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

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

MEMORANDUM

DATE: February 28, 2013

SUBJECT: Registration Review – Preliminary Problem Formulation for the Ecological Exposure and Risk Assessment for Iodosulfuron-methyl-sodium (PC Code 122021; DP Barcode 404946)

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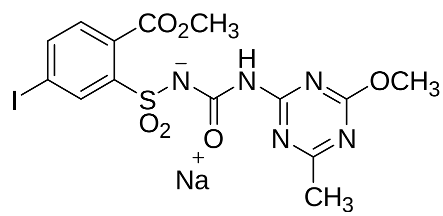
The Environmental Fate and Effects Division (EFED) has completed the preliminary problem formulation (attached) for the ecological risk, environmental fate, and endangered species assessments to be conducted as part of the Registration Review of iodosulfuron-methyl-sodium (also referred to as iodosulfuron). This document is intended to provide an overview of what is currently known regarding the environmental fate and ecological effects associated with iodosulfuron and its degradation products, and outlines uncertainties regarding attributes of the parent compound and its transformation products. It describes the preliminary ecological risk hypothesis and the processes that will be used during the completion of the ecological risk assessment in support of Registration Review.

1. INTRODUCTION

Iodosulfuron-methyl-sodium (iodosulfuron) is a sulfonylurea herbicide used to control annual and perennial grasses and broadleaf weeds. Iodosulfuron slows or stunts plant growth (or causes ultimate plant death) by limiting amino acid synthesis in plants through inhibition of acetolactate synthase (ALS). Iodosulfuron is absorbed through the leaves and roots of susceptible weed species. The structure of iodosulfuron, as well as the chemical name and other identifiers are provided in **Table 1**.

Table 1. Iodosulfuron Chemical Identifiers

Parameter	Identifier
Chemical Structure	
Chemical Name	4-Iodo-2-[[[[(4-methoxy-6-methyl,-3i, 5-triazin-2-yl)amino]carbonyl]amino]sulfonyl benzoic acid methyl ester, monosodium salt
SMILES	[Na+].COC(=O)C1=CC=C(I)C=C1S(=O)(=O)[N-]C(=O)NC1=NC(OC)=NC(C)=N1
CAS Number	144550-36-7
Company Code	AE F115008

In addition to the technical product (Reg. No.264-687), there are eight end-use products that contain iodosulfuron. Two different safener ingredients, isoxadifen-ethyl and mefenpyr-diethyl, are included in some of the formulations to protect the sprayed field corn (Reg. No. 264-686), triticale and wheat (Reg. Nos. 264-1103; 264-820) from damage. Several of the products contain additional active ingredients including: mesosulfuron-methyl (PC 122009), thiencarbazone-methyl (PC 015804), foramsulfuron (PC 122020), and dicamba (PC 029801). A summary of all the iodosulfuron formulated products is provided in **Table 2**.

Table 2. Iodosulfuron Formulated Products

Product	EPA Registration Number	Active Ingredient (Product Code)	Safener[1]
Atlantis Herbicide	264-1103	0.6 % Iodosulfuron-methyl-sodium (122021) 3.0 % Mesosulfuron-methyl (122009)	9.0% mefenpyr-diethyl
Autumn Super 51 WDG Herbicide	264-1134	6.0% Iodosulfuron-methyl-sodium (122021) 45% Thiencarbazone-methyl (15804)	
Tribute Solo WG32 (also known as Equip Corn Herbicide)	264-686	2.0% Iodosulfuron-methyl-sodium (122021) 30 % Foramsulfuron (122020)	30% isoxadifen-ethyl
Hussar Herbicide	264-820	5.0% Iodosulfuron-methyl-sodium (122021)	15% mefenpyr-diethyl

Product	EPA Registration Number	Active Ingredient (Product Code)	Safener[1]
Iodosulfuron 10 WDG Herbicide	264-843	10 % Iodosulfuron-methyl-sodium (122021)	
Iodosulfuron 10 WDG Herbicide	264-856	10 % Iodosulfuron-methyl-sodium (122021)	
Iodosulfuron Turf Herbicide	432-1404	10 % Iodosulfuron-methyl-sodium (122021)	
Celsius WG	432-1507	1.9% Iodosulfuron-methyl-sodium (122021) 8.7% Thiencarbazone-methyl (15804) 57.4% Dicamba (029801)	
1. Reported percentages are based on data provided on the material safety data sheet (MSDS)			

Iodosulfuron is registered for use on the following agricultural crops: cereal grains, corn (field, pop and sweet), cotton, sorghum, soybeans, triticale, and wheat. In addition, iodosulfuron is registered for use on lawns (residential and commercial), turf/sod farms, roadsides, and recreational areas including golf courses, sports fields, parks, campsites, and school grounds. All currently registered uses of iodosulfuron are listed in **Table 3**.

