles from the test site during periods of on-site weather station equipment failure (16-Dec-04 through 11-Jan-05, 10-Feb-05 through 28-Feb-05 and 1-Mar-05 through 16-Mar-05).

Table 2: Site usage and management history for the previous three years.

Use	Year	Site 1: California	Site 2: New York
Crops grown	Previous year	Wheat	Fallow
	2 years previous	Alfalfa	Cabbage
	3 years previous	Alfalfa	Fallow
Pesticides used	Previous year	None	None
	2 years previous	None	Dual II (S-metalochlor) Goal (oxyfluorfen) Prowl (pendimethalin)
	3 years previous	None	None
Fertilizers used	Previous year	Not reported	Not reported
	2 years previous	Not reported	Not reported
	3 years previous	Not reported	Not reported
Cultivation methods, if provided (eg., Tillage)	Previous year	Not reported	Not reported
	2 years previous	Not reported	Not reported
	3 years previous	Not reported	Not reported

Data were obtained from pp. 15-16 of the study report.

3. Soils:

Table 3a: Properties of the soil at Site 1 (California).

Property	Depth (cm)					
	0-15	**15-30**	**30-45**	**45-60**	**60-75**	**75-90**
Textural classification	Loam	Loam	Loam	Loam	Sandy loam	Sandy loam
%sand	50.0	50.7	50.0	51.3	55.7	58.0
%silt	30.7	30.7	32.7	35.3	33.3	32.3
%clay	19.3	18.7	17.3	13.3	11.0	9.7
pH	7.2	7.1	7.7	8.1	8.1	8.2
Organic matter (%)	1.0	0.9	0.5	0.3	0.2	0.2
Total organic carbon (%)	0.6	0.5	0.3	0.2	0.1	0.1
CEC (meq/100 g)	14.6	13.2	11.5	12.0	12.6	12.6
Bulk density (g/cm^3)	1.31	1.49	1.54	1.57	1.52	1.45
Moisture at 1/3 atm (%)	16.6	17.3	15.2	14.5	14.3	14.7
Taxonomic classification (e.g., ferro-humic podzol)	Coarse-loamy, mixed, active, thermic Mollic Haploxeralfs					
Soil mapping unit	Not reported					

Data are calculated means of the values reported in Table 1, p. 33 of the study report. The taxonomic classification was reported on pp. 13-14 of the study report. Organic carbon was calculated from percent organic matter (% o.c. = % o.m. x 0.58). The soil series description for the Pachappa soil series is provided in Appendix C, p. 73 of the study report.

Table 3b: Properties of the soil at Site 2 (New York).

Property	Depth (cm)					
	0-15	**15-30**	**30-45**	**45-60**	**60-75**	**75-90**
Textural classification	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Sand
%sand	81.3	80.0	80.7	82.0	81.3	91.3
%silt	14.0	14.7	16.0	14.7	16.0	6.7
%clay	4.7	5.3	3.3	3.3	2.7	2.0
pH	6.7	6.1	5.7	5.7	5.7	5.8
Organic matter (%)	2.7	1.9	0.8	0.5	0.2	0.2
Total organic carbon (%)	1.6	1.1	0.46	0.30	0.12	0.12
CEC (meq/100 g)	7.4	6.6	4.3	3.2	2.2	2.3
Bulk density (g/cm^3)	1.36	1.47	1.47	1.45	1.40	1.37
Moisture at 1/3 atm (%)	10.2	9.2	5.8	4.7	3.8	3.5
Taxonomic classification (e.g., ferro-humic podzol)	Mixed, mesic Typic Udipsamments					
Soil mapping unit	Not reported					

Data are calculated means of the values reported in Table 2, p. 34 of the study report. The taxonomic classification was reported on p. 14 of the study report. Organic carbon was calculated from percent organic matter (% o.c. = % o.m. x 0.58). The soil series description for the Oakville soil series is provided in Appendix C, p. 74.

B. EXPERIMENTAL DESIGN:

1. Experimental design:

Table 4: Experimental design.

Details		Site 1: California	Site 2: New York
Duration of study		11 months	5 months
Uncropped (bare) or cropped		Bare	Bare
Control used (Yes/No)		Yes	Yes
No. of replications	Controls	One	One
	Treatments	Three	Three
Plot size (L x W m)	Controls	4.9 x 7.3 m	4.9 x 7.3 m
	Treatments	39 x 7 m	40 x 8 m
Distance between control plot and treated plot		15 m	15 m
Distance between treated plots		0.3-1.8 m	0.3-1.8 m
Application rate(s) used (g a.i/ha)		110 g a.i./ha	110 g a.i./ha
Was the maximum label rate per ha used in study? (Yes/No)		110% of the maximum seasonal use rate	110% of the maximum seasonal use rate
Number of applications		One	One
Application Date (dd mm yyyy)		16/06/2004	11/05/2004
For multiple applications, application rate at Day 0 and at each application time (mg a.i./kg soil)		0.051 mg a.i./kg soil[1]	0.049 mg a.i./kg soil[1]
Application method (eg., spraying, broadcast etc.)		Broadcast	Broadcast
Type of spray equipment, if used		Tractor mounted spray rig and horizontal boom	Tractor mounted spray rig and horizontal boom
Total volume of spray solution applied/plot **OR** total amount broadcasted/plot		287.63 L/ha	284.76 L/ha
Identification and volume of carrier (e.g., water), if used		Water	Water
Name and concentration of co-solvents, adjuvants and/or surfactants, if used		None	None
Indicate whether the following monthly reports were submitted: Precipitation: Average minimum and maximum air temperature: Average minimum and maximum soil temperature: Average annual frost-free periods:		 Yes Yes No No	 Yes Yes No No
Indicate whether the Pan evaporation data were submitted		Yes (Penman evapotranspiration)	No

Details		Site 1: California	Site 2: New York
Meteorological conditions during application	Cloud cover	Not reported	Not reported
	Temperature (°C)	18.6	14.4
	Humidity	75%	90%
	Wind speed (mph) and direction	0	0
	Sunlight (hr)	Not reported	Not reported
Pesticides used during study: Name of product/a.i concentration: Amount applied: Application method:		 Glyphosate Not reported (7 applications) Ground broadcast	 Glyphosate Not reported (4 applications) Not reported
Supplemental irrigation used (Yes/No) If yes, provide the following details: No. of irrigation: Interval between irrigation: Amount of water added each time: Method of irrigation:		Yes 54 1-168 days 0.15-0.76 inches Semi-permanent (hand-line) sprinkler irrigation system	Yes 10 1-45 days 0.75 inches Overhead lateral sprinkler irrigation system
Indicate whether water received through rainfall + irrigation equals the 30 year average rainfall (Yes/No)		Yes	Yes
Were the application concentrations verified?		Yes	Yes
Were field spikes used?		No	No
Good agricultural practices followed (Yes/No)		Not reported	Not reported
Indicate if any abnormal climatic events occurred during the study (eg., drought, heavy rainfall, flooding, storm etc.)		None	Rainfall amounts of: 1.77 inches on 7/27/2004 2.08 inches on 8/29-30/2004 3.19 inches on 9/8-9/2004
If cropped plots are used, provide the following details: Plant - Common name/variety: Details of planting: Crop maintenance:		N/A	N/A
Volatilization included in the study (Yes/No)		No	No
Leaching included in the study (Yes/No)		Yes	Yes
Run off included in the study (Yes/No)		No	No

Data were obtained from pp. 13-19 and 25-26, Tables 3-4, pp. 35-36, Figure 3, p. 62, Appendix B, Tables 1-4, pp. 69-72, Appendix D, Tables 1-2, pp. 76-91 of the study report.

1 Calculated for the 0-15 cm soil depth, based on one application at 0.089 lb a.i./A and a site-specific bulk density of 1.31 g/cm^3 for Site 1, and one application at 0.089 lb a.i./A and a site-specific bulk density of 1.36 g/cm^3 for Site 2.

2. Application Verification: To verify the application rate, fifteen 24-cm filter paper circles were randomly placed in the treated plots prior to the test application at each test site (p. 18). The analytical method used to extract the filter paper circles was not reported.

In addition, spray solution samples were collected from both test sites prior to and after test application to determine the spray solution concentration (p. 13). Mean recovery of penoxsulam from the Site 1 tank mixture was 97.4% of the theoretical, and mean recovery of penoxsulam from the Site 2 tank mixture was 89.1% of the theoretical (Appendix B, Table 2, p. 70 and Table 4, p. 72).

