(3-22-2004)

Data Evaluation Report on the phototransformation of penoxsulam on soil

PMRA Submission Number {.....} EPA MRID Number 45830723

Data Requirement: PMRA Data Code:
EPA DP Barcode: D288160
OECD Data Point:
EPA Guideline: 161-3

Test material:
Common name: Penoxsulam.
Chemical names:
IUPAC: 6-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy-s-triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluoro-o-toluenesulfonamide;
3-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluorotoluene-2-sulfonamide.
CAS : 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 (Petitioner's code).
SMILES string: n1c(nc2n1c(ncc2OC)OC)NS(=O)(=O)c3c(cccc3C(F)(F)F)OCC(F)F.

Primary Reviewer: Lisa Koterwas
Dynamac Corporation
Signature:
Date:

QC Reviewer: Joan Gaidos
Dynamac Corporation
Signature:
Date:

Secondary Reviewer: Lucy Shanaman
EPA
Signature: Lucy Shanaman
Date: March 22, 2004

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

CITATION: Rutherford, L.A., R.N. Yoder, and J.L. Balcer. 2002. Photodegradation of XDE-638 on aerobic soil. Unpublished study performed, sponsored, and submitted by Regulatory Laboratories-Indianapolis Lab, Dow AgroSciences LLC, Indianapolis, IN. Laboratory Study No.: 000137. Experiment initiated February 22, 2000, and completed June 13, 2001 (pp.3, 6). Final report issued March 20, 2002.

(1)

EXECUTIVE SUMMARY

The phototransformation of [triazolopyrimidine-2- ^{14}C]- and [phenyl-U- ^{14}C]- labeled 3-(2,2-difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluorotoluene-2-sulfonamide (penoxsulam; XDE-638) was studied on silt loam soil (75% of 1/3 bar, pH 5.8, organic matter'2.02%) from Arkansas for 37 days under a 12 hour light/12 hour dark cycle at 22.1°C to 26.1°C; and on silty clay loam soil (air-dried, pH 6.2, organic matter 2.06%) from Greggio, Italy for 20 days under continuous irradiation at 17.3°C to 20.5°C. [^{14}C]Penoxsulam was applied at a nominal concentration of 2.4 mg a.i./kg for each soil (equivalent to 50 g a.i./ha). The test systems were irradiated by a UV-filtered xenon arc lamp (285-800 nm; 6.62 W/m^2 at 400 nm). Using an actinometer, it was estimated that the intensity of the xenon lamp for the Arkansas and Greggio soil samples was approximately 57% and 39%, respectively of the average summer sunlight at 40°N latitude. The wavelength distribution was similar. The study was conducted in accordance with the US EPA Pesticide Assessment Guidelines, Subdivision N §161-3, and in compliance with the U.S. EPA GLP Standards.

For irradiated samples, quartz boiling flasks containing 2.5 g of treated soil were placed in a circulating water bath within a temperature controlled incubator. For dark controls, pyrex glass tubes containing 2.5 g of treated soil were incubated in a temperature controlled incubator. For the irradiated Arkansas silt loam, volatile traps containing ascarite to trap CO_2 were fitted onto the flasks, covered with parafilm and wrapped with aluminum foil. No other volatile traps were present and volatile organics was not reported. The Arkansas silt loam soil samples (both labels) were collected at 0, 1, 3, 7, 14, 21, 30, and 37 days. The Greggio silty clay loam soil samples were collected at 0, 1, 3, 7, 10, 15, and 20 days. Single samples were collected for each label in each soil type at each sampling interval. The soils were extracted three-four times with acetonitrile:0.1N hydrochloric acid (90:10, v:v) by shaking and centrifugation. The soil extracts, extracted soils, and volatile traps were analyzed for total radioactivity using LSC. The soil extracts were also analyzed for penoxsulam and its transformation products using HPLC. Compounds were identified by cochromatographic comparison to unlabeled reference standards. Further identification of isolated compounds was done with LC-MS.

In the Arkansas silt loam soil (12 hour light/dark cycles at *ca.* 25°C), the overall recovery of radiolabeled material in the irradiated samples averaged 93.3 ± 5.1% (range 83.4-100.3%), and 96.5 ± 2.4% (range 92.9-100.9%) of the applied for the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively; there was a slight pattern of decline for both labels. In the corresponding dark controls, the overall radiolabeled recovery averaged 98.3 ± 2.3% (range 95.2-101.0%) and 99.7 ± 1.6% (range 97.6-102.4%) of the applied for the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively with no clear pattern of decline.

In the [^{14}C-Ph]-labeled irradiated samples, penoxsulam decreased from 98.4% of the applied at day 0, to 66.0% of the applied at 14 days, 33.3% at 30 days, and was 41.8% of the applied at 37 days posttreatment (study termination). Two major transformation products were identified: BSA (2-(2,2-difluoroethoxy)-6-(trifluoromethyl) benzenesulfonic acid) and BSTCA (3-[[[2-(2,2-difluoroethoxy)-6-(trifluoromethyl)phenyl]sulfonyl]amino]-1H-1,2,4-triazole-5-carboxylic acid. BSA increased to a

maximum of 8.1% of the applied at 30 days, and was 7.5% of the applied at 37 days posttreatment (study termination). BSTCA increased to a maximum of 10.5% of the applied at 21 days, and was 10.1% of the applied at 37 days postreatment. There were no minor transformation products identified. Two radioactive peaks at 17- and 20-minutes were a maxima of 6.7% (37 days) and 4.5% (21 days) of the applied, respectively. The total [^{14}C]extractable residue decreased from 99.2% of applied radioactivity at day 0, to 72.3% at 37 days; total [^{14}C]nonextractable residues increased from 1.1% of applied radioactivity at day 0, to a maximum of 19.2% at 30 days. Fulvic acid, humic acid and humin totaled 8.5%, 1.6%, and 7.9% of the applied, respectively in the nonextractable residues fraction at 37 days. Volatilized $^{14}CO_2$ totaled 3.2% of the applied at 37 days in the [^{14}C-Ph]-labeled penoxsulam. Volatile organics were not reported.

In the [^{14}C-TP]-labeled irradiated samples, penoxsulam decreased from 98.5% of the applied at day 0, to 53.3% at 21 days, and was 34.2% at 37 days posttreatment. Two major transformation products were identified: 2-amino TP (5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-amine) and BSTCA. 2-Amino TP increased to a maximum of 10.4% of the applied at 37 days posttreatment. BSTCA increased to a maximum of 11.1% of the applied at 30 days, and was 7.8% of the applied at 37 days posttreatment. There were no minor transformation products identified. Two radioactive peaks at 7- and 17-minutes were a maxima of 3.0% (14 days) and 8.0% (21 days) of the applied, respectively. The total [^{14}C]extractable residue decreased from 98.9% of applied radioactivity at day 0, to 64.5% of the applied at 37 days. Total [^{14}C]nonextractable residues increased from 2.0% of the applied radioactivity at day 0 to a maximum of 30.9% at 37 days. Nonextractable residues were not characterized. Volatilized $^{14}CO_2$ totaled 1.5% of the applied at 37 days in the [^{14}C-TP]-labeled penoxsulam. Volatile organics were not reported.

In the [^{14}C-Ph]-labeled dark controls, penoxsulam decreased from 98.4% of the applied at day 0, to 79.2% at 37 days. There were no major transformation products identified. BSA was detected only once at a maximum of 4.4% of the applied on day 30. BSTCA was a maximum of 3.7% of the applied (37 days). An unidentified radioactive peak at 20 minutes was a maximum of 3.1-4.4% of the applied (14-30 days). The extractable residue decreased from 99.2% of applied radioactivity at day 0, to 86.9% at 37 days. Total [^{14}C]nonextractable residue increased from 1.1% of applied radioactivity at day 0 to a maximum of 13.9% at 30 days (the 37-day sample was lost). Nonextractable residues were not characterized.

In the [^{14}C-TP]-labeled dark controls, penoxsulam decreased from 98.5% of the applied at day 0, to 79.8% of the applied at 37 days posttreatment. There were no major transformation products identified. BSTCA was a maximum of 2.3-2.7% of the applied (14-37 days). An unidentified radioactive peak at 20-minutes was a maximum of 4.0% (14 days) of the applied. The extractable residue decreased from 98.9% of applied radioactivity at day 0, to 85.2% of the applied at 37 days posttreatment. Total [^{14}C]nonextractable residue increased from 2.0% of applied radioactivity at day 0, to a maximum of 14.5% at 37 days. Fulvic acid, humic acid and humin totaled 6.5%, 1.4%, and 6.6% of the applied, respectively in the nonextractable residues fraction at 37 days. Volatiles were not collected for dark controls of either label.

(3)

Penoxsulam dissipated from the irradiated samples with calculated half-lives of 26.26, 28.52, and 27.29 days for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined-labeled penoxsulam, respectively, based on a 12-hour light/12-hour dark cycle. In the dark controls, penoxsulam dissipated with calculated half-lives of 161.20, 138.63, and 147.48 days, for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined-labeled penoxsulam, respectively. These half-lives for the dark controls are of limited value because they extend beyond the study duration and are based on the assumption that degradation continues to follow a linear pattern.

The **phototransformation half-lives** for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined-labeled penoxsulam were **31, 36, and 34 days**, respectively based on 12 hour light/dark cycle used in the study, or approximately 15.7, 18.0, and 16.8 days, respectively based on continuous irradiation. The predicted **environmental phototransformation half-lives** for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined labeled penoxsulam were approximately **17.9, 20.5, and 19.1 days**, respectively.

In the Greggio silty clay loam soil (continuous irradiation at *ca.* 20°C), the overall recovery of radiolabeled material in the irradiated samples averaged 98.1 ± 3.1% (range 93.6-102.6%) and 99.1 ± 2.3% (range 94.8-101.0%) for the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively. There was a slight pattern of decline, especially the [^{14}C-Ph]-labeled penoxsulam. In the corresponding dark controls, the overall radiolabeled recovery averaged 102.8 ± 0.6% (range 102.0-103.6%) and 101.3 ± 0.9% (range 99.9-102.7%) for the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively with no clear pattern of decline.

In the [^{14}C-Ph]-labeled irradiated samples, penoxsulam decreased from 94.8% of the applied at day 0, to 67.0% at 20 days posttreatment (study termination). No major or minor transformation products were identified. Four unidentified radioactive peaks at 7-, 16-, 19-, and 26-minutes were a maxima of 2.2% (15 days), 8.8% (20 days), 8.7% (20 days) and 2.9% (15 days) of the applied, respectively. Total [^{14}C]extractable residue decreased from 96.4% of applied at day 0, to 88.5% at 20 days. Total [^{14}C]nonextractable residue increased from 6.3% of applied at day 0, to a maximum of 10.3% at 10 days and was 6.8% at 20 days. Volatiles were not collected.

In the [^{14}C-TP]-labeled irradiated samples, penoxsulam decreased from 93.5% of the applied at day 0, to 57.2% at 15 days, and was 66.3% at 20 days. No major or minor transformation products were identified. Four unidentified radioactive peaks at 7-, 12-, 16-, and 19-minute a maxima of 3.9% (15 days), 3.3% (15 days), 7.9% (20 days), and 7.3% (15 days) of the applied, respectively. The study authors proposed that the 16-minute unidentified peak was a mixture of BSA and BSTCA based on its retention time. The total [^{14}C]extractable residue decreased from 94.5% of applied at day 0, to 85.0% at 20 days. Total [^{14}C]nonextractable residue increased from 6.3% of applied at day 0 to a maximum of 17.5% of the applied at 15 days, and was 12.7% at 20 days. Fulvic acid, humic acid and humin totaled 7.0%, 1.5%, and 4.2% of the applied, respectively in the nonextractable residues fraction at 20 days. Volatiles were not collected.

In the [^{14}C-Ph]-labeled dark controls, penoxsulam decreased from 94.8% of the applied at day 0, to 86.4% at 20 days. No transformation products were identified. The total [^{14}C]extractable residue were 96.4% of applied at day 0, and 99.9% at 20 days. The total [^{14}C]nonextractable residue increased from

6.3% of applied radioactivity at day 0, to a maximum of 10.0% at 10 days, and was 2.8% at 20 days. Fulvic acid, humic acid and humin totaled 5.6%, 0.9%, and 3.5% of the applied, respectively in the nonextractable residues fraction at 10 days.

In the [^{14}C-TP]-labeled dark controls, penoxsulam, was 93.5% of the applied at day 0 to 97.4% at 20 days posttreatment. No transformation products were identified. The total [^{14}C]extractable residue was 94.5% of applied at day 0, and 99.1% at 20 days. Total [^{14}C]nonextractable residue increased from 6.3% of applied at day 0, to a maximum of 9.8% at 7 days, and was 2.1% at 20 days. Volatiles were not collected for dark controls of either label.

Penoxsulam dissipated from the irradiated samples with calculated half-lives of 92, 78, and 84 days for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined-labeled penoxsulam, respectively, adjusted for 12 hour light/dark cycles. In the dark controls, penoxsulam dissipated with an uncorrected, calculated half-life of 130.78 days (continuos irradiation) for the [^{14}C-Ph]-labeled penoxsulam, and was stable for the [^{14}C-TP]- and combined-labeled penoxsulam. These half-lives are of limited value because they extend beyond the study duration and are based on the assumption that degradation continues to follow a linear pattern.

The **phototransformation half-life** for the [^{14}C-Ph]-labeled penoxsulam in Greggio silty clay loam soil was 70.0 days based on continuous irradiation used in the study, or approximately **140 days** based on 12 hour light/dark cycle, and corrected for dark control. The predicted **environmental phototransformation half-life** for the [^{14}C-Ph]-labeled penoxsulam was approximately **109 days**. No degradation occurred in the dark controls of the [^{14}C-TP]- and the plotted combined labeled penoxsulam data did not indicate a pattern of degradation, therefore, **phototransformation half-lives** were approximately **77 and 83 days**, respectively. The **environmental phototransformation half-lives** were approximately **30 and 32 days**, respectively.

A partial degradation pathway was illustrated by the study author. Penoxsulam degraded into BSA, BSTCA, and 2-amino TP in the Arkansas/Amagon soil and into minor degradates and the nonextractable residue in the Greggio soil. BSA and 2-amino TP were formed by the cleavage of the sulfonamide bridge, while BSTCA was formed by the opening of the pyrimidine ring.

Results Synopsis

Soil type: Arkansas silt loam soil incubated at 25°C.
Source of irradiation: Xenon lamp (12 hour light/dark cycle).
Half-life for irradiated samples (***not corrected* for dark controls**):

- [^{14}C-Ph]penoxsulam: 26 days (0-37 day data; $r^2 = 0.8979$).
- [^{14}C-TP]penoxsulam: 29 days (0-37 day data; $r^2 = 0.9043$).
- Combined label: 27 days (0-37 day data; $r^2 = 0.8993$).

Half-life for dark controls:

- [^{14}C-Ph]penoxsulam: 161 days (0-37 day data; $r^2 = 0.7326$).
- [^{14}C-TP]penoxsulam: 139 days (0-37 day data; $r^2 = 0.8583$).

Combined label: 147 days (0-37 day data; $r^2 = 0.7739$).

Major transformation products/irradiated samples (Ph label):

BSA {2-(2,2-difluoroethoxy)-6-(trifluoromethyl) benzenesulfonic acid}.

BSTCA {3-[[[2-(2,2-difluoroethoxy)-6-(trifluoromethyl)phenyl]sulfonyl]amino]-1H-1,2,4-triazole-5-carboxylic acid}.

Major transformation products/irradiated samples (TP label):

2-amino TP {5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidine-2-amine}.

BSTCA.

Minor transformation products/irradiated samples (both labels):

None.

Major and minor transformation products/dark controls (both labels):

None.

Soil type: Greggio silty clay loam soil incubated at 20°C.