Based on the BEAD Chemical Profile prepared by OPP's Biological and Economic Analysis Division, from 2006-2010, an annual average of <500 pounds of iodosulfuron was used on corn and soybeans.[1] Pesticide use was surveyed but not reported during this time period for cotton, sorghum, and wheat. Usage data are not available for triticale and the non-agricultural use sites such as: lawns, turf/sod farms, rights of way, and recreational areas.

[1] Ratnayake, S.; Prieto, R.; Smearman, S. BEAD Chemical Profile for Registration Review: Iodosulfuron-methyl-sodium (122021) **August 28, 2012**.

Table 3. Currently Registered Iodosulfuron Uses

Crop/Site (Reg. Nos.)	Residential	Agricultural	Forestry	Timing; Application Type	Method/ Equipment	Maximum Single Application Rate by Formulation[1] (lb a.i./A)	Maximum Application Rate		Maximum Application Number		PHI (days)[3]	REI (hours)[3]	MRI (days)[3]	Geographic Restrictions/ Comments[4]
							Per Year lb a.i./A	Per CC[2] lb a.i./A	Per Year	Per CC[2]				
CEREAL GRAINS, SWEET, AND POP CORN COTTON, SORGHUM 264-856		✓		Postharvest, burn down treatment	ground boom	0.002 WDG	0.002	NA	1	NS	NA	NS	NS	Product is used as a burn down application at least 60 d (for sweet corn, popcorn or corn grown for seed or cotton) or 30 d for field corn, sorghum prior to planting.
FIELD, CORN 264-686		✓		Foliar, broadcast,	ground boom	0.002 WDG	0.002	NA	NS	1	45	NS	NS	PHI: 45 d for corn forage; 70 d for corn grain
264-1134; 264-856		✓		Postharvest, burn down treatment	ground boom	0.002 WDG	0.002	NA	1	NS	30	NS	NS	Product is used as a burn down application at least 30 d prior to planting.
GOLF COURSE TURF/ ORNAMENTAL LAWNS AND TURF/ ORNAMENTAL SOD FARM (TURF)/ RECREATION AREA LAWNS/ RESIDENTIAL LAWNS 432-1404; 432-1507	✓	✓		foliar, established plantings broadcast	ground boom	0.009 WDG	0.009	NA	NS	NA	NS	NS	NS	
432-1507	✓	✓		foliar, spot treatment	handheld	0.0001 lb/gal WDG	0.009	NA	NS	NS	NS	NS	NS	

432-1507	✓	✓		foliar, zone application		0.006 WDG	0.009	NA	NS	NA	NS	NS	NS	
RECREATIONAL AREAS 432-1404				Weed postemergence, established plantings broadcast	ground boom	0.009 WDG	0.009	NA	NS	NA	NS	NS	NS	
SOYBEAN 264-1134; 264-856		✓		Postharvest, burn down treatment	ground boom	0.002 WDG	0.002	NA	1	NS	NA	NS	NS	Product used as a burn down application at least 60 d prior to planting.
TRITICALE 264-1103		✓		Postemergence, broadcast	ground boom	0.002/ 0.003 (ID, OR, WA) WDG	0.009	0.0023/ 0.0026 (ID, OR, WA)	NS	1	NS	NS	NS	Higher rates permitted in Idaho, Oregon, Washington
WHEAT 264-1103		✓		Postemergence, broadcast, spray	ground boom	0.002/ 0.003 (ID, OR, WA) WDG	0.009	0.0023/ 0.0026 (ID, OR, WA)	NS	NS	30	NS	NS	Higher rates permitted in Idaho, Oregon, Washington PHI: 30 d for forage; 60 d for hay, grain, and straw
264-820		✓		Foliar, broadcast	ground boom	0.009 WDG	0.009	NS	2	NS	21	NS	14	PHI: 21 d for forage; 55 d for grain, and straw, and 50 d for hay

1. WDG – water dispersible granular in water soluble packet
2. Reported as per crop cycle or per season
3. PHI – Preharvest interval; REI – reentry interval; MRI – Minimum retreatment interval
4. Rotational crop rotation intervals are provided on product labels.