3. Field Spiking: Field spikes were not prepared to determine the stability of the parent and transformation products during transport and storage.

4. Volatilization: Volatilization was not measured.

5. Leaching: Fifteen cores were taken from Site 1 at 0, 2, 7, 14, 22, 34, 65, 92, 120, 152, 182, 218, 254, 272, and 327 days posttreatment, and from Site 2 at 0, 3, 7, 14, 21, 30, 60, 90, 120, and 150 days posttreatment, to a depth of 90 cm (excluding day-0 samples which were collected to a depth of 15 cm) to determine the mobility of the test substance in the soil profile (pp. 15 and 19-20; Table 16, p. 58).

6. Run off: Run off was not studied.

7. Supplementary Study: The study authors stated that the storage stability of penoxsulam and its transformation products in soil under frozen conditions was investigated in a separate study (p. 22). Study methods such as the soils used and fortification rate were not reported.

8. Sampling:

Table 5: Soil sampling

Details	Site 1: California	Site 2: New York
Method of sampling (random or systematic)	Random	Random
Sampling intervals	0, 2, 7, 14, 22, 34, 65, 92, 120, 152, 182, 218, 254, 272, and 327 days.	0, 3, 7, 14, 21, 30, 60, 90, 120, and 150 days.
Method of soil collection (eg., cores)	Cores	Cores
Sampling depth	90 cm, except for day-0 samples which were collected to a depth of 15 cm.	90 cm, except for day-0 samples which were collected to a depth of 15 cm.
Number of cores collected per plot	5 per replicate plot (15 total)	5 per replicate plot (15 total)
Number of segments per core	Six	Six
Length of soil segments (after sectioning)	15 cm	15 cm
Core diameter	6 cm (2.25-2.36 inches) for 0-15 cm cores and 4 cm (1.5-1.75 inches) for lower depth cores.	6 cm (2.25-2.36 inches) for 0-15 cm cores and 4 cm (1.5-1.75 inches) for lower depth cores.
Method of sample processing, if any	Samples were composited by replicate plot and depth. Prior to analysis, the samples were blended with dry ice, broken apart with a hammer, and then ground using an Agvise Model 2001 hammer mill equipped with a 1/8-inch screen.	Samples were composited by replicate plot and depth. Prior to analysis, the samples were blended with dry ice, broken apart with a hammer, and then ground using an Agvise Model 2001 hammer mill equipped with a 1/8-inch screen.
Storage conditions	Frozen	Frozen
Storage length (days)	166 days	175 days

Data were obtained from pp. 15 and 19-22, Table 16, p. 58, Figure 3, p. 62 and Appendix E, Table 11, p. 166 of the study report.

9. Analytical Procedures:

Number of soil samples analysed per treatment or composite sample: Not reported.

Extraction, clean up and concentration of soil samples: Samples were extracted by shaking with acetonitrile:1.0N hydrochloric acid (90:10, v:v; Appendix E, p. 92). An aliquot of the extract was concentrated and diluted with 0.1N hydrochloric acid, and the extract was purified using an HLB solid phase extraction plate. Penoxsulam and its transformation products were eluted from the SPE plate with acetonitrile:methanol (80:20, v:v). The eluate was then concentrated to dryness and reconstituted with water:acetonitrile:methanol:acetic acid (90:5:5:0.1, v:v:v:v) containing a stable isotope of penoxsulam as internal standard prior to analysis.

Identification and quantification of parent compound: Extracts were analyzed for penoxsulam and the transformation products 5-OH-XDE-638, BSTCA, BSA, sulfonamide and 2-amino-TP by HPLC with tandem mass spectrometry (LC/MS/MS; p. 22; Appendix E, p. 92; chemical names are reported in DER Table 7).

Identification and quantification of transformation products: Same as for the parent compound.

Detection limits (LOD, LOQ) for the parent compound in soil: For HPLC analysis, the LOD and LOQ were 0.001 ppm and 0.003 ppm, respectively (p. 22; Appendix E, p. 93).

Detection limits (LOD, LOQ) for the transformation products in soil: Same as for the parent compound.

II. RESULTS AND DISCUSSION

APPLICATION MONITORS: Mean recovery of penoxsulam from the application rate monitors was equivalent to an application rate of 109.8 ± 32.5 g a.i./ha or a reviewer-calculated 99.8% of the 110 g a.i./ha target for Site 1 and 105.6 ± 14.9 g a.i./ha or a reviewer-calculated 96.0% of the target for Site 2 (Tables 5-6, pp. 37-38).

2. RECOVERY FROM FIELD SPIKES: Field spikes were not prepared.

3. MASS ACCOUNTING: A mass balance was not determined

.

Table 6a. Concentration of penoxsulam residues expressed as ppm in soil from Site 1 (California).

Compound	Soil depth (cm)	Sampling times (days)														
		0	2	7	14	22	34	65	92	120	152	182	218	254	272	327
Penoxsulam (XDE-638)	0-15	**0.0373**	**0.0330**	**0.0231**	**0.0165**	**0.0123**	**0.0050**	0.0021	0.0014	0.0013[2]	0.0012[1]	0.0012[1]	0.0010[1]	0.0016[1]	0.0012[1]	ND
	15-30	NC	ND	ND	**0.0059[2]**	0.0027[2]	0.0019	0.0016	ND	ND	ND	ND	ND	ND	ND	ND
	30-45	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	45-60	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	60-75	NC	NA	NA	ND	NA	NA	ND	ND	0.0014[1]	ND	ND	ND	ND	ND	ND
	75-90	NC	NA	NA	ND	NA	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND
5-OH-XDE-638	0-15	**0.0040**	**0.0046**	**0.0075**	**0.0049**	**0.0045**	0.0027	0.0011[1]	ND	ND	0.0012[1]	ND	ND	ND	ND	ND
	15-30	NC	ND	ND	0.0021[2]	0.0026[1]	0.0019	0.0012[2]	ND	ND	ND	ND	ND	ND	ND	ND
	30-45	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	45-60	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	60-75	NC	NA	NA	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
	75-90	NC	NA	NA	ND	NA	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND
BSTCA	0-15	ND	0.0021	**0.0041**	**0.0066**	**0.0103**	**0.0094**	**0.0063**	**0.0082**	**0.0045**	**0.0039**	0.0027	0.0026	0.0023	0.0021[2]	0.0018
	15-30	NC	ND	ND	0.0014[1]	0.0023[1]	**0.0035**	**0.0072**	**0.0058**	**0.0056**	**0.0062**	**0.0053**	**0.0040**	**0.0047**	**0.0036**	**0.0033**
	30-45	NC	ND	ND	0.0012[1]	ND	ND	0.0015[2]	0.0011[1]	0.0020[2]	0.0019	0.0023	0.0020	0.0022	0.0019	0.0017
	45-60	NC	ND	ND	ND	ND	ND	ND	ND	0.0013[1]	0.0019[1]	0.0017[2]	0.0017	0.0017	0.0014	0.0013
	60-75	NC	NA	NA	ND	NA	NA	ND	ND	0.0019[1]	0.0015[1]	0.0014[1]	0.0016[2]	0.0021[2]	0.0014[2]	0.0015
	75-90	NC	NA	NA	ND	NA	NA	ND	NA	0.0011[1]	ND	0.0012[1]	0.0017[1]	0.0017[2]	0.0013[1]	0.0014

Residue data are calculated means from the three replicate samples reported in Tables 7-9, pp. 39-47 in the study report. Total extractable and non-extractable residues and total recovery were not determined. NA = Not analyzed. ND = Not detected. NC = Not collected. Values not in bold are below the LOQ. Actual sampling dates are reported in Table 16, p. 58 of the study report. The transformation product BSA was detected once, below the LOQ, at 30 days posttreatment in the 0-15 cm soil depth, and the transformation products sulfonamide and 2-amino-TP were not detected in soil (p. 27).

1 Single replicate detection (analyte not detected in the other replicate samples).

2 Mean of two replicate samples (analyte not detected in the third replicate).

Table 6b. Concentration of penoxsulam residues expressed as ppm in soil from Site 2 (New York).