Source of irradiation: Xenon lamp (continuous irradiation).

Half-life for irradiated samples (***adjusted* for 12 hour light/dark cycle, but *not corrected* for dark controls**):

[^{14}C-Ph]penoxsulam: 92 days (0-20 day data; $r^2 = 0.7344$).

[^{14}C-TP]penoxsulam: 78 days (0-20 day data; $r^2 = 0.7078$).

Combined label: 84 days (0-20 day data; $r^2 = 0.7093$).

Half-life for dark controls:

[^{14}C-Ph]penoxsulam: 130 days (0-20 day data; $r^2 = 0.6921$).

[^{14}C-TP]penoxsulam: Stable (0-20 day data).

Combined label: Stable (0-20 day data).

Major transformation products/irradiated samples (both labels):

None.

Minor transformation products/irradiated samples (both labels):

Five unidentified transformation products.

Major and minor transformation products/dark controls (both labels):

None.

Study Acceptability: This study is classified supplemental for [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam photodegradation in soil, Subdivision N, Guideline §161-3. The study is scientifically valid, but the following deviations were noted: The mass balance for the [^{14}C-Ph]-labeled penoxsulam in the Arkansas silt loam soil at 30 days posttreatment was <90% of the applied. The temperature was not maintained at 25 ± 1°C for either the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam in either the Arkansas silt loam or the Greggio silty clay loam soil studies. In the Greggio silty clay loam, the moisture content was not maintained or adjusted during the experiment.

I. MATERIALS AND METHODS

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GUIDELINE FOLLOWED: This study was conducted in accordance with US EPA Pesticide Registration Guidelines, Subdivision N §161-3, and SETAC Guidelines- Section 2.0 (pp.15, 19). Significant deviations from Subdivision N guidelines were noted as follows:

The mass balance at 30 days posttreatment of the [^{14}C-Ph]penoxsulam experiment was reported as 83.4% for the Arkansas silt loam soil. USEPA Subdivision N Guideline §161-3 require the material balance be maintained between 90 and 110% of the applied. This does not affect the validity of the study.

The temperature of the Arkansas silt loam soil during the study period was reported as 25 ± 1°C. However, the temperature ranges of 22.1 to 24.3°C for the irradiated samples and 24.6 to 26.1°C for the dark controls were provided. In the Greggio silty clay loam soil, the temperature was reported as 20 ± 1°C. However, the temperature ranges of 17.3 to 19.2°C for the irradiated samples and 19.0 to 20.5°C for the dark controls were provided. USEPA Subdivision N Guideline §161-3 specifies that the incubation temperatures of the dark controls should be the same as the temperatures of the irradiated samples, and that the samples should be incubated at 25 ± 1°C. This does not affect the validity of the study.

In the Greggio silty clay loam, the study was conducted for only 20 days (continuous irradiation). USEPA Subdivision N Guideline §161-3 specifies that the study be conducted until the half-life of test material is established or *ca.* 30 days, whichever comes first. This does not affect the validity of the study.

Soil moisture was not reportedly maintained in either the irradiated (air-dried) or dark controls of the Greggio silty clay soil experiments. This does not affect the validity of the study.

COMPLIANCE: This study was conducted in compliance with U.S. EPA Good Laboratory Practice, 40 CFR Part 160 (1989; p.3). Signed and dated GLP, Quality Assurance, and Data Confidentiality were provided (pp.2-5). A Certificate of Authenticity was not provided.

A. MATERIALS:

1. Test Materials: [Triazolopyrimidine-2- ^{14}C]penoxsulam and [phenyl-U- ^{14}C]penoxsulam (p.20).

Chemical Structure: See DER Attachment 2.

Description: Solid (p.20).

Purity:

[Triazolopyrimidine-2- ^{14}C] label
Radiochemical purity: 98.7% pure (p.21)
Inventory No. INV1456.
Analytical purity: Not reported.
Specific activity: 28.9 mCi/mmole.
Location of the radiolabel: 2-Carbon in the triazolopyrimidine (TP) ring (p.20).

[Phenyl-U- ^{14}C] label
Radiochemical purity: 98.4% pure (p.21)
Inventory No. INV1475.
Analytical purity: Not reported.
Specific activity: 24.6 mCi/mmole.
Location of the radiolabel: Uniformly on the phenyl (Ph) ring.

Storage conditions of test chemicals: Not reported.

Physico-chemical properties of penoxsulam:

Parameter	Values	Comments
Molecular formula	Not reported.	
Molecular weight (g/mole):	483.4	
Water solubility	5.66 mg/L at pH 5; 0.408 g/L at pH 7; 1.46 g/L at pH 9; 4.91 mg/L unbuffered.	
Other solubilities (g/L):	78.4 in DMSO; 40.3 in NMP; 39.8 in DMF; 20.3 in acetone; 15.3 in acetonitrile; 3.23 in ethyl acetate; 1.48 in methanol; 0.035 in octanol; 0.017 in xylene; <1 µg/mL in heptane.	
Vapor pressure/volatility	7.16×10^{-16} mmHg	
UV absorption	254 nm	UV spectrum provided in Figure 2, p.72 of the study report.
pKa	5.1	
K_{ow}	Not reported.	
Log K_{ow}	1.137 at pH 5; -0.602 at pH 7; -1.418 at pH 9; -0.354 unbuffered.	
Stability of compound at room temperature	Not reported.	After 6 months of frozen storage, 97.3% and 99.6% a.i. remained in the TP- and Ph-labeled penoxsulam, respectively.

Data obtained from p.21; Figure 1, p.70; and Figure 2, p.72 of the study report.

2. Soil Characteristics:

Table 1: Field information and handling procedures.

Information	Amagon silt loam (M557)	Greggio silty clay loam (M570)
Geographic location	Arkansas county, Arkansas, USA.	Greggio of Piermonte, Italy.
Site description	Cropland, fallow. Representative of a US rice-growing region.	Cropland, rice. Representative of a European rice-growing region.
Pesticide use history at the collection site	Propanil, Grandstand, and Prowl.	UREA, and potassium phosphate.
Collection procedures	Hand trowel were used to collect 10-12 samples within a 50-ft x 50-ft plot, samples were transferred into a plastic, 5-gal bucket.	
Collection date	May 23, 1999	May 24, 1999
Sampling depth (cm)	15 cm	0-20 cm
Storage conditions	Soil samples were shipped under ambient conditions, stored at the receiving facility at 25°C, then sieved and stored refrigerated at 4°C until use.	
Storage length	Approximately 8 months.	
Soil preparation	Sieved, 2 mm.	

Data obtained from p.23; and Appendix A, pp.94-95 of the study report.

Table 2: Properties of the soil.

Property	Arkansas silt loam	Greggio silty clay loam
Soil texture (USDA):	Silt loam	Silty clay loam
% sand	4.3	6.0
% silt	71.7	58.8
% clay	24.0	35.2
pH	5.8	6.2
Organic matter (%)	2.02	2.06
Organic carbon (%)	1.17	1.19
CEC (meq/100 g)	16.54	10.73
Field moisture at 15 bar (%)	7.55	12.47
Field moisture at 1/3 bar (%)	24.82	27.25
Bulk density, disturbed (g/cm^3)	1.11	1.23
Heterotrophic plate count (ave. CFU/g; ave):	3.3×10^7	2.85×10^6
Soil Series	Amagon	Greggio
Soil Taxonomic classification	Fine-silty, mixed, active, thermic Typic Endoaqualfs.	Not reported.
Soil mapping unit (for EPA)	Not reported.	Not reported.

Data obtained from Table 1, p.50 of the study report.

11

3. Details of light source:

Table 3: Artificial light source.

Property	Details
Type of lamp used	Xenon arc lamp (Atlas Electronic Devices Company).
Emission wavelength spectrum	300-800 nm.
Light intensity	6.62 W/m^2 at 400 nm.
Filters used	Inner filter: Borosilicate glass CIRA filter (eliminated irradiance <285 nm). Outer filter: Soda lime filter (eliminated irradiance <300 nm).
Relationship to natural sunlight	The intensity and wavelength distribution of the artificial light were compared to sunlight measured at the summer solstice and the spring/summer average (data obtained from the Federal Register). A graphical comparison of the artifical light to sunlight is illustrated in Figure 3, p.73 of the study report. Compared to the predicted intensity of the summer sunlight at 40°N latitude, the artifical light intensity was 57% for the Arkansas soil irradiation, and 39% for the Greggio soil irradiation.

Data obtained from p.24; Table 2, p.51; Figure 3, p.73; Appendix B, pp.96-103; Appendix D, pp.116-118 of the study report.

B. EXPERIMENTAL DESIGN

1. Preliminary Study: No preliminary studies were reported.

2. Experimental Design

Table 4: Experimental design.

Parameter		Arkansas silt loam	Greggio silty clay loam
Duration of the test		37 days	20 days
Condition of soil:	Air dried/fresh:	Fresh	Air-dried
	Sterile/Non-sterile:	Non-sterile	
Test concentrations (mg a.i./kg soil)	[^{14}C-TP]-label	2.29	2.31
	[^{14}C-Ph]-label	2.41	2.44
Dark controls used (Yes/No): Method to maintain darkness:		Yes. Dark control samples were placed in a darkened incubator.	
Replications	Irradiated:	Single samples for each label were collected.	
	Dark control:	Single samples for each label were collected.	

Parameter		Arkansas silt loam	Greggio silty clay loam
Identity and concentration of co-solvent:		Acetonitrile (≤1% by wt.)	
Pesticide application	Volume of test solution used/treatment	25 µL/2.5 g soil (dry wt.).	
	Method of application	Applied evenly to the soil surface using a syringe.	
	Is the co-solvent evaporated?	No.	
Test apparatus: Type/Material/Volume		Irradiated: Soil was placed in quartz boiling flasks with a flat bottom. Each flask was fitted with a volatile trap and the ground glass joint between the trap and the flask was sealed with parafilm. Flasks were placed in a circulating water bath and incubated at 25 ± 1°C. An illustration of the test system was not provided.	Irradiated: Soil was placed in quartz boiling flasks with a flat bottom, fitted with ground glass stoppers, and the joint sealed with parafilm. Flasks placed in a circulating water bath and incubated at 20 ± 1°C.
		Dark controls: Soil was placed in pyrex glass tubes and incubated in an incubator set at 25 ± 1°C.	Dark controls: Soil was placed in pyrex glass tubes and incubated in an incubator set at 20 ± 1°C.
Details of traps for volatile, if any		Volatile traps contained a layer of 80:20 Silica Gel Grade 35 (12-42 mesh), which acted as a moisture barrier, followed by a layer of Ascarite II (20-30 mesh) to trap CO_2. The tops of the traps were covered with parafilm and the traps were wrapped with aluminum foil to minimize light exposure.	Based on low recovery of volatiles from Arkansas soil samples, volatile traps were not used with Greggio soil samples.
If no traps were used, is the system closed/open		Volatile traps were used.	Closed.
Any indication of the test material adsorbing to the walls of the test apparatus		Not indicated.	

Parameter		Arkansas silt loam	Greggio silty clay loam
Experimental Conditions	Temperature:	Irradiated: Range 22.1°C to 24.3°C. Dark Control: Range 24.6°C to 26.1°C.	Irradiated: Range 17.3°C to 19.2°C. Dark Control: Range 19.0°C to 20.5°C.
	Temperature maintenance method:	Irradiated: Samples were incubated in a circulating water bath maintained at *ca.* 25°C in an artificial light room set at 25 ± 1°C. Dark Controls: Samples were placed in an incubator set at 25 ± 1°C.	Irradiated: Samples were incubated in a circulating water bath maintained at *ca.* 20°C in an artificial light room set at 20 ± 1°C. Dark Controls: Samples were placed in an incubator set at 20 ± 1°C.
	Moisture content:	Irradiated: Soil samples were adjusted to *ca.* 75% at 1/3 bar. Dark controls: The soil moisture was not adjusted.	Irradiated and dark controls: The soil moisture was not adjusted.
	Moisture maintenance method:	Soil moisture was periodically determined gravimetrically and adjusted using deionized water.	Not applicable.
	Duration of light/darkness:	12-hour light/12-hour dark cycle.	Continuous irradiation.
Other details, if any		None.	

Data obtained from pp.24-28 and Table 3, p.52 of the study report.

3. Supplementary experiments: The intensity of the xenon lamp was measured using a p-nitroacetophenone (PNAP) and pyridine (pyr) as a chemical actinometer (pp.22, 27). The 1 x 10^{-4} M actinometry stock solution was prepared as follows: 1 mL of PNAP (1 x 10^{-2} M solution) and 150 mL pyr combined in a 100-mL volumetric flask, then HPLC grade water was added to 100 mL (p.27). Five mL aliquots of the actinometry stock solution was put into quartz flasks with a glass stopper (irradiated samples) and amber pyrex glass tubes with Teflon-lined screw caps (dark controls). The irradiated samples were put in the water bath under the xenon lamp (continuous or 12 hr light/dark cycle not specified). The dark controls were wrapped in aluminum foil and placed in the incubator. The actinometer samples were treated with the irradiated and dark samples of the corresponding soil in the definitive study. A theoretical half-life of 4 days was expected.

At sampling intervals, the actinometer vials were completely removed from the water bath or incubator (p.27). Posttreament, actinometer solutions were analyzed for PNAP by HPLC under the following conditions (p.33): Spherisorb ODS-2 (5 µm) column; UV-Visible detector (288 nm); and 1.5 mL/min flow rate. Actinometer solutions were stored refrigerated in amber vials until analysis (storage length not specified; p.29). A calibration curve for the actinometer was established using a series of set volumes of the stock solution. At least one aliquot from the experimental samples was measured for each sampling interval. Concentrations of PNAP were calculated from the peak area in the HPLC spectrum and the calibration curve.

4. Sampling:

Table 5: Sampling details.

Criteria	Arkansas silt loam	Greggio silty clay loam
Sampling intervals	0, 1, 3, 7, 14, 21, 30, and 37 days.	0, 1, 3, 7, 10, 15, and 20 days.
Sampling method	Irradiated and dark control samples were collected at all intervals, removed from water bath or incubator.	
Method of sampling CO_2 and volatile organic compounds	Silica and ascarite layers were poured into separate glass vials.	N/A
Sampling intervals/times for: Sterility check, if any: Moisture content: Temperature:	 Sterile controls were not used. Moisture content was checked at 6, 15, 22, and 35 days. Visually checked daily.	 Sterile controls were not used. N/A Visually checked daily.
Sample storage before analysis	Volatiles were analyzed the day of collection; HPLC analysis was conducted within one week. Soil and volatile extracts were stored refrigerated; extracted soil and silica gel were stored at room temperature. Samples awaiting metabolite identification by LC/ESI-MS analysis were stored in a freezer.	
Other observations, if any	None.	

Data obtained from pp.28-29; Table 4, p.53; and Appendix C, p.107 of the study report.

C. ANALYTICAL METHODS

Extraction/clean up/concentration methods: Irradiated soil samples were treated with 5 mL of acetonitrile:0.1N hydrochloric acid (90:10, v:v), swirled, and poured into pyrex vials (45 mL; p.30). The sample flasks was rinsed twice with the same extraction solution (*ca.* 5 mL), and the rinsate combined was the extracts. The extracts were shaken at low speed for one hour, centrifuged (2500 rpm for 15 minutes), and decanted into volumetric flasks (25 mL). The rinsing process was repeated twice using 4 mL of the acetonitrile:0.1N hydrochloric acid solution (shaking for 30 minutes, centrifuging at 2500 rpm for 10 minutes, and decanting into the 25-mL volumetric flask). The extracts/rinsates were brought to volume (25 mL) and aliquots analyzed using LSC and HPLC.