NA not applicable; NS not specified

2. PREVIOUS RISK ASSESSMENTS

Three ecological risk assessments have been completed for iodosulfuron: the new chemical assessment (field corn; DP267567; March 2002), and two new use assessments (turf, soybeans; DP315491; March 2006) and (wheat; DP350049; March 2008). All three of the previous assessments assessed both iodosulfuron (parent) and an environmental transformation product, metsulfuron methyl. Metsulfuron methyl also referred to as metsulfuron and is a registered sulfonylurea herbicide (PC 122010). EFED evaluated these assessments in association with the current toxicity, exposure, and usage information to determine if sufficient data are available and if further updates are needed to support registration review.

Potential direct risk to terrestrial and aquatic vascular and non-vascular plants from the use of iodosulfuron is expected. There is also the potential for various indirect effects on non-target animal species due to the effects on the plant community (for example, depletion of food sources and habitat). The major conclusions presented in the most recent assessments for iodosulfuron are summarized in **Table 4**.

Table 4. Summary of Risk Concerns Identified for Iodosulfuron in Previous Assessments

Birds	Mammals	Terrestrial Plants	Terrestrial Inverts	Fish	Aquatic Inverts	Aquatic Plants	Groundwater Contamination	Persistence	Degradates of Concern
--	--	√	--	--	--	√	--	--	√
√ Risk/concern identified in previous assessment									

Previous Drinking Water Assessments

A drinking water assessment for iodosulfuron was conducted at the time of the new chemical assessment, and updated with each subsequent new use, as highlighted in **Table 5** and **Table 6**. The uses assessed include applications made to field, sweet and pop corn, soybean, turf, and wheat. These assessments included estimated drinking water concentrations for both iodosulfuron and metsulfuron, modeled using FIRST, PRZM-EXAMS, and SCI-GROW. The two residues were modeled independently.

A drinking water assessment will be conducted to support future human health dietary risk assessments of iodosulfuron. Using EFED aquatic models, the drinking water assessment will incorporate model estimates of iodosulfuron in surface water (*e.g.*, PRZM-EXAMS) and groundwater (*e.g.*, (PRZM-GW). The major degradate, metsulfuron is currently considered a residue of concern in drinking water; however, all environmental transformation products of iodosulfuron will be reevaluated as potential residues of concern in drinking water as part of the registration review risk assessment process. Any additional residues identified as a potential toxicological concern with similar toxicity will also be considered using a total toxic residue (TTR) approach.

Table 5. Summary of Prior Drinking Water Assessments for Iodosulfuron and Metsulfuron in Surface Water

Assessment	Crop	Tier I Surface Water (FIRST)			
		Iodosulfuron		Metsulfuron	
		1-in-10 Year Peak Concentration µg/L (ppb)	1-in-10 Year Annual Average Concentration µg/L (ppb)	1-in-10 Year Peak Concentration µg/L (ppb)	1-in-10 Year Annual Average Concentration µg/L (ppb)
D279400/DWA New Chemical	Field Corn	0.056	0.0058	0.068	0.014
D315491/ DWA	Turf	0.6	0.06	0.53	0.11
D318084/ DWA	Soybean (preplant)				

Assessment	Crop	Tier II Surface Water (PRZM-EXAMS)					
		1-in-10 Year Peak Concentration µg/L (ppb)	1-in-10 Year Annual Average Concentration µg/L (ppb)	30 Year Average Yearly Concentration µg/L (ppb)	1-in-10 Year Peak Concentration µg/L (ppb)	1-in-10 Year Annual Average Concentration µg/L (ppb)	30 Year Average Yearly Concentration µg/L (ppb)
D350049/ DWA	Wheat	0.36	0.067	0.025	0.26	0.077	0.027

Table 6. Summary of Prior Drinking Water Assessments for Iodosulfuron and Metsulfuron in Groundwater

Assessment	Crop	Tier I Groundwater (SCI-GROW)			
		Iodosulfuron		Metsulfuron	
		Peak Concentration µg/L (ppb)	Yearly Mean Concentration µg/L (ppb)	Peak Concentration µg/L (ppb)	Yearly Mean Concentration µg/L (ppb)
D279400/DWA New Chemical	Field Corn	0.0006	0.0006	0.005	0.005
D315491/ DWA	Turf	0.00004	0.00004	0.02	0.02
D318084/ DWA	Soybean preplant				
D350049/DWA	Wheat	0.00002	0.00002	0.02	0.02

Clean Water Act Programs

Iodosulfuron is not identified as a cause of impairment for any water bodies listed as impaired under section 303(d) of the Clean Water Act. No Total Maximum Daily Load (TMDL) criteria have been developed for iodosulfuron. Aquatic Life Ambient Water Quality Criteria documents or Aquatic life benchmarks have not been published for iodosulfuron.