Compound	Soil depth (cm)	Sampling times (days)									
		0	3	7	14	21	30	60	90	120	150
Penoxsulam (XDE-638)	0-15	**0.0460**	**0.0222**	**0.0119**	**0.0034**	0.0024	0.0016[2]	ND	ND	ND	ND
	15-30	NC	ND	ND	0.0029	0.0016[2]	ND	ND	ND	ND	ND
	30-45	NC	ND	ND	0.0012[1]	0.0019[2]	ND	ND	ND	ND	ND
	45-60	NC	ND	ND	ND	0.0021[1]	ND	ND	ND	ND	ND
	60-75	NC	NA	ND	ND	ND	ND	ND	ND	ND	ND
	75-90	NC	NA	NA	ND	ND	ND	ND	ND	ND	ND
5-OH-XDE-638	0-15	**0.0047**	0.0013[1]	0.0025	0.0012[2]	0.0020[1]	0.0014[1]	ND	ND	ND	ND
	15-30	NC	ND	ND	0.0023[2]	0.0015[1]	0.0012[2]	ND	ND	ND	ND
	30-45	NC	ND	ND	0.0010[1]	ND	ND	ND	ND	ND	ND
	45-60	NC	ND	ND	ND	ND	ND	0.0017[1]	ND	ND	ND
	60-75	NC	NA	ND	ND	ND	ND	ND	0.0010[1]	ND	NA
	75-90	NC	NA	NA	ND	ND	ND	ND	ND	0.0011[1]	NA
BSTCA	0-15	ND	**0.0056**	**0.0070**	**0.0048**	**0.0044**	**0.0043**	**0.0033**	**0.0030**	0.0021	0.0024
	15-30	NC	ND	ND	0.0022	0.0018	0.0027	**0.0049**	0.0027	0.0025	0.0019[2]
	30-45	NC	ND	ND	ND	0.0017[1]	0.0010[1]	0.0016	0.0022	0.0017	ND
	45-60	NC	ND	ND	ND	0.0011[1]	ND	ND	0.0011[1]	0.0018[2]	ND
	60-75	NC	NA	ND	ND	ND	ND	ND	ND	ND	NA
	75-90	NC	NA	NA	ND	ND	ND	ND	ND	ND	NA
BSA	0-15	NA	0.0010[1]	ND	ND	ND	ND	ND	ND	ND	ND
	15-30	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND
	30-45	NC	ND	0.0017[1]	ND	ND	ND	ND	0.0019[1]	ND	ND
	45-60	NC	ND	ND	0.0015[1]	ND	ND	ND	ND	ND	ND
	60-75	NC	NA	ND	ND	0.0010[1]	ND	ND	ND	ND	NA
	75-90	NC	NA	NA	ND	ND	ND	ND	ND	ND	NA

Residue data are calculated means from the three replicate samples reported in Tables 10-13, pp. 48-55 of the study report. Total extractable and non-extractable residues and total recovery were not determined. NA = Not analyzed. ND = Not detected. NC = Not collected. Values not in bold are below the LOQ. Actual sampling dates are reported in Table 16, p. 58 of the study report. The transformation products sulfonamide and 2-amino-TP were not detected in soil (p. 28).

1 Single replicate detection (analyte not detected in the other replicate samples).

2 Mean of two replicate samples (analyte not detected in the third replicate).

4. PARENT COMPOUND: At the California test site (Site 1), the measured zero-time recovery of penoxsulam in the 0-15 cm soil layer was 0.0373 ppm or 73.1% of the theoretical based on the target application rate (calculated based on a theoretical day-0 recovery of 0.051 mg/kg; see footnote to DER Table 4). Penoxsulam decreased to 0.0165 ppm by 14 days, and was last detected above the LOQ at 0.0050 ppm at 34 days (Table 7, pp. 39-41). Penoxsulam was detected below the LOQ from 65 to 272 days posttreatment. Penoxsulam was only detected above the LOQ once below the 0-15 cm soil depth, at 0.0059 ppm (mean of two replicate detections) in the 15-30 cm depth at 14 days posttreatment.

At the New York test site (Site 2), the measured zero-time recovery of penoxsulam in the 0-15 cm soil layer was 0.0460 ppm or 93.9% of the theoretical based on the target application rate (calculated based on a theoretical day-0 recovery of 0.049 mg/kg; see footnote to DER Table 4). Penoxsulam decreased to 0.0222 ppm by 3 days, and was last detected above the LOQ at 0.0034 ppm at 14 days (Table 10, pp. 48-49). Penoxsulam was detected below the LOQ from 21 to 30 days. Penoxsulam was not detected above the LOQ in soil below the 0-15 cm depth, but was detected below the LOQ in the 15-30 cm (14-21 days), 30-45 cm (14-21 days), and 45-60 cm (21 days) soil depths.

HALF-LIFE: Under field conditions in the California test plot, penoxsulam had a calculated half-life value of 48.5 days in soil ($r^2 = 0.6638$; based on all available replicate data, using linear regression and the equation $t_{½} = ln\ 2 / k$, where k is the rate constant). However, dissipation was bi-phasic, with a more rapid decline phase occurring through approximately the 92-day sampling interval. The calculated half-life based on 0-92 day data was 18.8 days ($r^2 = 0.9362$). The calculated DT_{90} value was 53 days for penoxsulam (Figure 5, p. 64).

Under field conditions in the New York test plot, penoxsulam had a calculated half-life value of 5.9 days in soil ($r^2 = 0.8907$; based on all available replicate data, using linear regression and the equation $t_{½} = ln\ 2 / k$, where k is the rate constant). The dissipation pattern was linear. The calculated DT_{90} value was 12 days for penoxsulam (Figure 7, p. 66).

5. TRANSFORMATION PRODUCTS:

At the California test site (Site 1), 5-OH-XDE-638 (6-(2,2-difluoroethoxy)-N-(5,6-dihydro-8-methoxy-5-oxo-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluene sulfonamide) and BSTCA (3-[6-(2,2-difluoroethoxy)- α,α,α-trifluoro-o-toluenesulfonamido]-s-triazole-5-carboxylic acid) were detected as major transformation products (Tables 8-9, pp. 42-47).

5-OH-XDE-638 was initially detected in the 0-15 cm soil depth at 0.0040 ppm at day-0, increased to a maximum of 0.0075 ppm by 7 days (14.7% of the theoretical applied penoxsulam based on the target application rate; without converting to parent equivalents), then decreased to 0.0045 ppm by 22 days, and was less than the LOQ at 34 and 65 days posttreatment. 5-OH-XDE-638 was detected in the 15-30 cm soil depth at levels below the LOQ from 14 to 65 days posttreatment. The calculated half-life of 5-OH-XDE-638 was 23.8 days ($r^2 = 0.628$), calculated using 7-65 day data.

BSTCA was initially detected in the 0-15 cm soil depth at 0.0021 ppm at 2 days, increased to a maximum of 0.0103 ppm by 22 days (20.2% of the theoretical applied penoxsulam based on the target application rate; without converting to parent equivalents), then decreased to 0.0039-0.0045 ppm by 120-152 days, and was less than the LOQ from 182-327 days posttreatment. BSTCA was first detected in the 15-30 cm soil depth above the LOQ at 0.0035 ppm at 34 days, was a maximum of 0.0072 ppm at 65 days, then decreased to 0.0033 ppm by 327 days posttreatment. BSTCA was detected at levels below the LOQ in the 30-45 cm soil depth at 14 days and from 65 to 327 days, and in the 45-60, 60-75, and 75-90 cm soil depths from 120 to 327 days posttreatment. The calculated half-life of BSTCA was 110 days ($r^2 = 0.7549$) calculated using 22-327 day data. The transformation product BSA was detected once, below the LOQ, at 30 days posttreatment in the 0-15 cm soil depth (p. 27). The transformation products sulfonamide and 2-amino-TP were not detected in soil.

At the New York test site (Site 2), the major transformation product **BSTCA** was initially detected in the 0-15 cm soil depth at 0.0056 ppm at 3 days, increased to a maximum of 0.0070 ppm by 7 days (14.3% of the theoretical applied penoxsulam based on the target application rate; without converting to parent equivalents), then decreased to 0.0030-0.0033 ppm by 60-90 days, and was less than the LOQ from 120-150 days posttreatment (Table 12, pp. 52-53). BSTCA was detected once in the 15-30 cm soil depth above the LOQ, at 0.0049 ppm at 60 days, and was detected below the LOQ at all other sampling intervals from 14 to 150 days posttreatment. BSTCA was detected at levels below the LOQ in the 30-45 cm soil depth from 21 to 120 days and in the 45-60 cm soil depth at 21, 90, and 120 days posttreatment. The calculated half-life of BSTCA was 88.9 days ($r^2 = 0.6263$), calculated using 7-150 day data.