Dark control soil samples were treated with *ca.* 5 mL of acetonitrile:0.1N hydrochloric acid (90:10, v:v), shaken for one hour, centrifuged (2500 rpm for 15 minutes), and decanted into volumetric flasks (25 mL; p.29). The rinsing process was repeated twice suing using 5 mL of the acetonitrile:0.1 N hydrochloric acid solution (shaking for 30 minutes, centrifuging at 2500 rpm for 10 minutes, and decanting into the 25-mL volumetric flask). The extracts/rinsates were brought to volume (25 mL). Aliquots were analyzed using LSC and HPLC. An aliquot (10 mL) for each radiolabel of the day 37 Amagon soil were concentrated under nitrogen at 30°C, filtered (0.45 µm syringe filters) into volumetric flasks (20 mL), 75 µL of 0.1N HCl added and the samples brought to volume with water

before being analyzed by LC/MS (p.31). The extraction sample extraction process is illustrated in Figure 4 of the study report (p.74).

Nonextractable residue determination: Extracted soils were air-dried at room temperature, duplicate aliquots (0.3 g) were ground, and analyzed by LSC following combustion (p.30).

Non-extractable [^{14}C]residues were characterized in selected samples by partitioning into fulvic acid, humic acid, and humin. Subsamples (0.5 g) of the extracted, air-dried soils were transferred to centrifuge tubes, extracted by shaking with 0.5M sodium hydroxide (2.5 mL) at room temperature for 24 hours, centrifuged (3000 rpm for 15 minutes), and decanted into a volumetric flasks (10 mL; p.30). The sample was extracted again by briefly (not specified) mixing with 0.5M NaOH (2.5 mL), centrifuging as previously described and the extracts combined. The soil pellet was rinsed deionized water (2.5 mL), centrifuged, decanted, combined with original extracts, brought to volume (10 mL) with deionized water, and aliquots (3 x 0.5 mL) analyzed by LSC (p.31). The supernatant was then acidified to pH 2 (2M HCl), incubated at room temperature for 2 hours, centrifuged, decanted, brought to volume (10 mL) with deionized water, and aliquots (3 x 1 mL) analyzed by LSC (p.31).

Volatile residue determination: Based on low recovery of volatiles from Arkansas soil samples, volatile traps were not used with Greggio soil samples. For the Arkansas soil samples, the ascarite was transferred to a glass vial, and dissolved and extracted with water (p.29). The ascarite-water solutions were transferred to volumetric flasks (20 mL), and brought to volume with water. Aliquots (3 x 1mL) were analyzed for total radioactivity using LSC.

The $^{14}CO_2$ generated from the combustion of the extracted, air-dried soils of the irradiated and dark soil samples was captured in Harvey cocktail (15 mL) and assayed using LSC (pp.30-31).

Total ^{14}C measurement: Total [^{14}C]residues were determined by summing the concentration of residues measured in the soil extracts, combusted soil, and volatile trapping solutions (Tables 5-8, pp.54-57).

Derivatization method: A derivatization method was not employed.

Identification and quantification of penoxsulam: The soil extracts were analyzed using HPLC under the following conditions (pp.32-33): YMC ODS-AQ column (5 µm); a mobile gradient phase combining (A) water and 1% acetic acid, and (B) acetonitrile and 1% acetic acid [percent A:B (v:v) at 0 minutes, 95:5; 30-35 minutes, 0:100; 35.1 minutes, 95:5; and 45 minutes, 95:5]; flow rate 1.0 mL/minute; and UV (254 nm). Penoxsulam was identified by comparison to a unlabeled reference standard, XDE-638 (Figure 1, p.70). Representative HPLC chromatograms were provided in Figures 5-18 of the study report (pp.75-88). All HPLC recoveries were between 90 and 110% of the applied (p.40).

The identification of the parent by HPLC was confirmed by TLC (p.32). The non-labeled XDE-638 reference standard was developed on silica gel 60 F_{254} plates (20 x 20 cm; 250 µm, thickness) eluted

with a solution of toluene:ethyl acetate:acetic acid (45:55:3). The TLC results were viewed with a UV lamp (254 nm), and radio imaging (no data or graphical representations were presented).

The identity of the parent was further confirmed by LC/ESI-MS (alternating positive and negative modes) under the following conditions (Appendix C, p.106): YMC ODS-AQ S5 column (4.6 x 250 mm; 120 A; serial number 042540467); a mobile gradient phase combining (A) water and 1% acetic acid, and (B) acetonitrile and 1% acetic acid [percent A:B (v:v) at 0 minutes, 98:2; 40 minutes, 30:70; and 45-50 minutes, 98:2], and flow rate 1.0 mL/minute. LC/MS ion chromatograms of the reference standard and parent were provided in Figures 1-6 of Appendix C (pp.110-115).

Identification and quantification of transformation products: Transformation products were isolated and quantified using HPLC as described for the parent (pp.32-33). Samples were cochromatographed with the following unlabeled reference standards: 2-amino TP (5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-amine; Rt 12 minutes), BSA (2-(2,2-difluoroethoxy)-6-(trifluoromethyl) benzenesulfonic acid; Rt 15 minutes), and BSTCA (3-[[[2-(2,2-difluoroethoxy)-6-(trifluoromethyl)phenyl]sulfonyl]amino]-1H-1,2,4-triazole-5-carboxylic acid; Rt 16 minutes; Figure 1, pp.70-71). Representative HPLC chromatograms were provided in Figures 5-18 of the study report (pp.75-88).

The identification of the transformation products was confirmed by TLC and LC/ESI-MS as described for the parent (p.32; Appendix C, pp.106). HPLC retention times for LC/ESI-MS analysis for the reference standards are as follows:

Transformation product	Retention time (minutes)
XDE-638	30.84
2-amino TP	12.66
BSA	17.79
BSTCA	19.86

LC/MS ion chromatograms of the reference standards and transformation products were provided in Figures 1-6 of Appendix C (pp.110-115).

Detection limits (LOD, LOQ) for parent compound: The limits of detection (LOD) and Limits of quantitation (LOQ) for the HPLC samples were 0.44% and 1.98% of the applied, respectively (p.40; Table 18, p.67).

Detection limits (LOD, LOQ) for transformation products: Limits of detection (LOD) and Limits of quantitation (LOQ) were the same as those for the parent (p.40; Table 18, p.67).

II. RESULTS AND DISCUSSION:

A. TEST CONDITIONS: For the Arkansas silt loam, irradiated (12 hour light/12 hour dark) and dark control samples were maintained at a temperature range of 22.1 to 24.3°C, and 24.6 to 26.1°C, respectively (p.28). Soil moisture was maintained at approximately 75% of moisture at 1/3 bar with HPLC grade water for the irradiated samples only. No supporting data were provided. For the Greggio silty clay loam, irradiated (continuous irradiation) and dark control samples were maintained at a temperature range of 17.3 to 19.2°C, and 19.0 to 20.5°C, respectively. Soil moisture was not maintained or monitored during the experiments. Soil was air-dried before the experiments (p.28).

B. MASS BALANCE: In the Arkansas silt loam soil, the overall recovery of radiolabeled material in the irradiated samples (12 hour light/12 hour dark at *ca.* 25°C) averaged 93.3 ± 5.1% (range 83.4-100.3%), and 96.5 ± 2.4% (range 92.9-100.9%) of the applied for the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively. There was a slight pattern of decline for both labels (Tables 5-6, pp.54-55). In the corresponding dark controls, the overall radiolabeled recovery averaged 98.3 ± 2.3% (range 95.2-101.0%) and 99.7 ± 1.6% (range 97.6-102.4%) of the applied for the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively with no clear pattern of decline.

In the Greggio silty loam soil, the overall recovery of radiolabeled material in the irradiated samples (continuous irradiation at *ca.* 20°C) averaged 98.1 ± 3.1% (range 93.6-102.6%) and 99.1 ± 2.3% (range 94.8-101.0%) of the applied for the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively; there was a slight pattern of decline for the [^{14}C-Ph]-labeled penoxsulam (Tables 7-8, pp.56-57). In the corresponding dark controls, the overall radiolabeled recovery averaged 102.8 ± 0.6% (range 102.0-103.6%) and 101.3 ± 0.9% (range 99.9-102.7%) for the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively, with no clear pattern of decline.

Table 6: Phototransformation of [^{14}C-Ph]penoxsulam, expressed as percentage of applied radioactivity, on Arkansas silt loam soil (12 hour light/12 hour dark cycle).

Compound		Sampling times (Days)							
		0	1	3	7	14	21	30	37
XDE-638 (Penoxsulam)	Irradiated	98.4	86.0	84.2	72.2	66.0	46.7	33.3	41.8
	Dark	98.4	87.4	88.2	86.1	86.5	84.0	78.3	79.2
BSA	Irradiated	0.0	1.7	1.8	3.4	4.5	6.9	8.1	7.5
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0
BSTCA	Irradiated	0.0	1.6	3.7	7.2	7.3	10.5	10.2	10.1
	Dark	0.0	0.0	0.0	1.8	2.5	3.1	0.0	3.7
Unidentified peak (17 min)	Irradiated	0.0	0.0	0.0	0.0	3.2	5.0	3.9	6.7
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified peak (20 min)	Irradiated	0.0	1.9	3.7	3.6	3.9	4.5	3.8	4.0
	Dark	0.0	0.0	2.9	4.2	4.4	3.1	4.4	4.0
Total extractable residues	Irradiated	99.2	91.3	93.4	86.3	85.0	74.7	63.8	72.3
	Dark	99.2	88.9	92.0	92.3	93.5	90.1	87.1	86.9
Nonextractable residues	Irradiated	1.1	2.6	3.7	6.3	9.8	17.0	19.2	17.9
	Dark	1.1	6.3	5.7	2.9	5.6	9.2	13.9	NR
CO_2	Irradiated	N/A	0.3	0.7	1.5	2.1	2.4	2.8	3.2
	Dark	N/A							
Total % recovery[1]	Irradiated	100.3	94.2	97.5	93.4	95.3	91.9	83.4	90.6
	Dark	100.3	95.3	97.7	95.2	99.1	99.4	101.0	NR

Data were obtained from Table 5, p.54; Table 9, p.58 of the study report.

1 Differences in the total % recovery reported in two separate tables by the study author were accounted for as "...rounding errors, clean-up and chromatographic losses...". The data used was from Table 5, p.54, as suggested by the study author. Differences reported were generally ≤2% of the applied .

NR - Not reported; Sample lost during sample analysis.

N/A - Not applicable.

Table 7: Phototransformation of [^{14}C-TP]penoxsulam, expressed as percentage of applied radioactivity, on Arkansas silt loam soil (12 hour light/12 hour dark cycle).

Compound		Sampling times (Days)							
		0	1	3	7	14	21	30	37
XDE-638 (Pensoxsulam)	Irradiated	98.5	85.9	83.3	57.4	64.7	53.3	45.1	34.2
	Dark	98.5	91.0	92.6	91.0	85.7	82.8	NR	79.8
2-Amino TP	Irradiated	0.0	0.0	3.0	8.3	3.5	6.2	6.9	10.4
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	NR	0.0
BSTCA	Irradiated	0.0	0.0	3.5	7.4	4.1	8.1	11.1	7.8
	Dark	0.0	0.0	0.0	1.7	2.3	2.7	NR	2.5
Unidentified peak (7 min)	Irradiated	0.0	0.0	0.0	2.6	3.0	0.0	0.0	1.4
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified peak (17 min)	Irradiated	0.0	0.0	0.0	0.0	2.1	8.0	5.4	6.3
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	NR	0.0
Unidentified peak (20 min)	Irradiated	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dark	0.0	0.0	0.0	3.3	4.0	3.0	NR	2.2
Total extractable residues	Irradiated	98.9	89.1	92.1	80.1	81.2	77.5	72.7	64.5
	Dark	98.9	91.8	95.7	97.4	92.6	89.2	NR	85.2
Nonextractable residues	Irradiated	2.0	3.6	4.9	14.5	13.9	20.9	23.6	30.9
	Dark	2.0	5.8	2.4	5.1	6.9	10.6	NR	14.5
CO_2	Irradiated	N/A	0.1	0.3	1.0	1.2	1.3	1.4	1.5
	Dark	N/A							
Total % recovery[1]	Irradiated	100.9	92.9	97.2	95.2	95.3	98.5	96.4	95.4
	Dark	100.9	97.6	98.1	102.4	99.5	99.7	NR	99.6

Data were obtained from Table 6, p.55; Table 10, p.59 of the study report.

1 Differences in the total % recovery reported in two separate tables by the study author were accounted for as "...rounding errors, clean-up and chromatographic losses...". The data used was from Table 6, p.55, as suggested by the study author. Differences reported were generally ≤2% of the applied.

NR - Not reported; Sample lost during sample analysis.

N/A - Not applicable.

Table 8: Phototransformation of [^{14}C-Ph]penoxsulam, expressed as percentage of applied radioactivity, on Greggio silty clay loam soil (continuous irradiation).

Compound		Sampling times (Days)						
		0	1	3	7	10	15	20
XDE-638 (Penoxsulam)	Irradiated	94.8	84.4	76.7	70.1	72.4	65.5	67.0
	Dark	94.8	92.6	89.4	89.0	86.0	82.3	86.4
Unidentified peak (7 min)	Irradiated	0.0	0.0	0.0	0.0	0.0	2.2	1.9
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified peak (16 min)[2]	Irradiated	0.0	4.4	6.6	7.4	6.4	6.3	8.8
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified peak (19 min)	Irradiated	0.0	4.6	5.1	8.5	5.0	6.8	8.7
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified peak (26 min)	Irradiated	0.0	0.0	0.0	2.5	0.0	2.9	2.2
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total extractable residues	Irradiated	96.4	94.2	90.1	89.8	86.9	83.6	88.5
	Dark	96.4	95.6	100.4	100.4	93.4	96.5	99.9
Nonextractable residues	Irradiated	6.3	6.5	9.6	8.3	10.3	10.0	6.8
	Dark	6.3	8.0	2.9	1.9	10.0	5.6	2.8
Total % recovery[1]	Irradiated	102.6	100.7	99.6	98.1	97.2	93.6	95.2
	Dark	102.6	103.6	103.3	102.3	103.3	102.0	102.7

* Data were obtained from Table 7, p.56; Table 11, p.60 of the study report.

1 Differences in the total % recovery reported in two separate tables by the study author were accounted for as "...rounding errors, clean-up and chromatographic losses...". The data used was from Table 7, p.56, as suggested by the study author. Differences reported were generally ≤2% of the applied.

2 The unidentified peak at 16 minutes was not conclusively identified, but the study authors proposed that the retention time indicated that the peak was a mixture of BSA and BSTCA.

Table 9: Phototransformation of [^{14}C-TP]penoxsulam, expressed as percentage of applied radioactivity, on Greggio silty clay loam soil (continuous irradiation).

Compound		Sampling times (Days)						
		0	1	3	7	10	15	20
XDE-638 (Penoxsulam)	Irradiated	93.5	84.8	74.4	73.1	71.6	57.2	66.3
	Dark	93.5	98.5	93.3	92.8	92.7	93.8	97.4
Unidentified peak (7 min)	Irradiated	0.0	0.0	1.8	2.2	2.1	3.9	3.2
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified peak (12 min)	Irradiated	0.0	0.0	2.0	2.0	0.0	3.3	2.7
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified peak (16 min)[2]	Irradiated	0.0	2.5	3.7	4.3	4.1	5.6	7.9
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified peak (19 min)	Irradiated	0.0	3.1	5.0	4.3	5.4	7.3	4.8
	Dark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total extractable residues	Irradiated	94.5	92.5	87.0	86.1	85.2	77.3	85.0
	Dark	94.5	99.5	93.3	92.8	93.2	93.8	99.1
Nonextractable residues	Irradiated	6.3	8.4	12.8	12.9	15.8	17.5	12.7
	Dark	6.3	2.3	7.7	9.8	8.7	6.1	2.1
Total % recovery[1]	Irradiated	100.8	100.8	99.8	99.0	101.0	94.8	97.6
	Dark	100.8	101.7	101.0	102.7	101.9	99.9	101.2

Data were obtained from Table 8, p.57; Table 12, p.61 of the study report.