3. ENVIRONMENTAL FATE AND TRANSPORT

Physical and Chemical Properties

The physicochemical properties of iodosulfuron are shown in **Table 7**. Based on these properties alone, iodosulfuron is not expected to be volatile or to bioaccumulate. It is highly soluble in water. Solubility is pH dependent and has been shown to increase at higher pHs.

Table 7. Selected Physical/Chemical Parameters of Iodosulfuron

Parameter	Value	Source/Classification
Molecular mass (molecular formula)	529.24 g/mol ($C_{14}H_{13}IN_5O_6SNa$)	EPISuite v4.0
Vapor pressure (20°C)	2.6×10^{-9} Pa; 1.95×10^{-11} mmHg (20 °C) 6.7×10^{-9} Pa; 5.03×10^{-11} mmHg (25 °C) 1.6×10^{-8} Pa; 1.2×10^{-10} mmHg (30 °C)	MRID 45108609
Aqueous solubility (20°C)	170 mg/L (20 °C; pH 5) 25,000 mg/L (20 °C; pH 7) 65,000 mg/L (20 °C; pH 9)	MRID 45108619 MRID 45108620 (corrected values)
pK_a	3.22±0.06 (20 °C)	MRID 45108626
Log octanol-to-water partition coefficient (log K_{OW})	3.96 (pH 4) -0.70 (pH 7) -1.22 (pH 9)	MRID 45108622
MRID 45108621 provides iodosulfuron solubility data for a number of common solvents.		

Environmental Fate Properties

Environmental fate properties of iodosulfuron are summarized in **Table 8**. These half-life values presented in the table have been updated from previous assessments to reflect the NAFTA degradation kinetics guidance[2] for characterization purposes and will be used to calculate model input values. Updated model input values will be calculated based on current model input guidance for each respective exposure model at the time the assessment is completed. The updated kinetic analyses are presented in **APPENDIX A**. The results of the revised kinetic analyses are similar to those previously reported in the data evaluation documents. In general terms, iodosulfuron is susceptible to microbial mediated degradation in soil as well as in aquatic

[2] *Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media*, Health Canada, U.S. Environmental Protection Agency, December 2012.

environments. Iodosulfuron does not persist long in soil and is only slightly more persistent in aquatic environments under both aerobic and anaerobic conditions. It forms several different environmental transformation products (discussed in the section below). Hydrolysis of iodosulfuron is pH dependent with increased hydrolysis occurring under acidic conditions. Photodegradation in aquatic environments is not expected for iodosulfuron; however, it is susceptible to indirect photolysis (primarily observed in soil). Like all of the sulfonylurea herbicides, iodosulfuron does not bind strongly to soils and sediments, and is expected to be mobile.

Table 8. Environmental Fate Parameters of Iodosulfuron

Parameter	Conditions	Value	Source/Classification
Persistence[1]			
Hydrolysis half-life	25°C	pH 4: 2.5 d[2] pH 5: 18.4 d[2] pH 7: >365 d[2] pH 9: 167 d[2]	MRID 45108623/ acceptable
Aqueous photolysis half-life	25°C	212 d 30 °N 334 d 40 °N 644 d 50 °N	MRIDs 45108624, 45108625/ Supplemental
Soil photolysis half-life	25°C	SFO 4.2 d 30 °N SFO 5.0 d 40 °N SFO 7.0 d 50 °N DFOP Slow $t_{1/2}$ = 11.3 d 30 °N DFOP Slow $t_{1/2}$ = 13.4 d 40 °N DFOP Slow $t_{1/2}$ = 17.5 d 50 °N	45109003 Reclassified to supplemental[3] Phenyl label A clear pattern of formation and decline of the transformation product was not established.
Aerobic soil metabolism half-life	20°C, 40% MWRC	IORE DT50= 2.9 d; DT90= 12 d; tR_{IORE} = 3.6 d (Germany, silt loam)	MRIDs 45108934, 45109005/ Supplemental[3] Triazine label
		IORE DT50= 3.3 d; DT90= 13.7 d; tR_{IORE} = 4.1 d (France, clay loam)	
		IORE DT50= 2.9 d; DT90= 13 d; tR_{IORE} = 3.9d (United Kingdom, loamy sand)	MRIDs 45108935, 45109006/ Supplemental[4] Phenyl label
		IORE DT50= 4.3 d; DT90= 26.5 d; tR_{IORE} = 8.0 d (United Kingdom, silt loam)	MRIDs 45108936, 45109007/ Supplemental[4] Triazine label
	20°C, 30% MWRC	IORE DT50= 6.0 d; DT90= 41.2 d; tR_{IORE} = 12.4 d (United Kingdom, silt loam)	
	10°C, 40% MWRC	IORE DT50= 13.8 d; DT90= 104 d; tR_{IORE} = 31.3 d (United Kingdom, silt loam)	
	20°C, 25% MWRC	DFOP DT50= 16.2 d; DT90=132 d; Slow $t_{1/2}$ = 50.5 d (Germany, clay)	MRIDs 45109001, 45109008/ Supplemental[4] Triazine label
		IORE DT50= 9.2 d; DT90= 51.4 d; tR_{IORE} = 15.5 d (France, clay loam)	