The minor transformation product **5-OH-XDE-638** was initially detected in the 0-15 cm soil depth at a maximum concentration of 0.0047 ppm at day 0 (9.6% of the theoretical applied penoxsulam based on the target application rate; without converting to parent equivalents), and was detected below the LOQ from 3 to 30 days posttreatment. 5-OH-XDE-638 was detected in the 15-30 cm soil depth at levels below the LOQ from 14 to 30 days posttreatment, and was detected sporadically at lower depths. The calculated half-life of 5-OH-XDE-638 was 20.4 days ($r^2 = 0.2508$), calculated using all available replicate data.

The transformation product **BSA** (2-(2,2-difluoroethoxy)-6-(trifluoromethyl)benzenesulfonic acid) was detected sporadically, at levels below the LOQ, in soil to a depth of 60-75 cm (all single replicate detections; Table 13, pp. 54-55). The transformation products sulfonamide and 2-amino-TP were not detected in soil (p. 28).

Table 7: Chemical names and CAS numbers for the transformation products of penoxsulam.

Applicants Code Name	CAS Number	Chemical Name (IUPAC)	Chemical Formula	Molecular Weight (g/mol)	Smiles String
5-OH-XDE-638		6-(2,2-Difluoroethoxy)-N-(5,6-dihydro-8-methoxy-5-oxo-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluene sulfonamide		469	n1c(nc2n1c(ncc2OC)O)NS(=O)(=O)c3c(ccc c3C(F)(F)F)OCC(F)F
BSTCA		3-[6-(2,2-Difluoroethoxy)-α,α,α-trifluoro-o-toluenesulfonamido]-s-triazole-5-carboxylic acid		416	n1c(nc(n1)C(O)=O)NS(=O)(=O)c2c(cccc2C(F)(F)F)OCC(F)F
BSA		2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)benzenesulfonic acid		306	S(=O)(=O)(c1c(cccc1C(F)(F)F)OCC(F)F)O
Sulfanomide		2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)benzene-sulfonamide		305	NS(=O))(=O)c1c(cccc1C(F)(F)F)OCC(F)F
2-amino-TP		5,8-Dimethoxy[1,2,4] triazolo[1,5-c]pyrimidin-2-amine		195	n1c(nc2n1c(ncc2OC)OC)N

Data were obtained from Figure 1, pp. 59-60 of the study report.

6. EXTRACTABLE AND NON-EXTRACTABLE RESIDUES: Non-extractable residues were not measured.

Table 8: Dissipation routes of penoxsulam under field conditions.

Route of dissipation		% of applied amount (at the end of study period)	
		Site 1 (California)	Site 2 (New York)
Accumulation (residues) in soil/ carry over		0%	0%
Transformation (% of transformation products)		21.6% (as BSTCA)	8.8% (as BSTCA)
Leaching, if measured (maximum depth detected)	Penoxsulam	15-30 cm[1]	45-60 cm
	5-OH-XDE-638	15-30 cm	75-90 cm
	BSTCA	75-90 cm	45-60 cm
	BSA	0-15 cm	60-75 cm
	Sulfanomide	Not detected	Not detected
	2-Amino-TP	Not detected	Not detected
Volatilization, if measured		Not measured	Not measured
Plant uptake, if measured		N/A	N/A
Run off, if measured		Not measured	Not measured
Total			

Data were obtained from Tables 7-9, pp. 39-47 of the study report for Site 1, and Tables 10-13, pp. 48-55 for Site 2. Percentages of the applied values are calculated based on the theoretical penoxsulam expected in the 0-15 cm soil depth at each study site based on the target application rate (0.051 mg a.i./kg for Site 1 and 0.049 mg a.i./kg for Site 2; see footnote to DER Table 4). Transformation product values were not converted to parent equivalents.
1 Excludes one outlier detected in the 60-75 cm soil depth (single replicate).

7. VOLATILIZATION: The concentration of applied penoxsulam lost through volatilization was not determined.

8. PLANT UPTAKE: N/A.

9. LEACHING: Residues of penoxsulam at levels above the LOQ were confined to the 0-30 cm soil depth at Site 1, and to the 0-15 cm soil depth at Site 2 (Table 7, pp. 39-41; Table 10, pp. 48-49). However, residues were detected to a depth of 45-60 cm at Site 2. 5-OH-XDE-638 residues were confined to the upper 0-30 cm at Site 1, and were generally confined to the upper 0-30 cm at Site 2. However, residues were detected in all soil depths at Site 2 (from 0-90 cm; Tables 8 and 11, pp. 42-44 and 50-51). Residues of BSTCA were detected at all sampling depths, 0-90 cm, at Site 1, and were confined to the upper 45-60 cm depth at Site 2 (Tables 9 and 12, pp. 45-47 and 52-53. However, residues of BSTCA were detected above the LOQ only in the upper 0-30 cm). The reviewer notes that the Site 2 soil was more conducive to leaching due to its higher sand content. Total water input was much greater than historic rainfall for both test sites for the duration of the study (340% of the normal precipitation at Site 1 and 173% of the normal precipitation at Site 2).

The first precipitation event at Site 1 was a 0.15-inch irrigation event on day 0, and the first precipitation event at Site 2 was a 0.31-inch rainfall event occurring at 3-4 days posttreatment (pp. 24-25; Appendix D, Tables 1-2, pp. 76-91).

10. RUN OFF: Run off was not studied.

11. RESIDUE CARRYOVER: The calculated DT_{90} value for penoxsulam was 53 days for Site 1 and 12 days for Site 2 (pp. 27-28; Figure 5, p. 64 and Figure 7, p. 66). Carryover of residues was 21.6% of the applied penoxsulam for Site 1 (detected as BSTCA), and 8.8% for Site 2 (detected as BSTCA; Tables 7-13, pp. 39-55). Percentages of the applied values are calculated based on the theoretical penoxsulam expected in the 0-15 cm soil depth at each study site, based on the target application rate (transformation product concentrations were not converted to parent equivalents).

12. SUPPLEMENTARY STUDY RESULTS: The study authors stated that penoxsulam and its transformation products were stable for 781 days in soil stored under frozen conditions (p. 22). Storage stability data were not reported.

III. STUDY DEFICIENCIES

No deficiencies were noted.

IV. REVIEWER'S COMMENTS

1. The storage stability study was conducted as part of a separate study, and submitted under MRID number 46433902.

2. All of the reviewer-calculated values reported in terms of percent of the applied penoxsulam were calculated based on the target application rate of 110 g a.i./ha for both test sites (see footnote to DER Table 4). The study authors, however, calculated recoveries based not on the target application rate but on a calculated theoretical application rate that was based on the average spray solution concentration and the spray discharge rate (pp. 18 and 26; Appendix B, Tables 1-4, pp. 69-72). The study author-calculated theoretical application rates were 110.2 g a.i./ha (100.1% of the target) for Site 1 and 99.7 g a.i./ha for Site 2 (99.1% of the target).

3. The study authors reported a DT_{50} of 16 days ($r^2 = 0.9899$) for penoxsulam and a DT_{90} of 53 days at Site 1, calculated using SigmaPlot, an exponential, non-linear first-order regression model (pp. 23-24 and 27; Figures 4-5, pp. 63-64). The study authors reported a DT_{50} of 4 days ($r^2 = 0.9741$) for penoxsulam and a DT_{90} of 12 days at Site 2 (Figures 6-7, pp. 65-66). The study author-calculated DT_{50} values for 5-OH-XDE-638 and BSTCA were 26 days and 770 days, respectively, for Site 1 (Figure 5, p. 64). The study author-calculated DT_{50} values for 5-OH-XDE-638, BSTCA, and BSA were 23 days, 67 days, and 14 days, respectively, for Site 2 (Figure 7, p. 66).

4. Mean recoveries of penoxsulam, 5-OH-XDE-638, BSTCA, BSA, sulphonamide, and 2-amino-TP from control soil samples fortified with each analyte over the range of 0.003-0.10 ppm were 89 ± 10%, 84 ± 5%, 81 ± 7%, 73 ± 11%, 78 ± 7%, and 61 ± 14%, respectively (p. 22; Appendix E, Tables 4-9, pp. 152-163). The source of the control soil was not reported.