1 Differences in the total % recovery reported in two separate tables by the study author were accounted for as "...rounding errors, clean-up and chromatographic losses...". The data used was from Table 8, p.57, as suggested by the study author. Differences reported were generally ≤2% of the applied.

2 The unidentified peak at 16 minutes was not conclusively identified, but the study authors proposed that the retention time indicated that the peak was a mixture of BSA and BSTCA.

C. TRANSFORMATION OF PARENT COMPOUND:

Arkansas silt loam soil (12 hour light/dark cycles at *ca.* 25°C): In the [^{14}C-Ph]-labeled irradiated samples, penoxsulam decreased from 98.4% of the applied at day 0, to 66.0% of the applied at 14 days, 33.3% at 30 days, and was 41.8% of the applied at 37 days posttreatment (study termination). In the dark controls, [^{14}C-Ph]-labeled penoxsulam decreased from 98.4% of the applied at day 0, to 79.2% at 37 days (Table 9, p.58). In the [^{14}C-TP]-labeled irradiated samples, penoxsulam decreased from 98.5% of the applied at day 0, to 53.3% at 21 days, and was 34.2% at 37 days posttreatment. In the dark controls, [^{14}C-TP]-labeled penoxsulam decreased from 98.5% of the applied at day 0, to 79.8% of the applied at 37 days posttreatment (Table 10, p.59).

Greggio silty clay loam soil (continuous irradiation at *ca.* 20°C): In the [^{14}C-Ph]-labeled irradiated samples, penoxsulam decreased from 94.8% of the applied at day 0, to 67.0% at 20 days posttreatment (study termination). In the dark controls, [^{14}C-Ph]-labeled penoxsulam decreased from 94.8% of the applied at day 0, to 86.4% at 20 days (Table 11, p.60). In the [^{14}C-TP]-labeled irradiated samples, penoxsulam decreased from 93.5% of the applied at day 0, to 57.2% at 15 days, and was 66.3% at 20 days. In the dark controls, [^{14}C-TP]-labeled penoxsulam, was 93.5% of the applied at day 0 to 97.4% at 20 days posttreatment (Table 12, p.61).

Half-lives: Based on first order linear regression analysis (Excel 2000), the half-lives of penoxsulam in the Arkansas silt loam soil and Greggio silty clay loam soil were calculated for the [triazolopyrimidine-3- ^{14}C]- and [phenyl-U- ^{14}C]- labeled penoxsulam experiments.

In the Arkansasa silt loam soil, penoxsulam dissipated from the irradiated samples with calculated half-lives of 26.26, 28.52, and 27.29 days for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined labeled penoxsulam, respectively, based on a 12-hour light/12-hour dark cycle. In the dark controls, penoxsulam dissipated with calculated half-lives of 161.20, 138.63, and 147.48 days, for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined-labeled penoxsulam, respectively. These half-lives for the dark controls are of limited value because they extend beyond the study duration and are based on the assumption that degradation continues to follow a linear pattern.

In the Greggio silty clay loam soil, penoxsulam dissipated from the irradiated samples with calculated half-lives of 45.60, 38.72, and 41.76 days for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined-labeled penoxsulam, respectively, *based on continuous irradiation.* In the dark controls, penoxsulam dissipated with a calculated half-life of 130.78 days for the [^{14}C-Ph]-labeled penoxsulam, and was stable for the [^{14}C-TP]- and combined-labeled penoxsulam. These half-lives are of limited value because they extend beyond the study duration and are based on the assumption that degradation continues to follow a linear pattern.

The study authors calculated the decay rate constant for penoxsulam in the Arkansas and Greggio soils using Microsoft Excel. From the rate constant, the study authors calculated half-lives and DT90s for penoxsulam in both soils (combined labels).

Half-lives*

Test system		First order linear			DT50 (days)*	DT90 (days)*
		Half-life (days)	Regression equation	r^2		
Arkansas silt loam soil: 12 hour light/12 hour dark, 0 to 37 day data.						
Irradiated	[^{14}C-Ph]	26.26	y = -0.0264x + 4.5015	0.8979	ND	ND
	[^{14}C-TP]	28.52	y = -0.0243x + 4.4685	0.9043	ND	ND
	Combined	27.29	y = -0.0254x + 4.485	0.8993	27	91
Dark	[^{14}C-Ph]	161.20	y = -0.0043x + 4.5136	0.7326	ND	ND
	[^{14}C-TP]	138.63	y = -0.005x + 4.5449	0.8583	ND	ND
	Combined	147.48	y = -0.0047x + 4.5293	0.7739	147	488
Greggio silty clay loam soil: *not corrected for continuous irradiation*, 0 to 20 day data.						
Irradiated	[^{14}C-Ph]	45.60	y = -0.0152x + 4.4427	0.7344	ND	ND
	[^{14}C-TP]	38.72	y = -0.0179x + 4.4423	0.7078	ND	ND
	Combined	41.76	y = -0.0166x + 4.4425	0.7093	84	278
Dark	[^{14}C-Ph]	130.78	y = -0.0053x + 4.526	0.6921	ND	ND
	[^{14}C-TP]	Stable			ND	ND
	Combined	Stable			Stable[1]	Stable[1]

* Half-lives were calculated by the reviewer using data obtained from Tables 9-12, pp.58-61 of the study report. DT50s and DT90s were obtained from Tables 19-20, pp.68-69. The reviewer assumed that the units of the DT50s and DT90s were days of natural light (12 hour light/dark cycle).

1 The study authors performed a t-test with the data and determined that no degradation of penoxsulam occurred in the dark controls of the Greggio soil samples (combined labels; p.43).

ND = Not determined.

The **phototransformation half-life** for penoxsulam was determined using the equation:

(Ln 2) ÷ [(Ln 2/dark control half-life) - (Ln 2/irradiated half-life)].

In the Arkansas silt loam soil, the phototransformation half-lives for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined labeled penoxsulam were 31.4, 35.9, and 33.5 days, respectively based on 12 hour light/dark cycle used in the study, or approximately 15.7, 18.0, and 16.8 days, respectively based on continuous irradiation. A quantitative comparison of the artificial light to natural sunlight based on average summer sunlight at 40°N latitude was provided. The study author reported that the xenon lamp was 57% of the intensity of natural sunlight in the Arkansas soil. Therefore, the predicted environmental phototransformation half-lives for the [^{14}C-Ph]-, [^{14}C-TP]-, and combined labeled penoxsulam were approximately 17.9, 20.5, and 19.1 days, respectively.

39

In the Greggio silty clay loam soil, the phototransformation half-life for the [^{14}C-Ph]-labeled penoxsulam was 70.0 days based on continuous irradiation used in the study, or approximately 140 days based on 12 hour light/dark cycle. A quantitative comparison of the artificial light to natural sunlight based on average summer sunlight at 40°N latitude was provided. The study author reported that the xenon lamp was 39% of the intensity of natural sunlight in the Greggio soil. Therefore, the predicted environmental phototransformation half-life for the [^{14}C-Ph]-labeled penoxsulam was approximately 54.6 days. No degradation occurred in the dark controls of the [^{14}C-TP]- and combined labeled penoxsulam, therefore, phototransformation half-lives were approximately 38.72 and 41.76 days, respectively. The environmental phototransformation half-lives were approximately 15.1 and 16.3 days, respectively.

TRANSFORMATION PRODUCTS:

Arkansas silt loam soil: In the [^{14}C-Ph]-labeled irradiated samples, two major transformation products were identified: BSA (2-(2,2-difluoroethoxy)-6-(trifluoromethyl) benzenesulfonic acid) and BSTCA (3-[[[2-(2,2-difluoroethoxy)-6-(trifluoromethyl)phenyl]sulfonyl]amino]-1H-1,2,4-triazole-5-carboxylic acid; Table 9, p.58). BSA increased to a maximum of 8.1% of the applied at 30 days, and was 7.5% of the applied at 37 days posttreatment (study termination). BSTCA increased to a maximum of 10.5% of the applied at 21 days, and was 10.1% of the applied at 37 days postreatment. There were no minor transformation products identified. Two radioactive peaks at 17- and 20-minutes were a maxima of 6.7% (37 days) and 4.5% (21 days) of the applied, respectively. In the dark controls, there were no major transformation products identified. BSA was detected only once at a maximum of 4.4% of the applied on day 30. BSTCA was a maximum of 3.7% of the applied at 37 days. An unidentified radioactive peak at 20 minutes was a maximum of 3.1-4.4% of the applied (14-30 days).

In the [^{14}C-TP]-labeled irradiated samples, two major transformation products were identified: 2-amino TP (5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-amine) and BSTCA (Table 10, p.59). 2-Amino TP increased to a maximum of 10.4% of the applied at 37 days posttreatment. BSTCA increased to a maximum of 11.1% of the applied at 30 days, and was 7.8% of the applied at 37 days posttreatment. There were no minor transformation products identified. Two radioactive peaks at 7- and 17-minutes were a maxima of 3.0% (14 days) and 8.0% (21 days) of the applied, respectively. In the dark controls, there were no major transformation products identified. BSTCA was a maximum of 2.3-2.7% of the applied (14-37 days). An unidentified radioactive peak at 20-minutes was a maximum of 4.0% (14 days) of the applied.

Greggio silty clay loam soil: In the [^{14}C-Ph]-labeled irradiated samples, no major or minor transformation products were identified (Table 11, p.60). Four unidentified radioactive peaks at 7-, 16-, 19-, and 26-minutes were a maxima of 2.2% (15 days), 8.8% (20 days), 8.7% (20 days) and 2.9% (15 days) of the applied, respectively. In the dark controls, no transformation products were identified.

In the [^{14}C-TP]-labeled irradiated samples, no major or minor transformation products were identified (Table 12, p.60-61). Four unidentified radioactive peaks at 7-, 12-, 16-, and 19-minute a maxima of 3.9% (15 days), 3.3% (15 days), 7.9% (20 days), and 7.3% (15 days) of the applied, respectively. The

study authors proposed that the 16-minute unidentified peak was a mixture of BSA and BSTCA based on its retention time. In the dark controls, no transformation products were identified.

Table 10. Chemical names and CAS numbers for the transformation products of penoxsulam.

Applicant's Code Name	CAS Number	Chemical Name	Chemical formula	Molecular weight (g/mol)	SMILES string
BSTCA	–	3-[[[2-(2,2-difluoroethoxy)-6-(trifluoromethyl)phenyl]sulfonyl]amino]-1H-1,2,4-triazole-5-carboxylic acid (CAS) 3-[6-(2,2-difluoroethoxy)-α,α,α-trifluoro-o-toluenesulfonamido]-s-triazole-c-5-carboxylic acid (IUPAC)	–	416	–
2-amino TP	–	5,8-dimethoxy[1,2,4]triazolo-[1,5-*c*]pyrimidin-2-amine (CAS) 2-amino-5,8-dimethoxy-s-triazolo[1,5-c]pyrimidine (IUPAC)	–	195	–
BSA	–	2-(2,2-difluoroethoxy)-6-(trifluoromethyl) benzenesulfonic acid (CAS) 6-(2,2-difluoroethoxy)-α,α,α-trifluoro-o-toluenesulfonic acid (IUPAC)	–	306	–

Data obtained from Figure 1, pp.70-71 of the study report.
– Not reported.

NONEXTRACTABLE AND EXTRACTABLE RESIDUES:

Arkansas silt loam soil: In the [^{14}C-Ph]-labeled irradiated samples, the total [^{14}C]extractable residue decreased from 99.2% of applied at day 0, to 72.3% at 37 days. Total [^{14}C]nonextractable residues increased from 1.1% of applied at day 0, to a maximum of 19.2% at 30 days (Table 5, p.54). In the [^{14}C-Ph]-labeled penoxsulam irradiated samples, fulvic acid, humic acid and humin totaled 8.5%, 1.6%, and 7.9% of the applied, respectively in the nonextractable residues fraction at 37 days (Table 17, p.66). In the dark controls, the extractable residue decreased from 99.2% of applied at day 0, to 86.9% at 37 days; total [^{14}C]nonextractable residue increased from 1.1% of applied at day 0 to a maximum of 13.9% at 30 days (the 37-day sample was lost).

In the [^{14}C-TP]-labeled irradiated samples, the total [^{14}C]extractable residue decreased from 98.9% of applied at day 0, to 64.5% of the applied at 37 days. Total [^{14}C]nonextractable residues increased from 2.0% of the applied at day 0 to a maximum of 30.9% at 37 days (Table 6, p.55). In the dark controls, the extractable residue decreased from 98.9% of applied at day 0, to 85.2% at 37 days. Total [^{14}C]nonextractable residue increased from 2.0% of applied at day 0, to a maximum of 14.5% at 37 days. In the [^{14}C-TP]-labeled penoxsulam dark controls, fulvic acid, humic acid and humin totaled

6.5%, 1.4%, and 6.6% of the applied, respectively in the nonextractable residues fraction at 37 days (Table 17, p.66).

Greggio silty clay loam soil at 20°C (continuous irradiation): In the [^{14}C-Ph]-labeled irradiated samples, the total [^{14}C]extractable residue decreased from 96.4% of applied at day 0, to 88.5% at 20 days. Total [^{14}C]nonextractable residue increased from 6.3% of applied at day 0, to a maximum of 10.3% at 10 days and was 6.8% at 20 days (Table 7, p.56). In the dark controls, the total [^{14}C]extractable residue were 96.4% of applied at day 0, and 99.9% at 20 days. The total [^{14}C]nonextractable residue increased from 6.3% of applied radioactivity at day 0, to a maximum of 10.0% at 10 days, and was 2.8% at 20 days. In the [^{14}C-Ph]-labeled penoxsulam dark controls, fulvic acid, humic acid and humin totaled 5.6%, 0.9%, and 3.5% of the applied, respectively in the nonextractable residues fraction at 10 days (Table 17, p.66).

In the [^{14}C-TP]-labeled irradiated samples the total [^{14}C]extractable residue decreased from 94.5% of applied at day 0, to 85.0% at 20 days. Total [^{14}C]nonextractable residue increased from 6.3% of applied at day 0 to a maximum of 17.5% of the applied at 15 days, and was 12.7% at 20 days (Table 8, p.57). In the [^{14}C-TP]-labeled penoxsulam irradiated samples, fulvic acid, humic acid and humin totaled 7.0%, 1.5%, and 4.2% of the applied, respectively in the nonextractable residues fraction at 20 days (Table 17, p.66). In the dark controls, the total [^{14}C]extractable residue was 94.5% of applied at day 0, and 99.1% at 20 days. Total [^{14}C]nonextractable residue increased from 6.3% of applied at day 0, to a maximum of 9.8% at 7 days, and was 2.1% at 20 days.

VOLATILIZATION: Volatiles were collected only for the irradiated Arkansas silt loam (p.25). [^{14}C-Ph]-labeled penoxsulam experiment, volatilized $^{14}CO_2$ totaled 3.2% and 1.5% of the applied at 37 days in the [^{14}C-Ph]- and [^{14}C-TP]-labeled penoxsulam, respectively (Table 5-6, pp.54-55).

PATHWAY: A partial degradation pathway was illustrated by the study author in Figure 19 of the study report (p.89). Penoxsulam degraded into BSA, BSTCA, and 2-amino TP in the Arkansas/Amagon soil and into minor degradates and the nonextractable residue in the Greggio soil (p.46). BSA and 2-amino TP were formed by the cleavage of the sulfonamide bridge, while BSTCA was formed by the opening of the pyrimidine ring (p.46).