Parameter	Conditions	Value	Source/Classification
	20°C, 50% MWRC	IORE DT50= 2.3 d; DT90= 24 d; $t_{R\ IORE}$ = 7.3 d (Germany, clay)	
		IORE DT50= 3 d; DT90= 11.9 d; $t_{R\ IORE}$ = 3.6 d (France, clay loam)	
	20°C	IORE DT50= 1.5 d; DT90= 7.43 d; $t_{R\ IORE}$ = 2.2 d (Germany, sandy loam)	MRID 45108933/ 45109004 Supplemental[5] triazine label
	20°C	SFO DT50= 1.6 d; DT90= 5.2 d; (Germany, loamy sandy)	
	20°C	DFOP DT50= 3.1 d; DT90= 10.2 d; DFOP Slow $t_{1/2}$ = 3.1 d (USA, sand) Same as SFO	
	20°C	SFO DT50= <1 d; DT90= 2.5 d; (Germany, silt loam)	
Aerobic aquatic metabolism half-life	20°C, Nidda	SFO $t_{1/2}$ = 19.1 d; DT90= 63.3 d (water) SFO $t_{1/2}$ = 20.1 d; DT90= 66.9 d (total system)	MRID 45109021 Supplemental Storage stability data was not provided. Up to 30% of the applied radioactivity was not extracted.
	20°C, Rhine	SFO $t_{1/2}$ = 10.5 d; DT90= 34.9 d (water) SFO $t_{1/2}$ = 11 d; DT90= 36.5 d (total system)	
Anaerobic aquatic metabolism half-life	20°C	DFOP DT50= 21.3 d; DT90= 90.1 d; Slow $t_{1/2}$ = 29.6 d (water; silt loam) IORE DT50= 25.6 d; DT90= 108 d; $t_{R\ IORE}$ = 32.6 d (total system; silt loam)	MRID 45109002, 45109009/ Supplemental (model input value calculations will be based on total system)
		SFO DT50= 15.1 d; DT90= 50.1 d; SFO $t_{1/2}$ = 15.1 d (water; loamy sand) IORE DT50= 17 d; DT90= 45.8 d; $t_{R\ IORE}$ = 13.8 d (total system; loamy sand) SFO DT50= 15.6 d; DT90= 51.9 d; SFO $t_{1/2}$ = 15.6 d (total system; loamy sand) IORE N value <1; SFO is an appropriately conservative model	