5. The study authors stated that human error resulted in an over-application to the California plot of about 1.7x, and as a result, the over-applied test plot and associated control plot were decommissioned and a new test plot and control plot were established at the site (pp. 18-19). Application to the new treatment plot was conducted about 1 week after the decommissioned test plot application date.

6. The study authors stated that sampling events would continue until 540 days posttreatment at the California site under a separate protocol, but will not be analyzed or reported in this study. The sampling events were added to track the BSTCA transformation product in more detail.

7. The study authors reported mean and total soil profile concentrations over time for Site 1 and Site 2 in percent of the applied in Tables 14-16, pp. 56-58. The study authors' calculations are based on a day-0 theoretical application rate that was calculated from the average spray solution concentration and the spray discharge rate.

V. REFERENCES

1. U.S. Environmental Protection Agency. 1982. Pesticide Assessment Guidelines, Subdivision N, Chemistry: Environmental Fate, Section 164-1, Terrestrial Field Dissipation Studies. Office of Pesticide and Toxic Substances, Washington, DC. EPA 540/9-82-021.

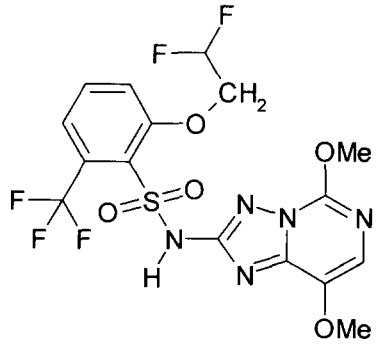
2. U.S. Environmental Protection Agency. 1993. Pesticide Registration Rejection Rate Analysis - Environmental Fate. Office of the Prevention, Pesticides, and Toxic Substances, Washington, DC. EPA 738-R-93-010.

3. U.S. Environmental Protection Agency. 1989. FIFRA Accelerated Reregistration, Phase 3 Technical Guidance. Office of the Prevention, Pesticides, and Toxic Substances, Washington, DC. EPA 540/09-90-078.

Attachment 1: Structures of Parent Compound and Transformation Products

Penoxsulam [XDE-638; DE-638; TSN101649; SP1019 (SePRO)]

IUPAC Name:	3-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluorotoluene-sulfonamide. 2-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide. 6-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluenesulfonamide.
CAS Name:	2-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide.
CAS Number:	219714-96-2.
SMILES String:	FC(c1cccc(c1S(=O)(=O)N(c1nn2c(n1)ccnc2))OCC(F)F)(F)F (ISIS v2.3/Universal SMILES). No EPI Suite, v3.12 SMILES String found as of 6/27/06. n1c(nc2n1c(ncc2OC)OC)NS(=O)(=O)c3c(cccc3C(F)(F)F)OCC(F)F.



Identified Compounds

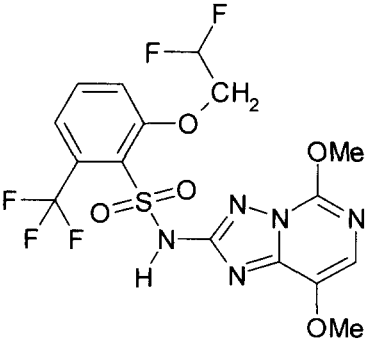
Penoxsulam [XDE-638; DE-638; TSN101649; SP1019 (SePRO)]

IUPAC Name: 3-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluorotoluene-sulfonamide.
2-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide.
6-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluenesulfonamide.

CAS Name: 2-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide.

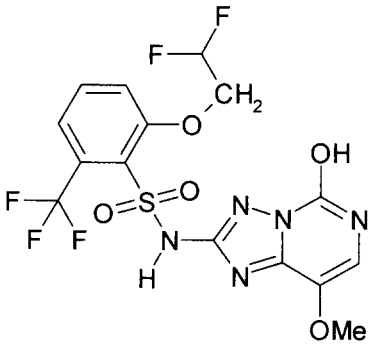
CAS Number: 219714-96-2.

SMILES String: FC(c1cccc(c1S(=O)(=O)N(c1nn2c(n1)ccnc2))OCC(F)F)(F)F
(ISIS v2.3/Universal SMILES).
No EPI Suite, v3.12 SMILES String found as of 6/27/06.
n1c(nc2n1c(ncc2OC)OC)NS(=O)(=O)c3c(cccc3C(F)(F)F)OCC(F)F.



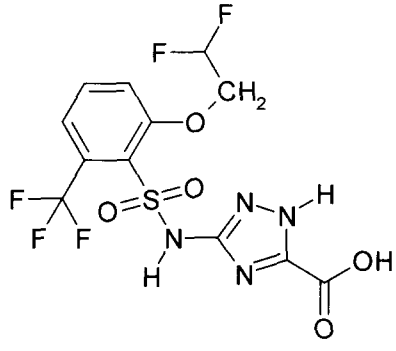
5-OH-XDE-638 [5-Hydroxy-XDE-638; 5-OH-DE-638; TSN101756; 5-OH]

IUPAC Name:	6-(2,2-Difluoroethoxy)-N-(5,6-dihydro-8-methoxy-5-oxo-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluenesulfonamide.
CAS Name:	2-(2,2-Difluoroethoxy)-N-(5,6-dihydro-8-methoxy-5-oxo[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide.
CAS Number:	Not reported.
SMILES String:	n1c(nc2n1c(ncc2OC)O)NS(=O)(=O)c3c(cccc3C(F)(F)F)OCC(F)F.



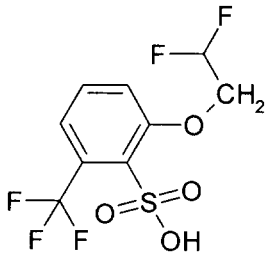
BSTCA [TSN103610; TSN101979]

IUPAC Name:	3-[6-(2,2-Difluoroethoxy)-α,α,α-trifluoro-o-toluenesulfonamido]-s-triazole-5-carboxylic acid.
CAS Name:	3-[[[2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)phenyl]sulfonyl]amino]-1H-1,2,4-triazole-5-carboxylic acid.
CAS Number:	Not reported.
SMILES String:	n1c(nc(n1)C(O)=O)NS(=O)(=O)c2c(cccc2C(F)(F)F)OCC(F)F.



BSA [Penoxsulam sulfonic acid; TSN101980]

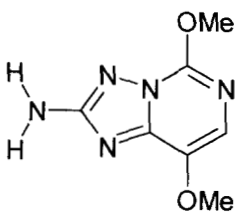
IUPAC Name: 6-(2,2-Difluoroethoxy)-α,α,α-trifluoro-o-toluenesulfonic acid.
CAS Name: 2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)benzenesulfonic acid.
CAS Number: Not reported.
SMILES String: S(=O)(=O)(c1c(cccc1C(F)(F)F)OCC(F)F)O.



Unidentified Reference Compounds

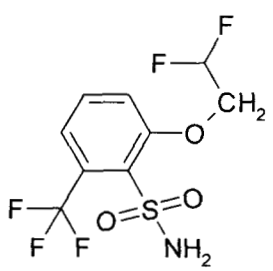
2-Amino-TP [TSN101824]

IUPAC Name: 2-Amino-5,8-dimethoxy-s-triazolo[1,5-c]pyrimidine.
CAS Name: 5,8-Dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-amine.
CAS Number: Not reported.
SMILES String: n1c(nc2n1c(ncc2OC)OC)N.



Sulfonamide [TSN102354]

IUPAC Name: 2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)-benzenesulfonamide.
CAS Name: 2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)-benzenesulfonamide.
CAS Number: Not reported.
SMILES String: NS(=O)(=O)c1c(cccc1C(F)(F)F)OCC(F)F.