D. SUPPLEMENTARY EXPERIMENT-RESULTS: The intensity of the xenon lamp was measured by a p-nitroacetophenone (PNAP)/pyridine (pyr) actinometer (p.27). The results of the experiment were reported in Appendix B (pp.96-103). The half-life of the PNAP/pyr actinometer at 40°N latitude was calculated as 4.1 days (Appendix B, p.97). The observed half-lives for the PNAP/pyr actinometer were 7.1 and 10.3 days in the Arkansas and Greggio soil samples, respectively (Appendix B, Tables 1-2, pp.100-101). Therefore, the study authors concluded that the light intensity of the xenon lamp was 57% and 39% of the predicted intensity at 40°N latitude in the Arkansas and Greggio soil samples, respectively (Appendix B, p.98).

III. STUDY DEFICIENCIES:

1. In the Arkansas silt loam soil, the mass balance at 30 days posttreatment of the [^{14}C-Ph]penoxsulam experiment was reported as 83.4% (Table 5, p.54). USEPA Subdivision N Guideline §161-3 specifies that the mass balance should be maintained >90% to <110%.

2. The temperature of the Arkansas silt loam soil during the study period was reported as 25 ± 1°C; however, the temperature ranges of 22.1 to 24.3°C for the irradiated samples and 24.6 to 26.1°C for the dark controls were provided (p.28; Table 3, p.52). No further details about the temperatures were reported. USEPA Subdivision N Guideline §161-3 specifies that the incubation temperatures of the dark controls should be the same as the temperatures of the irradiated samples, and that the samples should be incubated at 25 ± 1°C.

3. In the Greggio silty clay loam soil, the temperature was reported as 20 ± 1°C. However, the temperature ranges of 17.3 to 19.2°C for the irradiated samples and 19.0 to 20.5°C for the dark controls were provided (p.28; Table 3, p.52). No further details about the temperatures were reported. USEPA Subdivision N Guideline §161-3 specifies that the incubation temperatures of the dark controls should be the same as the temperatures of the irradiated samples, and that the samples should be incubated at 25 ± 1°C.

4. In the Greggio silty clay loam, the study was conducted for only 20 days (continuous irradiation). USEPA Subdivision N Guideline §161-3 specifies that the study be conducted until the half-life of test material is established or *ca.* 30 days, whichever comes first.

5. Soil moisture was not reportedly maintained in either the irradiated (air-dried) or dark controls of the Greggio silty clay soil experiments.

IV. REVIEWER'S COMMENTS

1. The study authors reported that the observed light intensity of the xenon arc lamp was 57% and 39% of the predicted intensity of summer sunlight at 40°N latitude for the Arkansas and Greggio soils, respectively (Appendix B, pp.97-98). The reviewer assumed this comparison was based on a 12 hour light/12 hour dark cycle. The intensity of the artificial light in comparison to natural sunlight seems low.

2. The decay rate constant was used to calculate the half-life and DT 90 for the irradiated and dark controls (combined labels) of the Greggio and Arkansas soils using Microsoft Excel (p.43). In the irradiated Arkansas soil, the half-life and DT90 were 27 days and 91 days, respectively. In the dark controls they were 147 days and 488 days, respectively (p.44). In irradiated Greggio soil, the half-life and DT90 were 84 days and 278 days. The study authors determined that no degradation occurred in the dark controls of the Greggio soil based on analysis with a t-test.

   The rate constant for photolysis were used to determine the phototransformation half-lives and DT90 and corrected for the amount of light received by the samples as determined by the

actinometer degradation, which was 0.57 and 0.39 for the Arkansas and Greggio soils, respectively; The photodegradation half-life and DT 90 for the Arkansas soil was 19 days and 64 days, respectively; and for the Greggio soil, were 33 and 108 days, respectively (p.45; Tables 19-20, pp.68-69). These calculated values were corrected for intensity of the lamp, and the reviewer assumed that the half-life and DT90 of the Greggio irradiation samples were normalized to natural light (12 hour light/dark cycles).

3. The water bath for the irradiated samples of the Arkansas silt loam soil malfunctioned during the study period on March 14 (p.40). Water had evaporated from the water bath. The study authors did not report any further details of a temperature fluctuation which most likely occurred due to this malfunctioning.

4. The glassware which was used in the study for the dark controls was only characterized as pyrex glass tubes (pp.24, 25). However, in the supplementary actinometry experiment, the glassware for the dark controls was described as amber-colored pyrex glass tubes with Teflon-lined screw caps (p.27). It was unclear if the amber pyrex glass tubes with Teflon-lined screw caps were also used in the definitive study. Therefore, the reviewer did not include that information in the experimental details of the Data Evaluation Report.

5. Some conflicting information was presented in the experimental protocol. It was not clear if deionized water (p.24) or HPLC grade water (p.28) was used to maintain the Arkansas/Amagon soil moisture.

6. Protocol deviations were provided by the study authors in Appendix E of the study report (pp.119-120).

7. The study author reported that the anticipated maximum application rate for penoxsulam is 50 g a.i./ha depending on timing, weed targets, and the crop (p.20). Assuming an 11.4 cm^2 surface area of soil in the test container, the target application rate was 5.7 µg/sample (equivalent to 50 g/ha).

8. The Arkansas (Amagon) silt loam soil (Arkansas, USA; M557) was also used in the aerobic soil metabolism study, MRID 45830724.

9. The study author reported that normal phase TLC was used to confirm the HPLC results (p.32). However, no TLC data was presented and therefore the HPLC results could not be compared.

10. Data reported for the material balance in Tables 9-12, pp.58-61, differed from the material balance reported in Tables 5-8, pp.54-57. The study author reported that these differences were due to "...rounding errors, clean-up and chromatographic losses, and some differences in metabolites seen in each label contribute to different totals...". Differences were noted as being generally ≤2% of the applied. The material balances from Tables 5-8, pp.54-57 were used by the reviewer, as suggested by the study author.

11. In the Arkansas silt loam, the study author reported that the soil temperature probe was set at 25°C, that the water bath was maintained at *ca.* 25°C in the lamp room set at 25 ± 1°C, and that the incubator containing the dark controls was set on 25 ± 1°C. However, the temperature in the lamp room was measured at 22.1°C to 24.3°C, and the incubator for the dark controls measured 24.6°C to 26.1°C (pp.26, 28). Likewise, in the Greggio silty clay loam, the study author reported that the soil temperature probe was set at 20°C, that the water bath was maintained at *ca.* 20°C in the lamp room set at 20 ± 1°C, and that the incubator containing the dark controls was set on 20 ± 1°C. However the measured temperatures were in the lamp room was measured at 17.3°C to 19.2°C, and the incubator for the dark controls measured 19.0°C to 20.5°C. Due to these temperature discrepancies, the reviewer reported the range of measured temperatures.

12. The study author reported that determination of storage stability was unnecessary, because LSC analysis was performed within one day, and HPLC analysis was performed within one week of sampling (p.46). Also, re-analysis of soil extracts after at least several weeks of frozen storage showed similar results as the first analyses. Recoveries of penoxsulam after 6 months of frozen storage were 97.6% and 97.3% in the [^{14}C-Ph]- and [^{14}C-TP]-labels, respectively (p.21). The storage stability of transformation products was not reported.

    In an anaerobic aquatic metabolism study (MRID 45830725) submitted concurrently with this study, the authors of that study reported that transformation products BSTCA-methyl and 5,8-diOH degraded after 2-3 days even in frozen storage. Therefore, all extracts in that study were analyzed by HPLC the same day or within one day of sampling (p.26 in MRID 45830825). BSTCA-methyl and 5,8-diOH were not detected in this study; however, they are possible intermediary transformation products between 5-OH-XDE-638 and BSTCA (Figure 25, p.99 in MRID 45830725).

    A soil storage stability study (MRID 45830718) indicated that penoxsulam did not significantly degrade after 327 days of frozen storage (average recovery 97.3%), nor was there significant degradation of the transformation products, 5-OH, sulfonamide, BSA and 2-amino-TP. However, BSTCA did degrade from an average of 88.7% of the applied at day 0 to 76.7% at 327 days (Tables 2-7, pp.26-31 in MRID 45830718).

V. REFERENCES:

1. U.S. Environmental Protection Agency. 1982. Pesticide Assessment Guidelines, Subdivision N, Chemistry: Environmental Fate, Section 161-3. Phototransformation studies. Office of Pesticide and Toxic Substances, Washington, DC. EPA 540/9-82-021.

2. 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.

3. 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.

Attachment 1

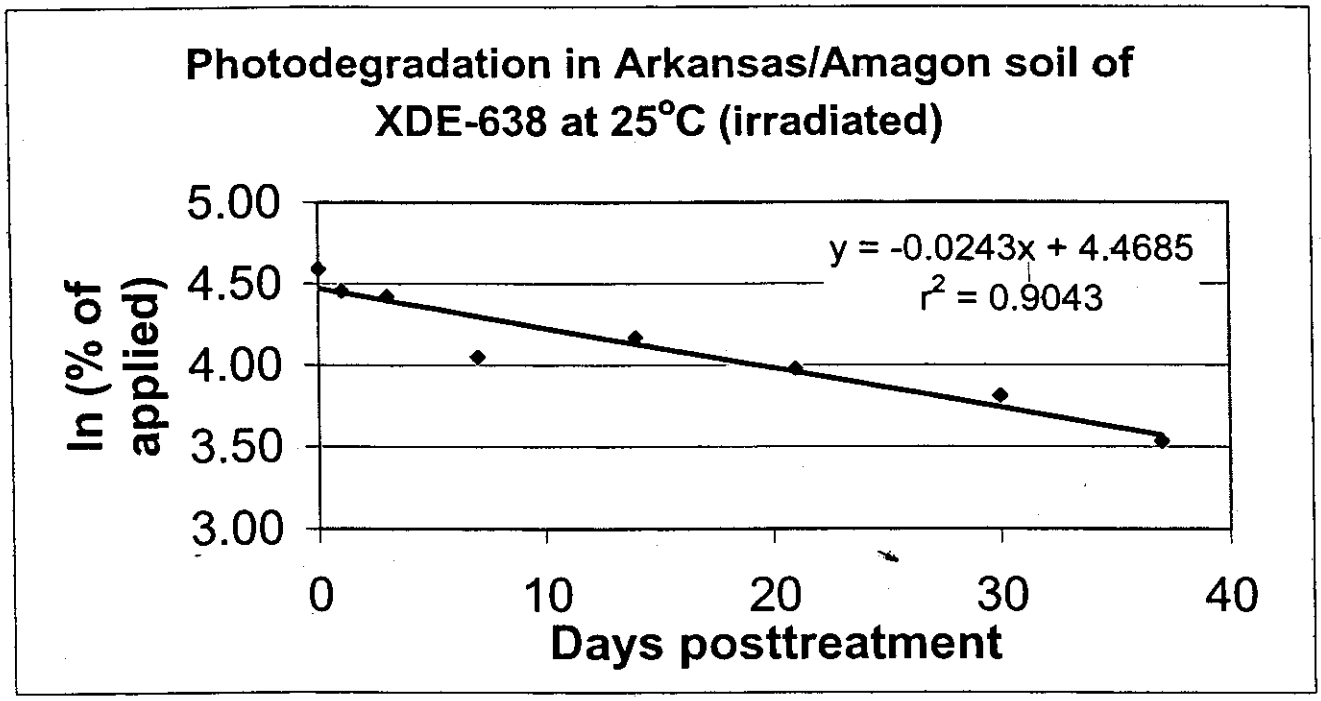
Excel Spreadsheets

Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: [^{14}C-TP]XDE-638
Soil: **Arkansas/Amagon silt loam**
Half-life: 28.52 days (12hr light/12hr dark cycle)

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	98.5	4.5901
1	85.9	4.4532
3	83.3	4.4224
7	57.4	4.0500
14	64.7	4.1698
21	53.3	3.9759
30	45.1	3.8089
37	34.2	3.5322

Data obtained from Table 10, p. 59 of MRID 45830723.

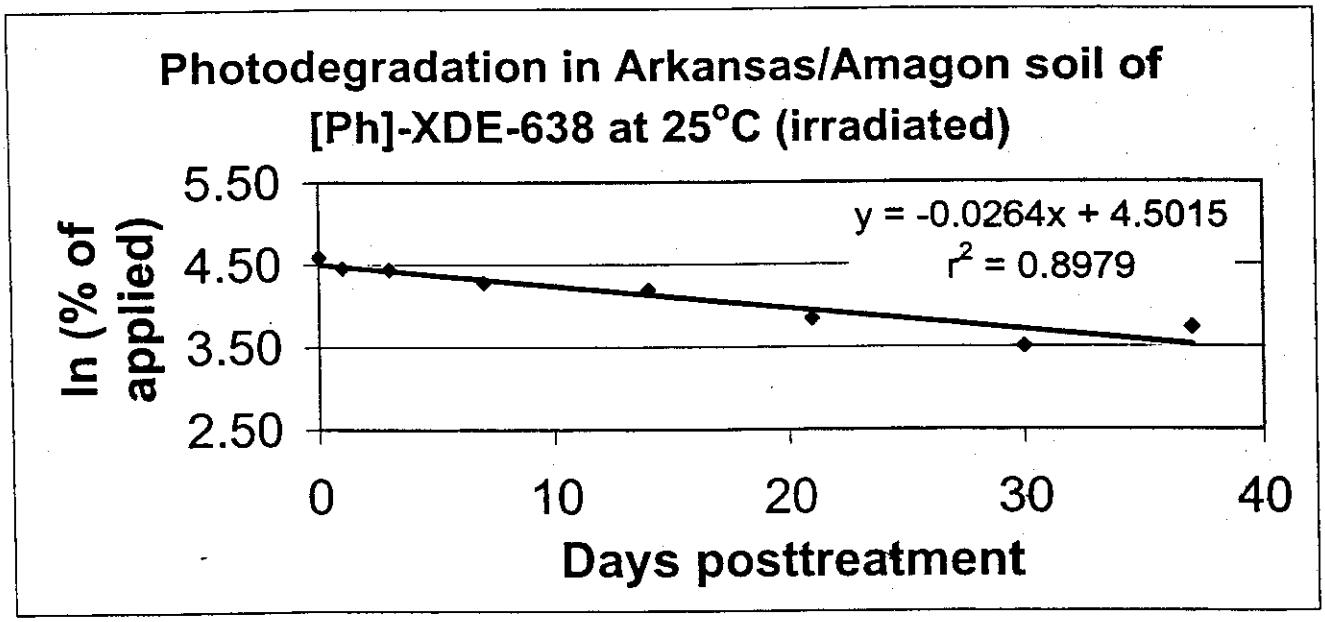


Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: [^{14}C-Ph]XDE-638
Soil: **Arkansas/Amagon silt loam**
Half-life: 26.26 days (12hr light/12hr dark cycle)

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	98.4	4.5890
1	86.0	4.4543
3	84.2	4.4332
7	72.2	4.2794
14	66.0	4.1897
21	46.7	3.8437
30	33.3	3.5056
37	41.8	3.7329

Data obtained from Table 9, p. 58 of MRID 45830723.