Parameter	Conditions	Value	Source/Classification
	20°C	SFO $t_{1/2}$ = 11.8 d; DT90= 39.1 d IORE N value <1; SFO is an appropriately conservative model	MRID 45109023/ Supplemental A highly polar unknown was not identified. Up to 10% of the applied radioactivity was unextracted. The concentration of CO_2 varied substantially between days 275 and 366. Storage stability data are not adequate.
	Mobility		
Freundlich soil-water partition coefficients (K_F); organic carbon-normalized Freundlich coefficients (K_{FOC})	Loam, Loivre, France; pH 7.3, 3.1% OC	0.694 L/kg; 22.6 L/kg_{OC}	MRID 45109015/ Acceptable
	Clay loam, Bourgogne, France; 7.2, 2.4% OC	0.368 L/kg; 15.5 L/kg_{OC}	
	Sand, Germany; pH 5.62, 1.3% OC	0.12 L/kg; 10 L/kg_{OC}	MRID 45109014/ Supplemental The soils used in this study were autoclaved. Generally this would invalidate the study; however, the results indicate low sorption and are consistent with MRID 45109015 as well as known mobility of other sulfonylurea herbicides. For this reason, the study was classified as supplemental; however, the results should only be used for characterization and not for quantitative risk assessment.
	Loamy sand, Germany; pH 5.7, 2.5 % OC	0.54 L/kg; 22 L/kg_{OC}	
	Sandy loam, Germany; pH 6.0, 1.1 % OC	0.13 L/kg; 12 L/kg_{OC}	
	Silt loam, Mississippi, pH 5.4, 0.69 % OC	1.1 L/kg; 152 L/kg_{OC}	
	Loamy sand, Arizona; pH 8.0, 0.16 % OC	0.01 L/kg; ND	
	Sandy Loam, Illinois; pH 7.5, 2.5 % OC	2.0 L/kg; 82 L/kg_{OC}	
	Clay loam, Minnesota; pH 7.2, 2.8% OC	2.5 L/kg; 90 L/kg_{OC}	
	Loamy sand, United Kingdom; pH 7.9, 1.3% OC	0.02 L/kg; 0.8 L/kg_{OC}	

Parameter	Conditions	Value	Source/Classification
Field Dissipation			
Terrestrial field dissipation half-life;	Silt loam, France; pH 7.4	8.8 d 0.2 lb a.i./A bareground 7.1 d 0.9 lb a.i./A bareground 6.4 d 0.9 lb a.i./A grassed	MRID 45109010/ supplemental Only one transformation product was analyzed and the study was conducted in Europe.
	Silt, France; pH 5.8	7.1 d 0.2 lb a.i./A bareground 9.4 d 10.9 lb a.i./A bareground 9.1 d 0.9 lb a.i./A grassed	
	Silt loam, Duerrn, Germany; pH 6.9	8.9 d 0.2 lb a.i./A bareground 14.8 d 0.9 lb a.i./A bareground 11.6 d 0.9 lb a.i./A grassed	
	Silt loam, Warpe, Germany; pH 6.4	6.5 d 0.2 lb a.i./A bareground 2.0 d 0.9 lb a.i./A bareground 7.6 d 0.9 lb a.i./A grassed	
	Silt loam, United Kingdom; pH 6.2	<3 d 0.2 lb a.i./A bareground 11.2 d 0.9 lb a.i./A bareground <1d 0.9 lb a.i./A grassed	
	Silt loam, Spain, pH 7.8	11.3 d 0.2 lb a.i./A bareground 9.3 d 0.9 lb a.i./A bareground 12.5 d 0.9 lb a.i./A grassed	
Fish Bioconcentration			
Fish bioconcentration factor (steady-state); depuration rate		--	No data available

MWRC= maximum water retention capacity

1. Reported half-life values were calculated using the draft NAFTA degradation kinetics (*Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media*, Health Canada, U.S. Environmental Protection Agency, December 2012.) document: Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media (draft document June 29, 2011); Single First Order (SFO), Nth-Order Rate Model or Indeterminate Order Rate Equation Model (IORE), and Double First-Order in Parallel (DFOP); Representative half-life to be used to calculate model input value for IORE (tR_{IORE})
2. First-order rate constant and hydrolysis half-lives at 25 °C were estimated using the Arrhenius equation. Half-lives were extrapolated beyond the experimental data.
3. This study was originally classified as acceptable (noting the deficiency of not having data on the triazine moiety); however, it is being reclassified as supplemental because the study only provides information on the dissipation of the phenyl moiety of iodosulfuron and formation and decline of the observed transformation products is not clear.
4. Several study deficiencies were noted. The studies were conducted outside the United States.
5. This study has multiple deficiencies including inadequate sampling times

pH: One divided by the log of the hydrogen ion concentration; Organic Carbon (OC); days (d)

Transformation Products

Several major degradates of iodosulfuron were reported in the submitted environmental fate studies. These major transformation products as well as a few minor degradates are listed in **Table 9** with the maximum amounts of each chemical formed in the various studies.