Attachment 2: Excel Spreadsheets

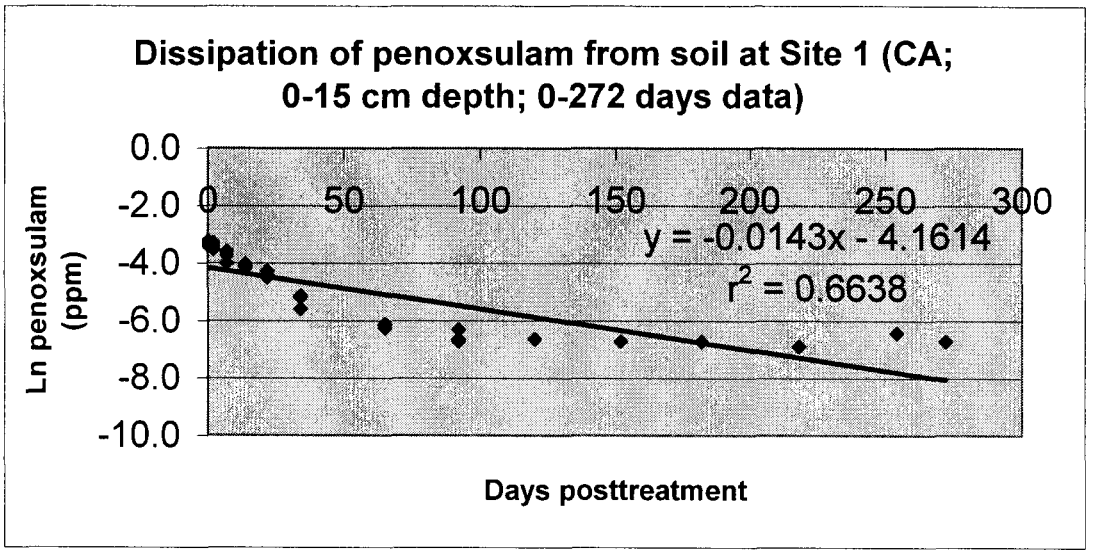
Chemical name Penoxsulam
PC code 119031
MRID 46703501
Guideline No. 164-1

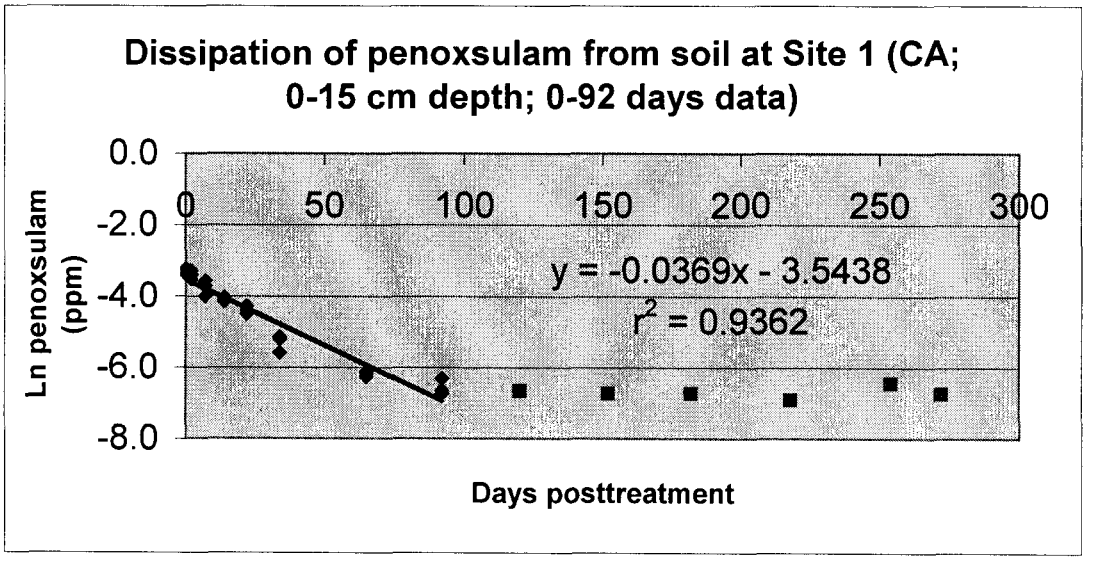
Site 1 - California
0-15 cm depth

Half-life (days) = 48.5
***Calculated using all available data**
Half-life (days) = 18.8
***Calculated using 0-92 day data**

Days posttreatment	Replicate plot	Penoxsulam (ppm)	Ln (penoxsulam)	Mean (ppm)
0	1	0.0391	-3.24	
0	2	0.0394	-3.23	**0.0373**
0	3	0.0334	-3.40	
2	1	0.0368	-3.30	
2	2	0.0294	-3.53	**0.0330**
2	3	0.0329	-3.41	
7	1	0.0181	-4.01	
7	2	0.0275	-3.59	**0.0231**
7	3	0.0238	-3.74	
14	1	0.0175	-4.05	
14	2	0.0156	-4.16	**0.0165**
14	3	0.0165	-4.10	
22	1	0.0122	-4.41	
22	2	0.0110	-4.51	**0.0123**
22	3	0.0137	-4.29	
34	1	0.0055	-5.20	
34	2	0.0037	-5.60	**0.0050**
34	3	0.0058	-5.15	
65	1	0.0022	-6.12	
65	2	0.0021	-6.17	**0.0021**
65	3	0.0019	-6.27	
92	1	0.0013	-6.65	
92	2	0.0012	-6.73	**0.0014**
92	3	0.0018	-6.32	
120	1	nd		
120	2	0.0013	-6.65	**0.0013**
120	3	0.0013	-6.65	
152	1	nd		
152	2	0.0012	-6.73	**0.0012**
152	3	nd		
182	1	nd		
182	2	nd		**0.0012**
182	3	0.0012	-6.73	
218	1	0.0010	-6.91	
218	2	nd		**0.0010**
218	3	nd		
254	1	nd		
254	2	nd		**0.0016**
254	3	0.0016	-6.44	
272	1	nd		
272	2	nd		**0.0012**
272	3	0.0012	-6.73	
327	1	nd		
327	2	nd		
327	3	nd		

* Data obtained from Table 7, pp. 39-41 of the study report.
nd = not detected


Dissipation of penoxsulam from soil at Site 1 (CA; 0-15 cm depth; 0-272 days data)
Ln penoxsulam (ppm)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
0
50
100
150
200
250
300
y = -0.0143x - 4.1614
r2 = 0.6638
Days posttreatment


Dissipation of penoxsulam from soil at Site 1 (CA; 0-15 cm depth; 0-92 days data)
Ln penoxsulam (ppm)
0.0
-2.0
-4.0
-6.0
-8.0
0
50
100
150
200
250
300
y = -0.0369x - 3.5438
r2 = 0.9362
Days posttreatment

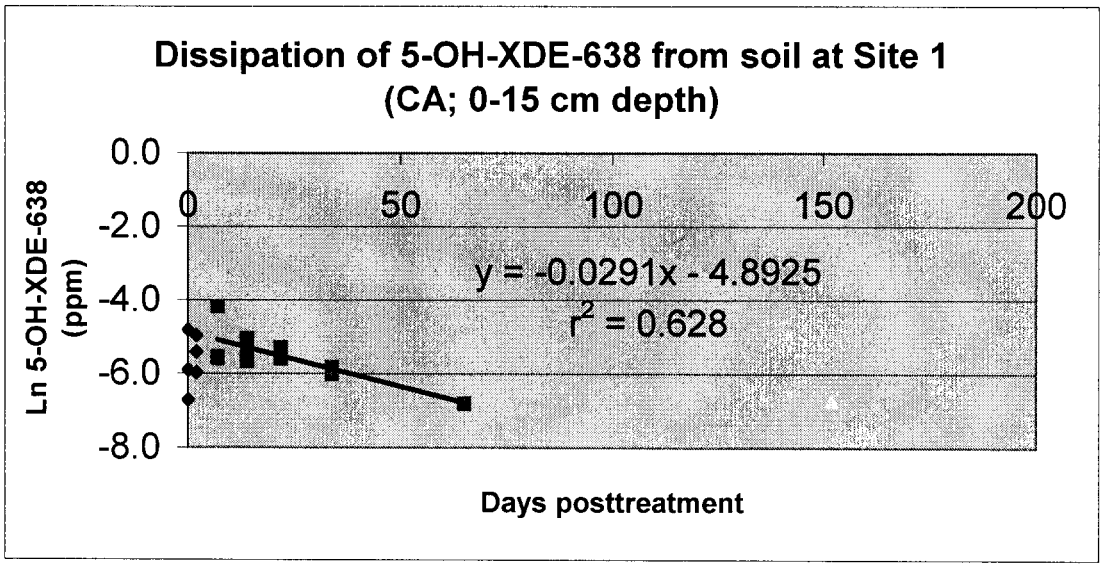
5-OH-XDE-638
Half-life (days) = 23.8
***Calculated using 7-65 day data**