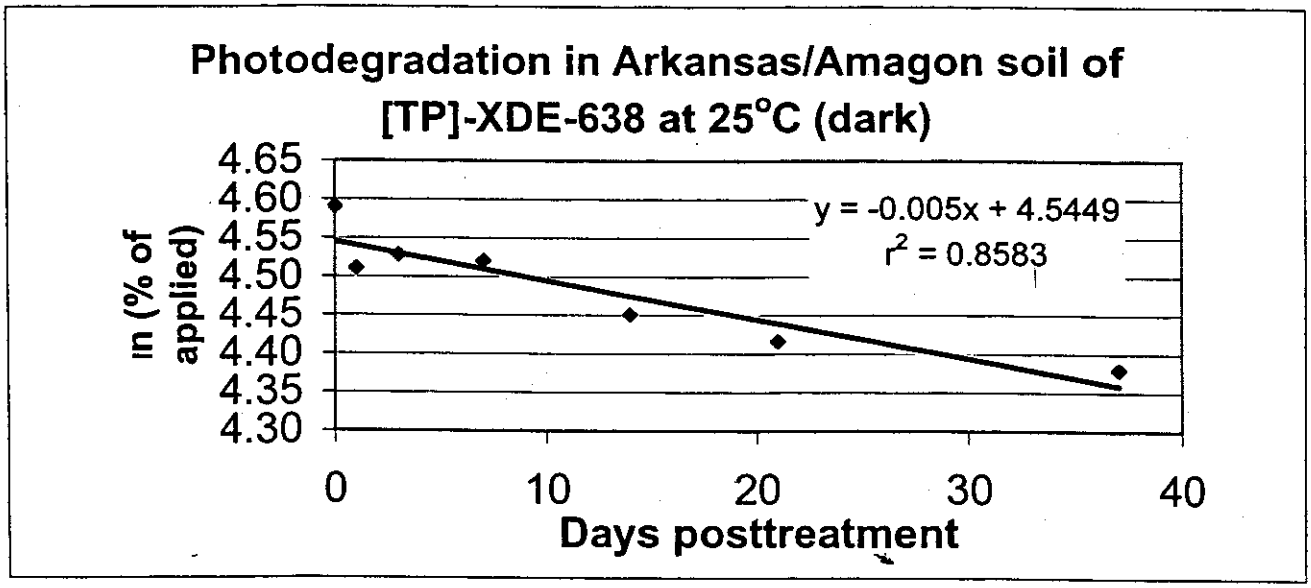


Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: [^{14}C-TP]XDE-638
Soil: **Arkansas/Amagon silt loam**
Half-life: 138.63 days (12hr light/12hr dark cycle)

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	98.5	4.5901
1	91.0	4.5109
3	92.6	4.5283
7	91.9	4.5207
14	85.7	4.4509
21	82.8	4.4164
30		
37	79.8	4.3795

Data obtained from Table 10, p. 59 of MRID 45830723.

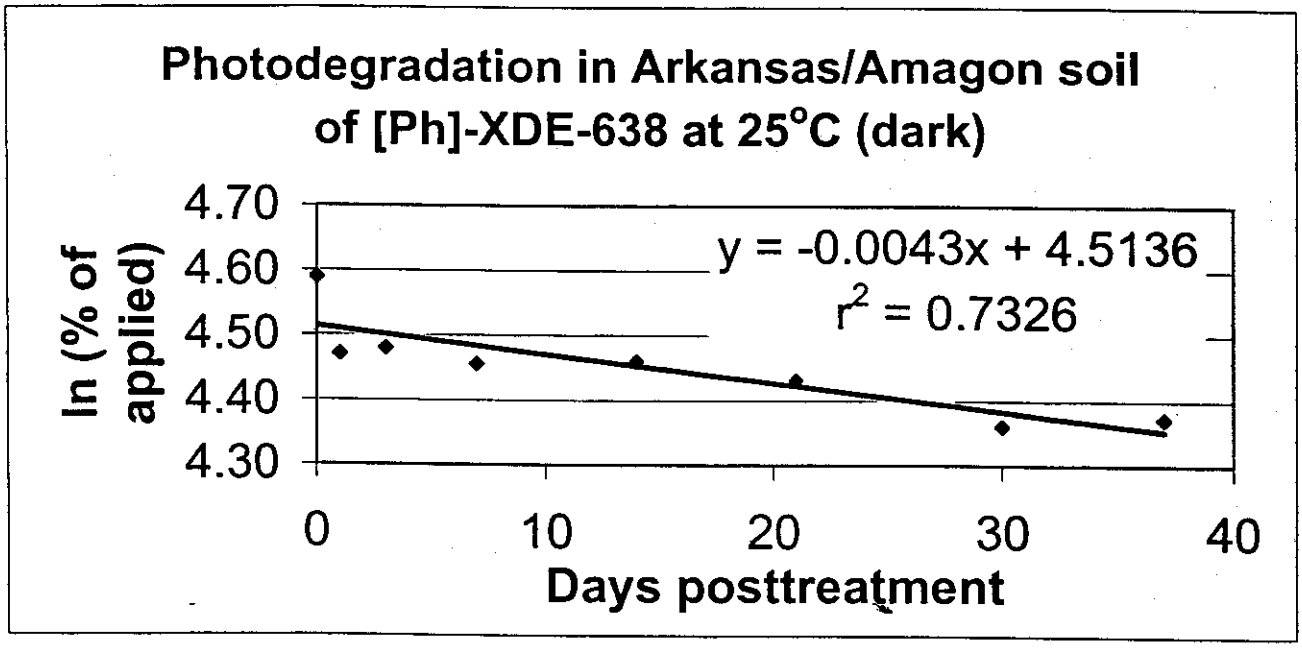


Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: [^{14}C-Ph]XDE-638
Soil: **Arkansas/Amagon silt loam**
Half-life: 161.20 days (12hr light/12hr dark cycle)

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	98.4	4.5890
1	87.4	4.4705
3	88.2	4.4796
7	86.1	4.4555
14	86.5	4.4601
21	84.0	4.4308
30	78.3	4.3605
37	79.2	4.3720

Data obtained from Table 9, p. 58 of MRID 45830723.

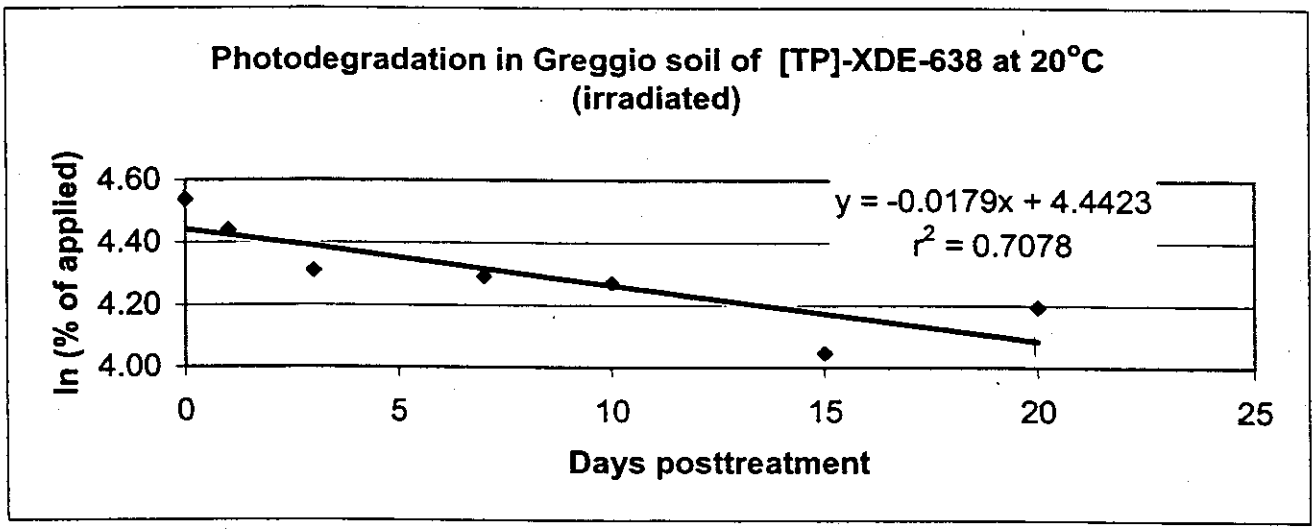


Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: [^{14}C-TP]XDE-638
Soil: **Greggio silty clay loam**
Half-life: 38.72 days (continuous irradiation)

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	93.5	4.5380
1	84.8	4.4403
3	74.4	4.3095
7	73.1	4.2918
10	71.6	4.2711
15	57.2	4.0466
20	66.3	4.1942

Data obtained from Table 12, p. 61 of MRID 45830723.

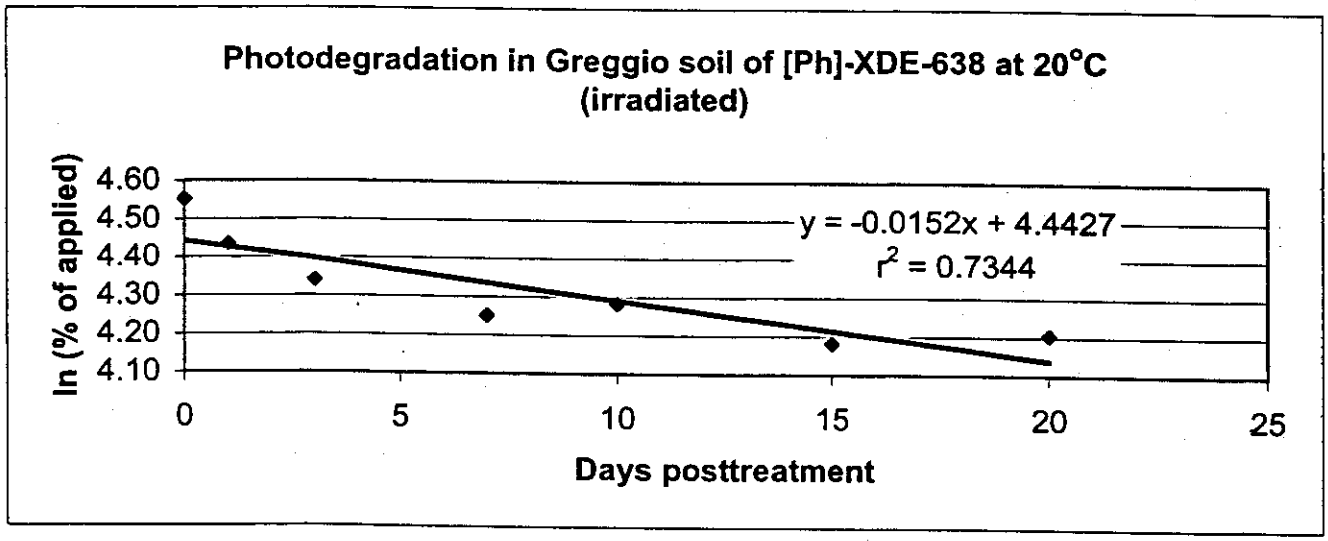


Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: **[^{14}C-Ph]XDE-638**
Soil: **Greggio silty clay loam**
Half-life: 45.60 days (continuous irradiation)

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	94.8	4.5518
1	84.4	4.4356
3	76.7	4.3399
7	70.1	4.2499
10	72.4	4.2822
15	65.5	4.1821
20	67.0	4.2047

Data obtained from Table 11, p. 60 of MRID 45830723.

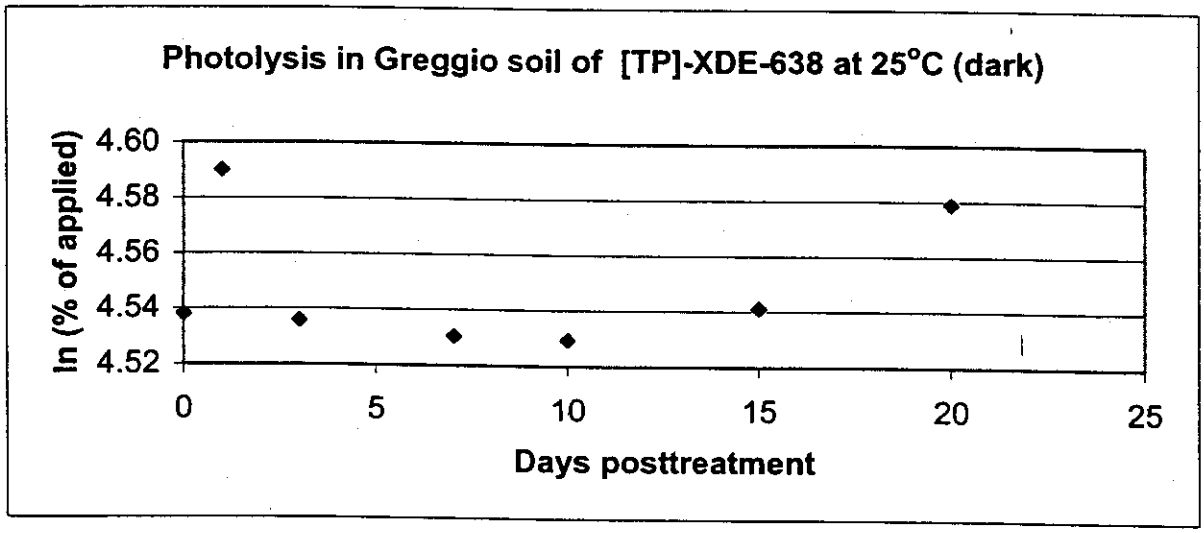


Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: [^{14}C-TP]XDE-638
Soil: **Greggio silty clay loam**
Half-life: Stable

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	93.5	4.5380
1	98.5	4.5901
3	93.3	4.5358
7	92.8	4.5304
10	92.7	4.5294
15	93.8	4.5412
20	97.4	4.5788

Data obtained from Table 12, p. 61 of MRID 45830723.

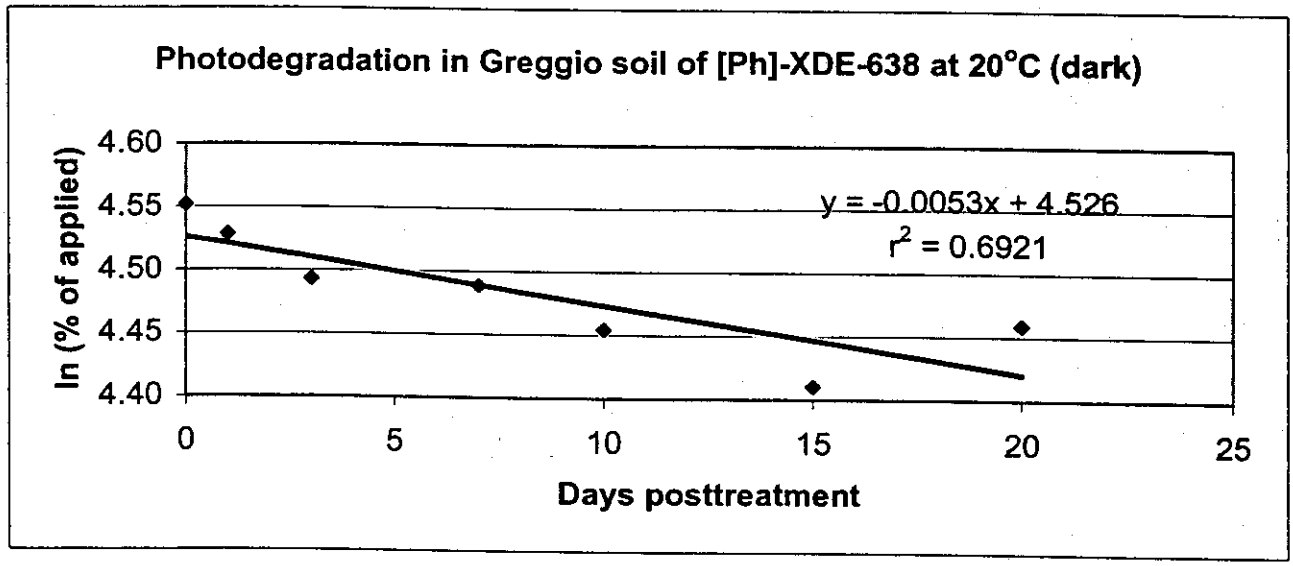


Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: [^{14}C-Ph]XDE-638
Soil: **Greggio silty clay loam**
Half-life: 130.78 days (continuous irradiation)

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	94.8	4.5518
1	92.6	4.5283
3	89.4	4.4931
7	89.0	4.4886
10	86.0	4.4543
15	82.3	4.4104
20	86.4	4.4590

Data obtained from Table 11, p. 60 of MRID 45830723.