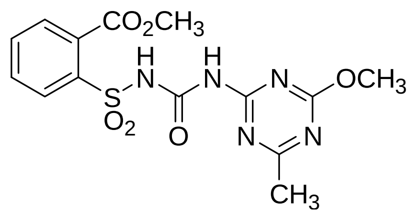
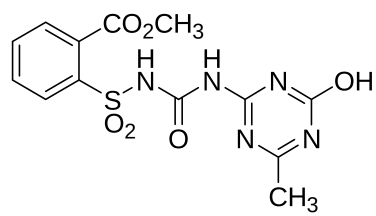
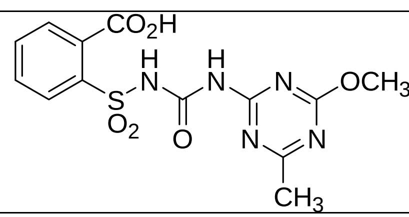
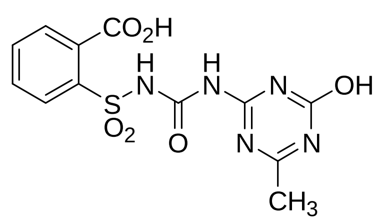
One of the major environmental transformation products of iodosulfuron is metsulfuron-methyl, a registered sulfonylurea herbicide. Metsulfuron forms in high levels (up to 70% applied) under aerobic conditions. Two mobility studies have been submitted for metsulfuron-methyl to support the registration of iodosulfuron. Metsulfuron does not bind to soils/sediments and is expected to be mobile in soils. In addition, since metsulfuron-methyl is registered as an active ingredient fate data for metsulfuron has been submitted to EPA to support the metsulfuron registration.[3] As part of the registration review process for metsulfuron methyl several studies have been requested including: batch equilibrium (adsorption/desorption), soil photolysis, aerobic soil metabolism, anaerobic soil, aerobic aquatic, and anaerobic aquatic. Fate characteristics of metsulfuron are summarized in **Table 10**.[4] In general, metsulfuron is mobile and is expected to be more persistent than iodosulfuron.

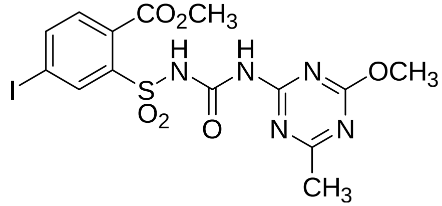
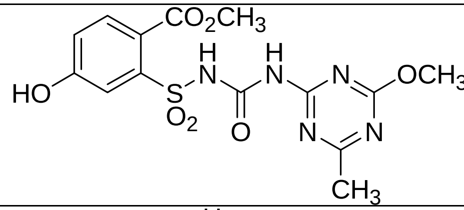
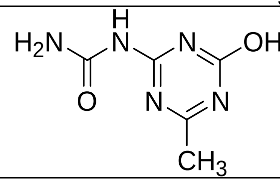
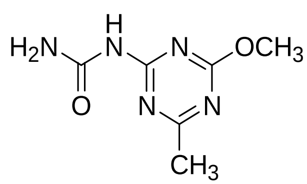
No environmental fate data for the other iodosulfuron transformation products have been submitted to EPA. Many of these transformation products retain the sulfonyl urea bridge and; therefore, may pose toxicological concerns.

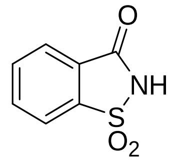
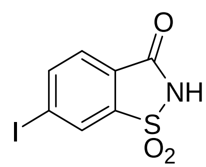
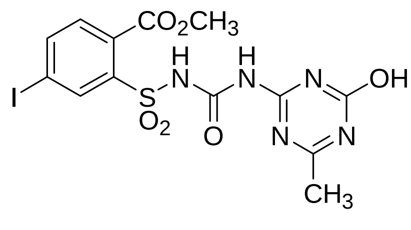
[3] Registered uses of metsulfuron methyl include: agricultural crops (wheat, barley, sorghum, and pastureland), non-crop and industrial areas, pasture and rangeland, and turf (residential lawns, golf courses, and ornamental grasses).

[4] With the exception of the highlighted mobility data the data are taken directly from the metsulfuron-methyl registration review problem formulation: Kiernan, B. D.; Baris, R. Registration Review: Preliminary Problem Formulation for Environmental Fate and Ecological Risk, Endangered Species, and Drinking Water Assessments for Metsulfuron-methyl (Case 7205) **PC 122010 DP389258** September 22, 2011.