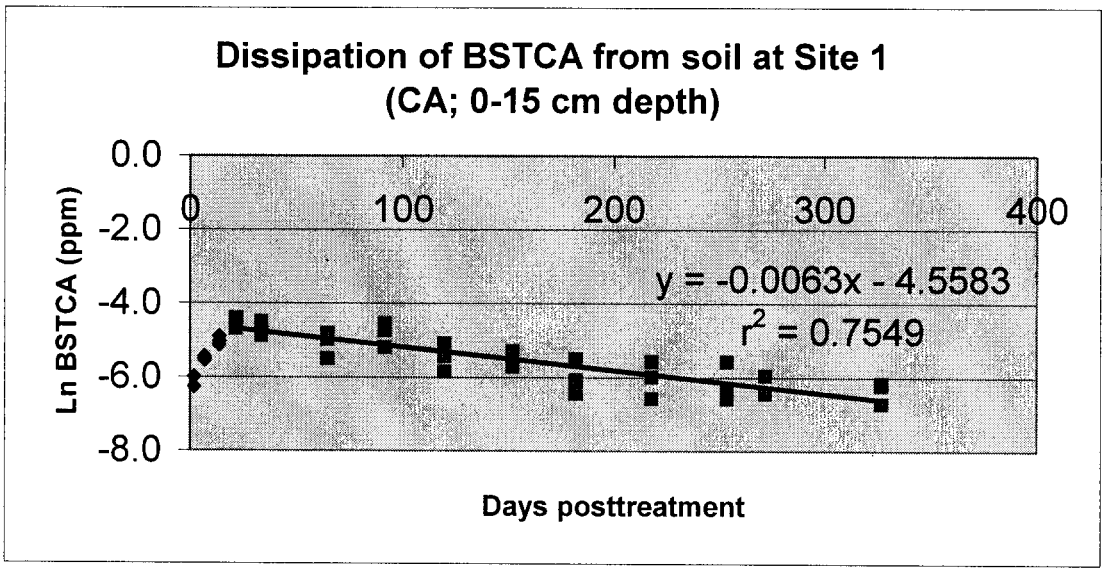
Days posttreatment	Replicate plot	5-OH-XDE-638 (ppm)	Ln (5-OH-XDE-638)	Mean (ppm)
0	1	0.0012	-6.73	
0	2	0.0027	-5.91	**0.0040**
0	3	0.0080	-4.83	
2	1	0.0069	-4.98	
2	2	0.0044	-5.43	**0.0046**
2	3	0.0025	-5.99	
7	1	0.0149	-4.21	
7	2	0.0037	-5.60	**0.0075**
7	3	0.0039	-5.55	
14	1	0.0048	-5.34	
14	2	0.0034	-5.68	**0.0049**
14	3	0.0064	-5.05	
22	1	0.0048	-5.34	
22	2	0.0037	-5.60	**0.0045**
22	3	0.0050	-5.30	
34	1	0.0028	-5.88	
34	2	0.0024	-6.03	**0.0027**
34	3	0.0029	-5.84	
65	1	nd		
65	2	nd		**0.0011**
65	3	0.0011	-6.81	
92	1	nd		
92	2	nd		
92	3	nd		
120	1	nd		
120	2	nd		
120	3	nd		
152	1	nd		
152	2	nd		**0.0012**
152	3	0.0012	-6.73	
182	1	nd		
182	2	nd		
182	3	nd		
218	1	nd		
218	2	nd		
218	3	nd		
254	1	nd		
254	2	nd		
254	3	nd		
272	1	nd		
272	2	nd		
272	3	nd		
327	1	nd		
327	2	nd		
327	3	nd		

BSTCA
Half-life (days) = 110.0
***Calculated using 22-327 day data**

BSTCA (ppm)	Ln (BSTCA)	Mean (ppm)
nd		
nd		
nd		
0.0025	-5.99	
0.0019	-6.27	**0.0021**
0.0019	-6.27	
0.0041	-5.50	
0.0043	-5.45	**0.0041**
0.0039	-5.55	
0.0074	-4.91	
0.0065	-5.04	**0.0066**
0.0059	-5.13	
0.0095	-4.66	
0.0092	-4.69	**0.0103**
0.0121	-4.41	
0.011	-4.51	
0.0075	-4.89	**0.0094**
0.0098	-4.63	
0.0068	-4.99	
0.0041	-5.50	**0.0063**
0.0081	-4.82	
0.0055	-5.20	
0.0087	-4.74	**0.0082**
0.0105	-4.56	
0.0029	-5.84	
0.0043	-5.45	**0.0045**
0.0062	-5.08	
0.0035	-5.65	
0.0033	-5.71	**0.0039**
0.005	-5.30	
0.0023	-6.07	
0.0016	-6.44	**0.0027**
0.0041	-5.50	
0.0025	-5.99	
0.0014	-6.57	**0.0026**
0.0038	-5.57	
0.0014	-6.57	
0.0017	-6.38	**0.0023**
0.0038	-5.57	
0.0016	-6.44	
nd		**0.0021**
0.0026	-5.95	
0.0012	-6.73	
0.0021	-6.17	**0.0018**
0.002	-6.21	

* Data obtained from Table 8-9, pp. 42-47 of the study report.
nd = not detected


Dissipation of 5-OH-XDE-638 from soil at Site 1
(CA; 0-15 cm depth)
Ln 5-OH-XDE-638 (ppm)
0.0
-2.0
-4.0
-6.0
-8.0
0
50
100
150
200
y = -0.0291x - 4.8925
r2 = 0.628
Days posttreatment


Dissipation of BSTCA from soil at Site 1
(CA; 0-15 cm depth)
Ln BSTCA (ppm)
0.0
-2.0
-4.0
-6.0
-8.0
0
100
200
300
400
y = -0.0063x - 4.5583
r2 = 0.7549
Days posttreatment

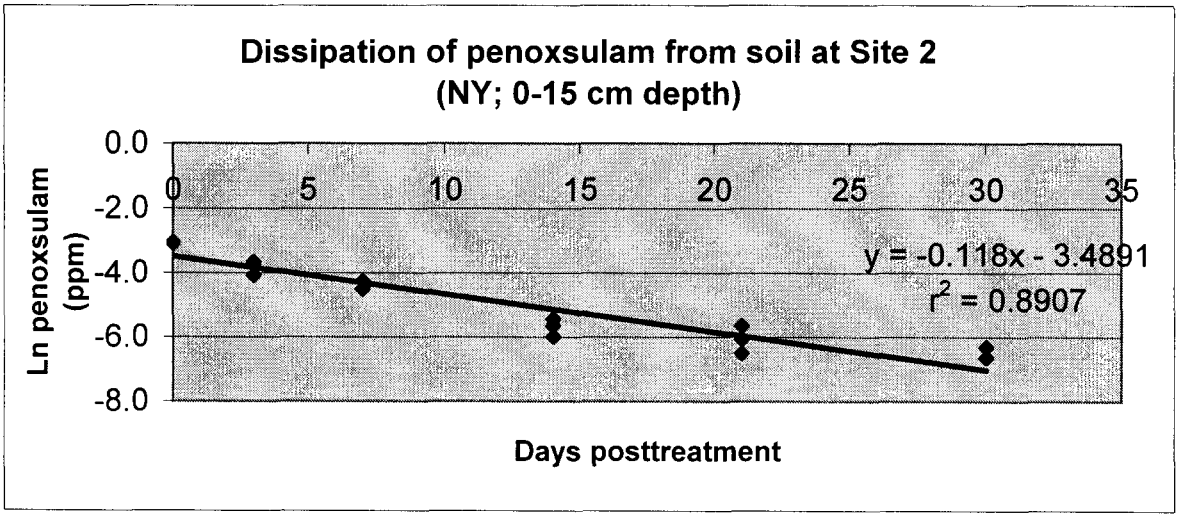
Chemical name Penoxsulam
PC code 119031
MRID 46703501
Guideline No. 164-1

Site 2 - New York
0-15 cm depth

Half-life (days) = 5.9
***Calculated using all available data**

Days posttreatment	Replicate plot	Penoxsulam (ppm)	Ln (penoxsulam)	Mean (ppm)
0	1	0.0447	-3.11	
0	2	0.0464	-3.07	**0.0460**
0	3	0.0469	-3.06	
3	1	0.0253	-3.68	
3	2	0.0169	-4.08	**0.0222**
3	3	0.0243	-3.72	
7	1	0.0109	-4.52	
7	2	0.0138	-4.28	**0.0119**
7	3	0.0109	-4.52	
14	1	0.0035	-5.65	
14	2	0.0025	-5.99	**0.0034**
14	3	0.0043	-5.45	
21	1	0.0035	-5.65	
21	2	0.0023	-6.07	**0.0024**
21	3	0.0015	-6.50	
30	1	0.0018	-6.32	
30	2	0.0013	-6.65	**0.0016**
30	3	nd		
60	1	nd		
60	2	nd		**#DIV/0!**
60	3	nd		
90	1	nd		
90	2	nd		**#DIV/0!**
90	3	nd		