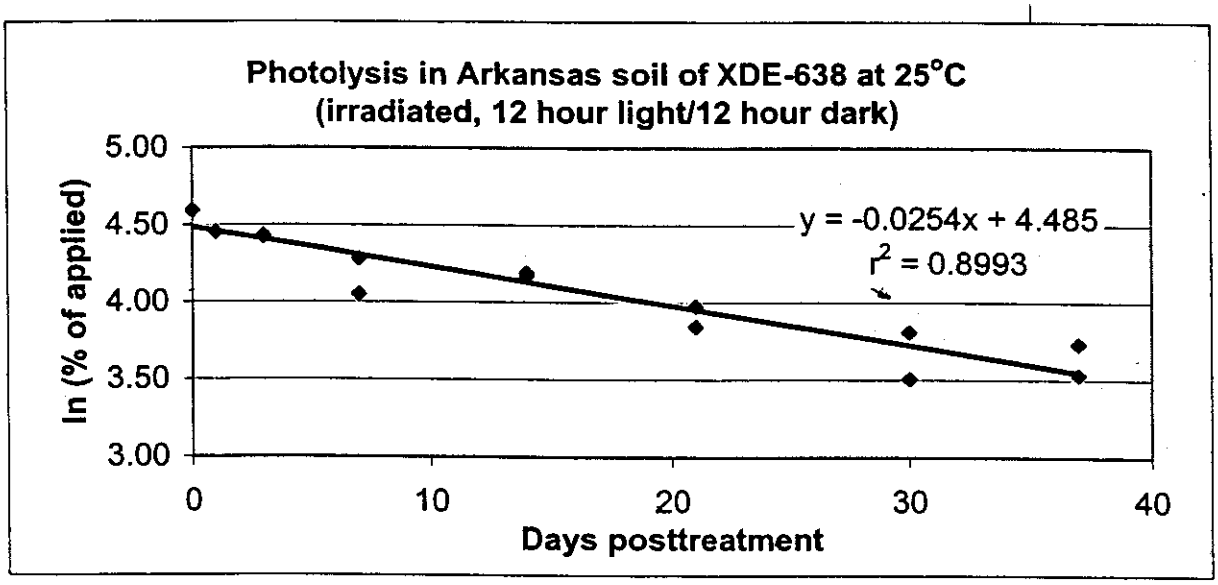
Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Temperature: 25°C
Soil: Arkansas 12 hours light/dark
Irradiated Combined Labels

Half-life:	27.29 days

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	98.4	4.5890
1	86.0	4.4543
3	84.2	4.4332
7	72.2	4.2794
14	66.0	4.1897
21	46.7	3.8437
30	33.3	3.5056
37	41.8	3.7329
0	98.5	4.5901
1	85.9	4.4532
3	83.3	4.4224
7	57.4	4.0500
14	64.7	4.1698
21	53.3	3.9759
30	45.1	3.8089
37	34.2	3.5322

Data obtained from Tables 9-10, pp. 58-59 of the study report.



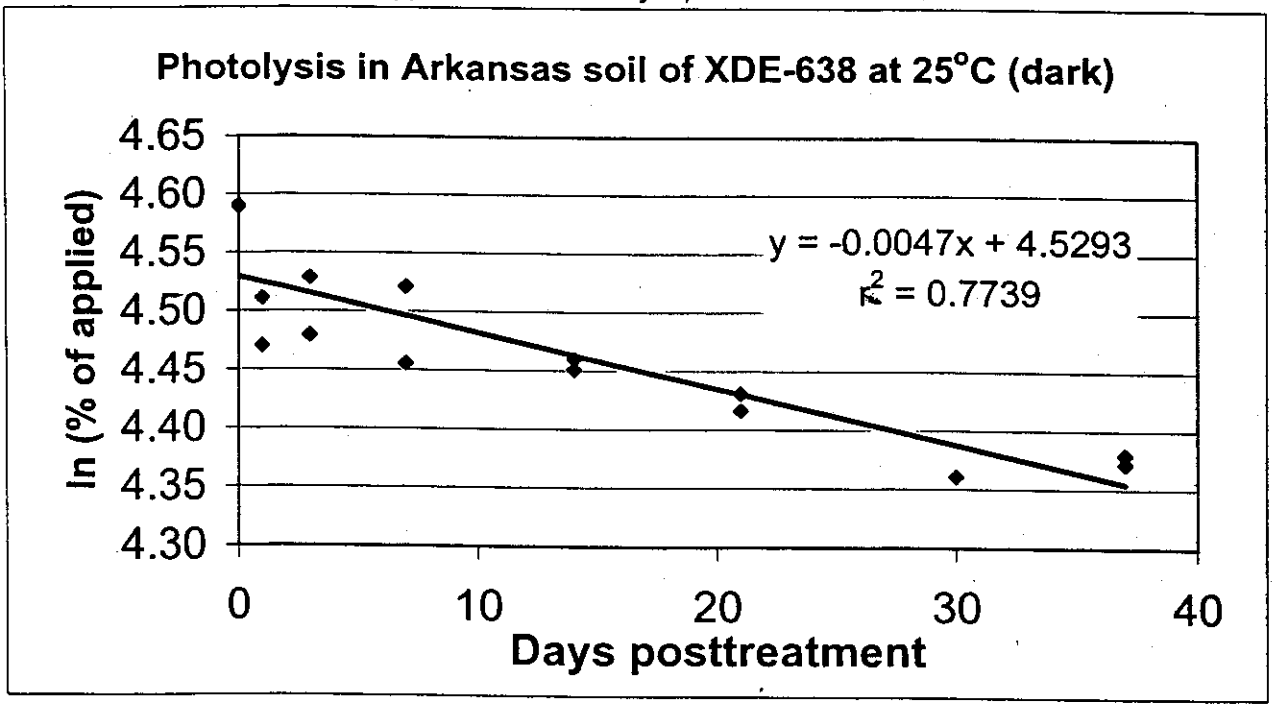
Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Temperature: 25°C
Soil: Arkansas 12 hours light/dark
Dark Combined labels

Half-life:	147.48 days

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	98.4	4.5890
1	87.4	4.4705
3	88.2	4.4796
7	86.1	4.4555
14	86.5	4.4601
21	84.0	4.4308
30	78.3	4.3605
37	79.2	4.3720
0	98.5	4.5901
1	91.0	4.5109
3	92.6	4.5283
7	91.9	4.5207
14	85.7	4.4509
21	82.8	4.4164
30		
37	79.8	4.3795

Data obtained from Tables 9-10, pp. 58-59 of the study report.



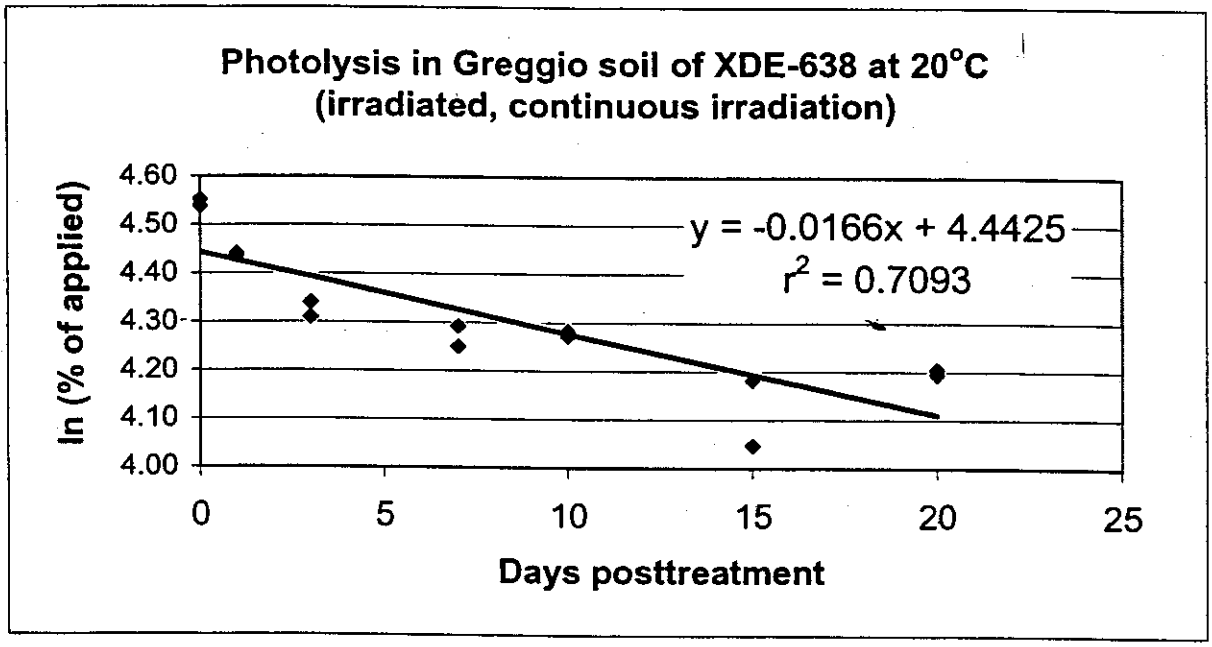
Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Temperature: 20°C
Soil: Greggio Continuous irradiation
Irradiated Combined labels

Half-life:	41.76 days

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	94.8	4.5518
1	84.4	4.4356
3	76.7	4.3399
7	70.1	4.2499
10	72.4	4.2822
15	65.5	4.1821
20	67.0	4.2047
0	93.5	4.5380
1	84.8	4.4403
3	74.4	4.3095
7	73.1	4.2918
10	71.6	4.2711
15	57.2	4.0466
20	66.3	4.1942

Data obtained from Tables 11-12, pp. 60-61 of the study report.



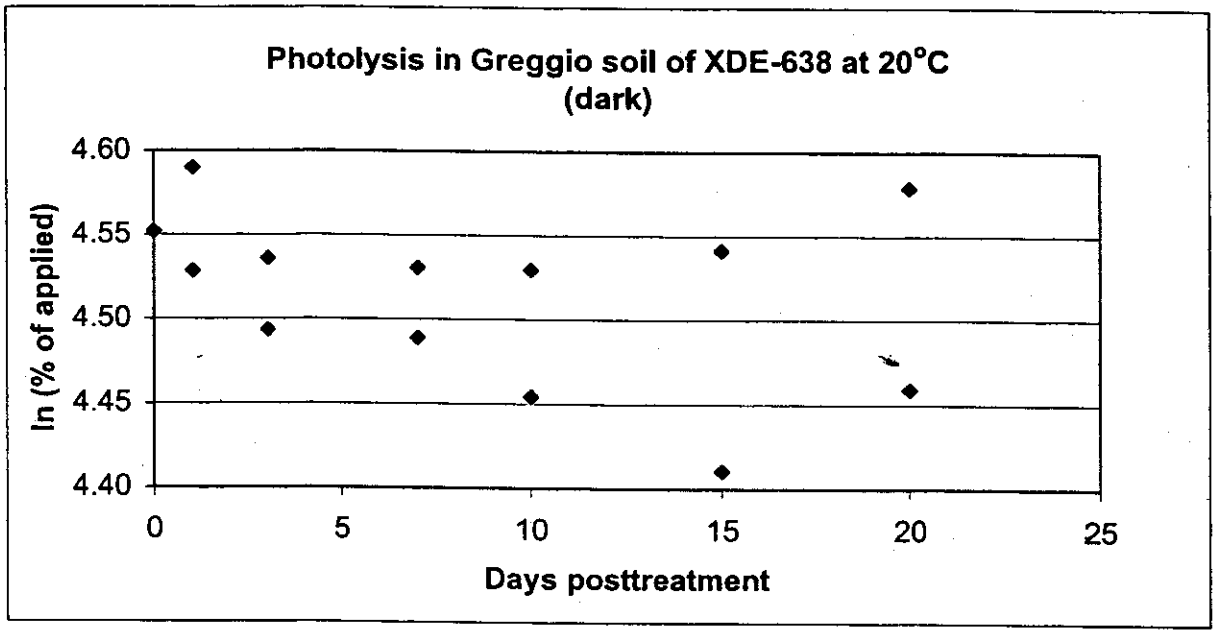
Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Temperature: 20°C
Soil: Greggio Continuous irradiation
Dark Combined Labels

Half-life:	Stable

Days	XDE-638 (% applied)	ln (% applied XDE-638)
0	94.8	4.5518
1	92.6	4.5283
3	89.4	4.4931
7	89.0	4.4886
10	86.0	4.4543
15	82.3	4.4104
20	86.4	4.4590
1	98.5	4.5901
3	93.3	4.5358
7	92.8	4.5304
10	92.7	4.5294
15	93.8	4.5412
20	97.4	4.5788

Data obtained from Tables 11-12, pp. 60-61 of the study report.



Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Label: [^{14}C-Ph]XDE-638
Soil: Arkansas/Amagon silt loam
Irradiated

Days	Total (% applied)
0	100.3
1	94.2
3	97.5
7	93.4
14	95.3
21	91.9
30	83.4
37	90.6
Mean	93.3
SD	5.1

Label: [^{14}C-Ph]XDE-638
Soil: Arkansas/Amagon silt loam
Dark

Days	Total (% applied)	
0	100.3	
1	95.3	
3	97.7	
7	95.2	
14	99.1	
21	99.4	
30	101.0	
37		Sample lost
Mean	98.3	
SD	2.3	

Label: [^{14}C-TP]XDE-638
Soil: Arkansas/Amagon silt loam
Irradiated

Days	Total (% applied)
0	100.9
1	92.9
3	97.2
7	95.2
14	95.3
21	98.5
30	96.4
37	95.4
Mean	96.5
SD	2.4
Overall	94.9
SD	4.2

Label: [^{14}C-TP]XDE-638
Soil: Arkansas/Amagon silt loam
Dark

Days	Total (% applied)	
0	100.9	
1	97.6	
3	98.1	
7	102.4	
14	99.5	
21	99.7	
30		Sample lost
37	99.6	
Mean	99.7	
SD	1.6	
Overall	99.0	
SD	2.1	

Data obtained from Table 5, p. 54, and Table 6, p. 55 of the study report.

Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3 Data obtained from Table 7, p. 56, and Table 8, p. 57 of MRID 45830723.

Label: [^{14}C-Ph]XDE-638
Soil: Greggio silty clay loam
Irradiated

Days	Total (% applied)
0	102.6
1	100.7
3	99.6
7	98.1
10	97.2
15	93.6
20	95.2
Mean	98.1
SD	3.1

Label: [^{14}C-Ph]XDE-638
Soil: Greggio silty clay loam
Dark

Days	Total (% applied)
0	102.6
1	103.6
3	103.3
7	102.3
10	103.3
15	102.0
20	102.7
Mean	102.8
SD	0.6

Label: [^{14}C-TP]XDE-638
Soil: Greggio silty clay loam
Irradiated

Days	Total (% applied)
0	100.8
1	100.8
3	99.8
7	99.0
10	101.0
15	94.8
20	97.6
Mean	99.1
SD	2.3
Overall	98.9
SD	2.6

Label: [^{14}C-TP]XDE-638
Soil: Greggio silty clay loam
Dark

Days	Total (% applied)
0	100.8
1	101.7
3	101.0
7	102.7
10	101.9
15	99.9
20	101.2
Mean	101.3
SD	0.9
Overall	102.0
SD	1.1

Chemical Name: Penoxsulam
PC Code: 119031
MRID: 45830723
Guideline No.: 161-3

Cummulative CO_2

Label: **[^{14}C-Ph]XDE-638**
Soil: **Arkansas/Amagon silt loam**
Irradiated

Days	CO_2	Cumm. CO_2
0	NA	
1	0.3	0.3
3	0.4	0.7
7	0.8	1.5
14	0.6	2.1
21	0.3	2.4
30	0.4	2.8
37	0.4	3.2

Label: **[^{14}C-TP]XDE-638**
Soil: **Arkansas/Amagon silt loam**
Irradiated

Days	CO_2	Cumm. CO_2
0	NA	
1	0.1	0.1
3	0.2	0.3
7	0.7	1
14	0.2	1.2
21	0.1	1.3
30	0.1	1.4
37	0.1	1.5

Attachment 2

Structures of Parent and Transformation Products

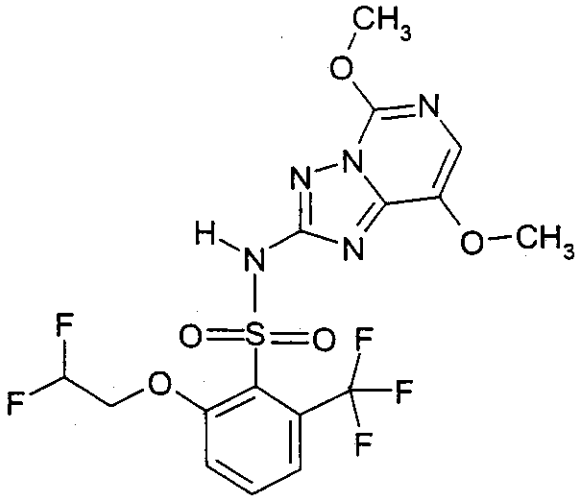
Penoxsulam

IUPAC name: 3-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-α,α,α-trifluorotoluene-2-sulfonamide

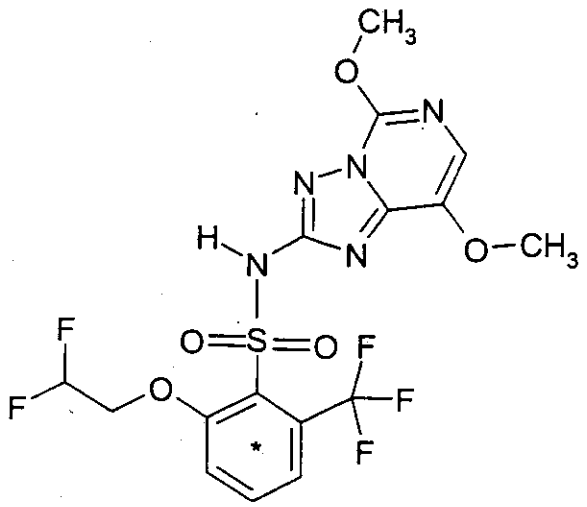
CAS name: 2-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide

CAS No: 219714-96-2

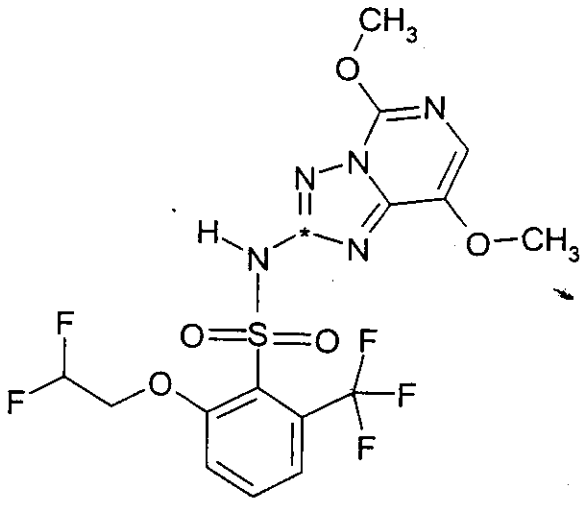
Unlabeled



[Phenyl-U-^{14}C] label



[Triazolopyrimidine-2-^{14}C] label



* Position of the radiolabel.

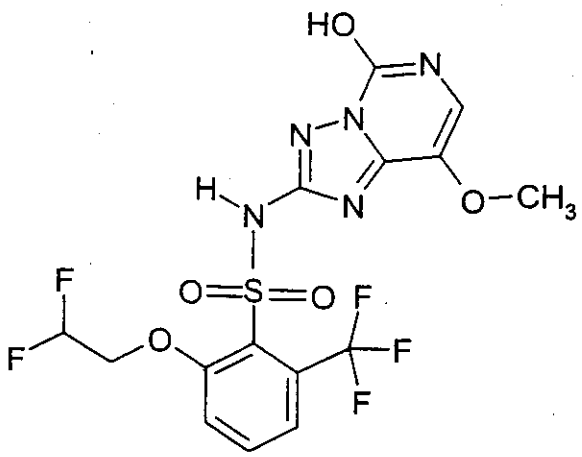
5-OH-XDE-638

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

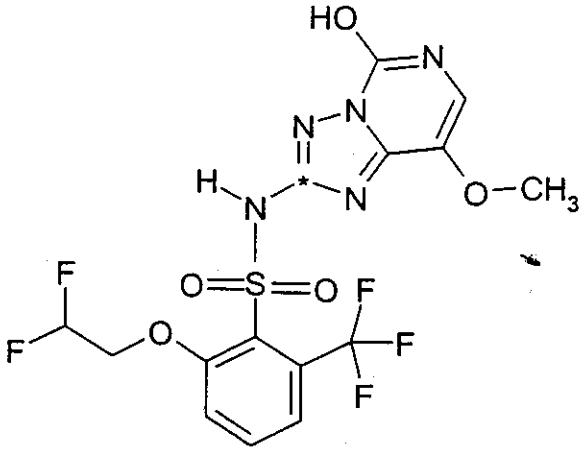
CAS name: 2-(2,2-Difluoroethoxy)-N-(5,6-dihydro-8-methoxy-5-oxo[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide

CAS No: NA

Unlabeled



[Triazolopyrimidine-2-^{14}C] label



* Position of the radiolabel.

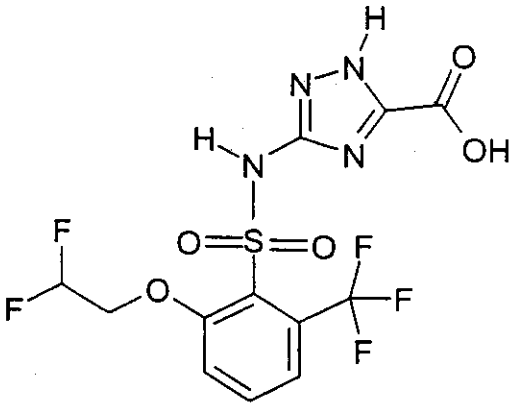
BSTCA

IUPAC name: 3-[6-(2,2-Difluoroethoxy)-α,α,α-(trifluoro-o-toluenesulfonamido]-s-triazole-5-carboxylic acid

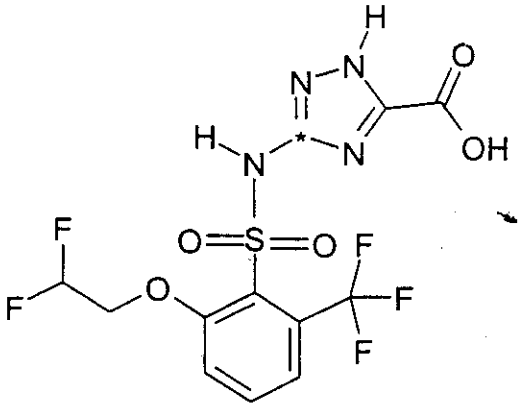
CAS name: 3-[[[2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)phenyl]-sulfonyl]amino]-1H-1,2,4-triazole-5-carboxylic acid

CAS No: NA

Unlabeled



[Triazolopyrimidine-2-^{14}C] label



* Position of the radiolabel.

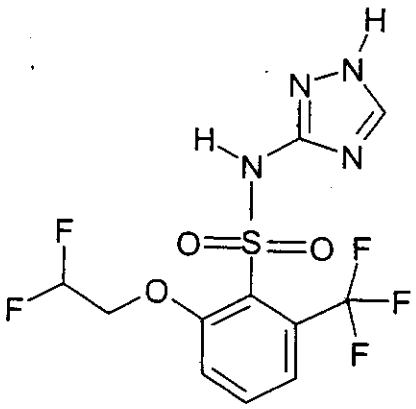
BST

IUPAC name: 6-(2,2-Difluoroethoxy)-α,α,α-trifluoro-N-s-triazol-3-yl-o-toluenesulfonamide

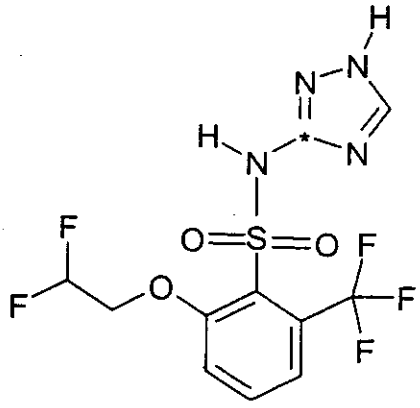
CAS name: 2-(2,2-Difluoroethoxy)-N-1H-1,2,4-triazole-3-yl-6-(trifluoromethyl)benzenesulfonamide

CAS No: NA

Unlabeled



[Triazolopyrimidine-2-^{14}C] label



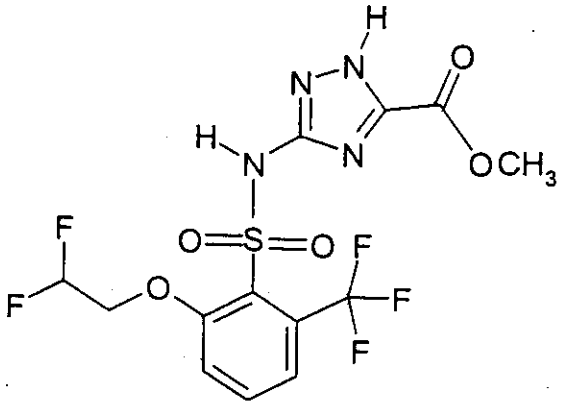
* Position of the radiolabel.

BSTCA-methyl

IUPAC name: Methyl 3-[6-(2,2-difluoroethoxy)-α,α,α-trifluoro-o-toluenesulfonamido]-s-triazole-5-carboxylate

CAS name: Methyl 3-[[[2-(2,2-difluoroethoxy)-6-(trifluoromethyl)phenyl]sulfonyl]amino]-1H-1,2,4-triazole-5-carboxylate

CAS No: NA

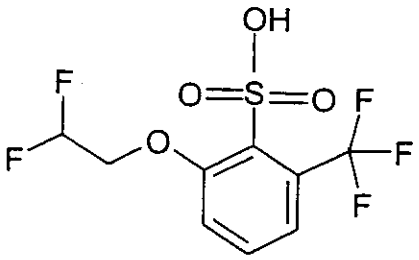


BSA

IUPAC name: 6-(2,2-Difluoroethoxy)-α,α,α-trifluoro-o-toluenesulfonic acid

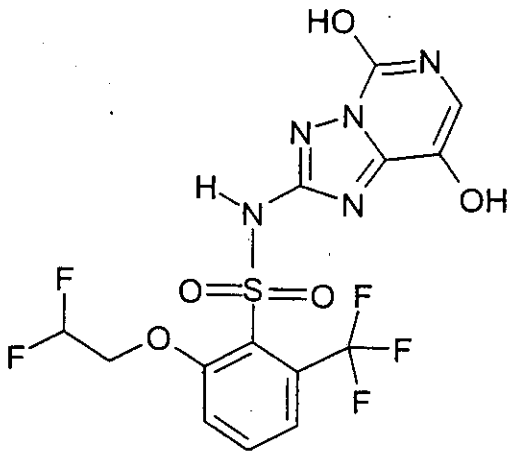
CAS name: 2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)benzenesulfonic acid

CAS No: NA



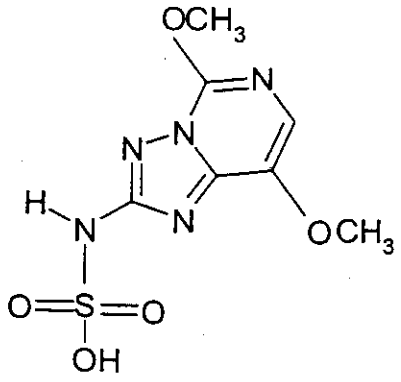
5,8-diOH

IUPAC name: NA
CAS name: 2-(2,2-Difluoroethoxy)-6-trifluoromethyl-N-(5,8-dihydroxy-[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)benzenesulfonamide
CAS No: NA



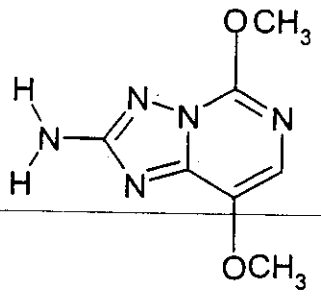
TPSA

IUPAC name: NA
CAS name: 5,8-Dimethoxy[1,2,4]triazolo-[1,5-c]pyrimidin-2-yl-sulfamic acid
CAS No: NA



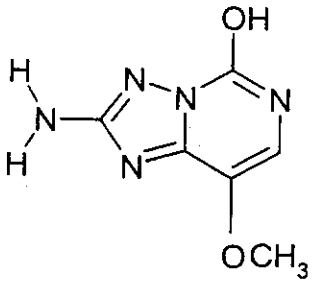
2-Amino TP

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 No: NA



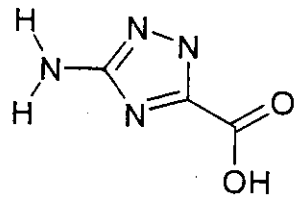
5-OH, 2-Amino TP

IUPAC name: NA
CAS name: 8-Methoxy[1,2,4]triazolo-[1,5-c]pyrimidin-5-ol-2-amine
CAS No: NA



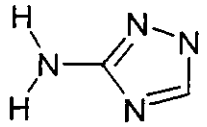
2-Amino TCA

IUPAC name: NA
CAS name: 2-Amino-1,3,4-triazole-5-carboxylic acid
CAS No: NA



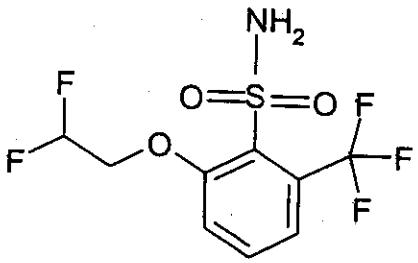
2-Amino-1,3,4-triazole

IUPAC name: NA
CAS name: 2-Amino-1,3,4-triazole
CAS No: NA



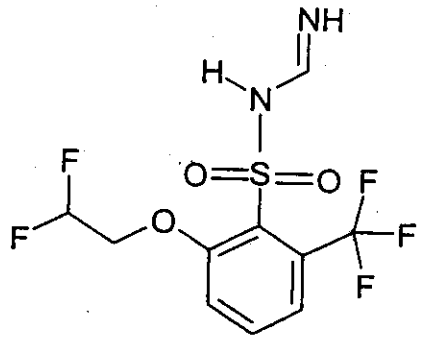
Sulfonamide

IUPAC name: 2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)-benzenesulfonamide
CAS name: 2-(2,2-Difluoroethoxy)-6-(trifluoromethyl)-benzenesulfonamide
CAS No: NA



Sulfonylformamidine

IUPAC name: 2-(2,2-Difluoroethoxy)-N-[(E)iminomethyl-6-(trifluoromethyl)benzenesulfonamide
CAS name: 2-(2,2-Difluoroethoxy)-N-(iminomethyl-6-(trifluoromethyl)-benzenesulfonamide
CAS No: NA



Attachment 3

Transformation Pathway Presented by Registrant
Comparison of Artificial Light to Natural Sunlight

DER FOR

MRID #45830723

Page____ is not included in this copy.

Pages 60 through 61 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

__✓__ FIFRA registration data.

____ The document is a duplicate of page(s) _____.

____ The document is not responsive to the request.

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