* Data obtained from Table 10, pp. 48-49 of the study report.
nd = not detected



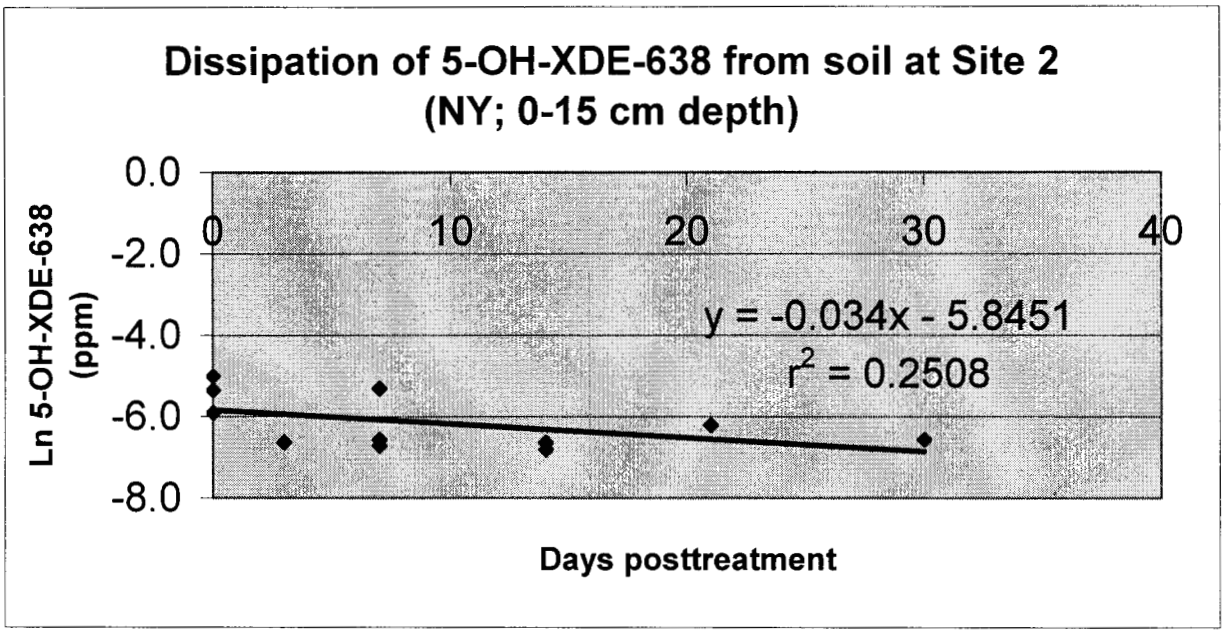
5-OH-XDE-638
Half-life (days) = 20.4
***Calculated using all replicate data**

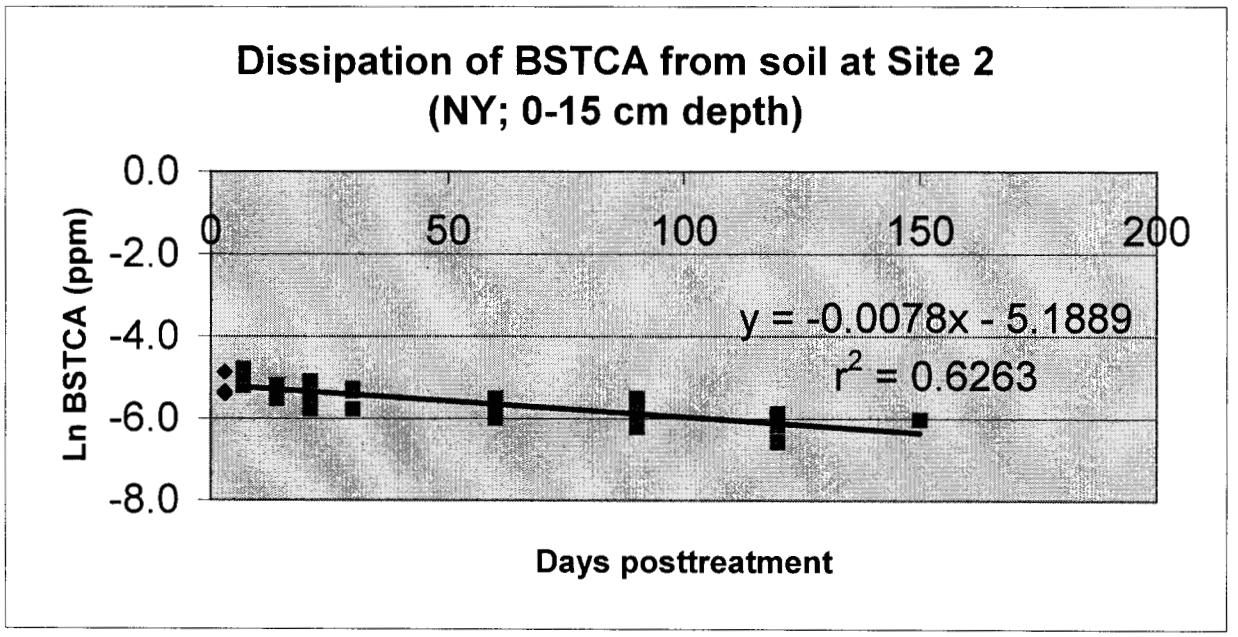
Days posttreatment	Replicate plot	5-OH-XDE-638 (ppm)	Ln (5-OH-XDE-638)	Mean (ppm)
0	1	0.0047	-5.36	
0	2	0.0027	-5.91	**0.0047**
0	3	0.0066	-5.02	
3	1	0.0013	-6.65	
3	2	nd		**0.0013**
3	3	nd		
7	1	0.0049	-5.32	
7	2	0.0014	-6.57	**0.0025**
7	3	0.0012	-6.73	
14	1	0.0011	-6.81	
14	2	nd		**0.0012**
14	3	0.0013	-6.65	
21	1	0.0020	-6.21	
21	2	nd		**0.0020**
21	3	nd		
30	1	0.0014	-6.57	
30	2	nd		**0.0014**
30	3	nd		
60	1	nd		
60	2	nd		
60	3	nd		
90	1	nd		
90	2	nd		
90	3	nd		
120	1	nd		
120	2	nd		
120	3	nd		
150	1	nd		
150	2	nd		
150	3	nd		

BSTCA
Half-life (days) = 88.9
***Calculated using 7-150 day data**

BSTCA (ppm)	Ln (BSTCA)	Mean (ppm)
nd		
nd		
nd		
0.0076	-4.88	
0.0047	-5.36	**0.0056**
0.0045	-5.40	
0.0072	-4.93	
0.0082	-4.80	**0.0070**
0.0055	-5.20	
0.0048	-5.34	
0.004	-5.52	**0.0048**
0.0055	-5.20	
0.0061	-5.10	
0.0039	-5.55	**0.0044**
0.0031	-5.78	
0.0051	-5.28	
0.0048	-5.34	**0.0043**
0.0031	-5.78	
0.0025	-5.99	
0.004	-5.52	**0.0033**
0.0033	-5.71	
0.004	-5.52	
0.0029	-5.84	**0.0030**
0.002	-6.21	
0.0028	-5.88	
0.0021	-6.17	**0.0021**
0.0014	-6.57	
nd		
nd		**0.0024**
0.0024	-6.03	

* Data obtained from Table 11-12, pp. 50-53 of the study report.
nd = not detected


Dissipation of 5-OH-XDE-638 from soil at Site 2
(NY; 0-15 cm depth)
Ln 5-OH-XDE-638 (ppm)
0.0
-2.0
-4.0
-6.0
-8.0
0
10
20
30
40
y = -0.034x - 5.8451
r2 = 0.2508
Days posttreatment


Dissipation of BSTCA from soil at Site 2
(NY; 0-15 cm depth)
Ln BSTCA (ppm)
0.0
-2.0
-4.0
-6.0
-8.0
0
50
100
150
200
y = -0.0078x - 5.1889
r2 = 0.6263
Days posttreatment