Table 9. Iodosulfuron Environmental Transformation Products

Code Name/ Synonym	Chemical Name	Chemical Structure	Study Type	Ref. (MRID)	Maximum %AR (day)	Final %AR (study length)
		MAJOR				
AE F075736	Metsulfuron methyl; methyl 2-[3-(4-methoxy-6-methyl-1,3,5-triazin-2-y1)ureido-sulfonyl]benzoate $C_{14}H_{15}N_5O_6S$ Mol. Wt.: 381.3638		Aerobic Soil	45108934	55.3 1 DAT	2.9 120 d
				45108935	**70.1** 14 DAT	25.5 120 d
				45108936	47.7 14 DAT	10 120 d
				45109001	58.6 11 DAT	4.4 120 d
			Aerobic Aquatic	45109021	67.8 43 DAT	1.4 365 d
			Anaerobic Aquatic	45109023	1.5 5 DAT	<LOD 366 d
AE F161778	methyl 2-[3-(4-hydroxy-6-methyl-1,3,5-triazin-2-yl)ureidosulfonyl] benzoate $C_{13}H_{13}N_5O_6S$ Mol. Wt.: 367.3372		Aerobic Soil	45108934	**12.2** 28 DAT	3.5 120 d
				45108935	5.8 63 DAT	3.5 120 d
				45108936	13.7 42 DAT	9.3 120 d
				45109001	8.5 28 DAT	3.3 120 d
AE 0014966	2-[3-(4-methoxy-6-methyl-1,3,5-triazin-2-yl)ureidosulfonyl]benzoic acid $C_{13}H_{13}N_5O_6S$ Mol. Wt.: 367.3372		Aerobic Aquatic	45109021	15.5 91 DAT	n.d. 365 d
			Anaerobic Aquatic	45109023	**33.2** 113 DAT	<LOD 366 d
AE 0014965	Dimethoxy-metsulfuron free acid 2-[3-(4-hydroxy-6-methyl-1,3,5-triazin-2-yl)ureidosulfonyl]benzoic acid $C_{12}H_{11}N_5O_6S$ Mol. Wt.: 353.3106		Anaerobic Aquatic	45109023	**16.0** 113 DAT	2.5 366 d

AE F145740	4-iodo-2-[3-(4-methoxy-6-methyl-1,3,5-~idosulfonyl benzoic acid $C_{14}H_{14}IN_5O_6S$ Mol. Wt.: 507.2603		Aerobic Soil	45108934	3.2 11 DAT	1.3 120 d
				45108935	1.0 4 DAT	n.d. 120 d
				45108936	1.4 42 DAT	0.7 120 d
				45109001	**4.4** 64 DAT	3.6 120 d
			Anaerobic Aquatic	45109023	**50.6** 28 DAT	<LOD 366 d
				45108936	18.8 120 DAT	18.8 120 d
				45109001	33.4 120 DAT	33.4 120 d
			Aerobic Aquatic	45109021	27.5 365 DAT	13.7 365 d
AE0002166	Methyl 4-hydroxy-2-[3-(4-methoxy-6-methyl-1,3,5-triazin-2-yl)ureido]benzoate $C_{14}H_{15}N_5O_6S$ Mol. Wt.: 381.3638		Soil Photolysis	45109003	**21.4** 144 HAT	21.4 144 h
AE0 034855	4-hydroxy-6-methyl-1,3,5-triazine-2-yl)urea $C_5H_7N_5O_2$ Mol. Wt.: 169.1414		Aerobic Aquatic	45109021	**24.2** 182 DAT	16.5 365 d
AE 0000119	(4-methoxy-6-methyl-1,3,5-triazin-2-yl)urea $C_6H_9N_5O_2$ Mol. Wt.: 183.1680		Aerobic Soil	45108934	4.2 28 DAT	4.1 120 d
			Aerobic Aquatic	45108936	5.4 120 DAT	5.4 120 d
				45109001	4.0 64 DAT	3.9 120 d
				45109021	**24.9** 120 DAT	12.4 365 d

AEF159737	saccharin 1,2-benzisothiazol-3(2H)-one 1,1-dioxide $C_7H_5NO_3S$ Mol. Wt.: 183.1845		Anaerobic Aquatic	45109023	**9.7** 182 DAT	<LOD 366 d
Unknowns			Soil Photolysis	45109003	9.5 (combined) 327 HAT	6.9 393 h
			Aerobic Soil	45108934	6.2 63 DAT	3.3 120 d
				45108935	7.2 (combined) 120 DAT	1.2 120 d
				45109001	9.8 (single) 120 DAT	9.8 120 d
Non-extracted Residues			Aerobic Soil	45108934	**39.3** 120 DAT	39.3 (120 d)
				45108935	9.3 91 DAT	9.0 120 d
				45108936	33.8 120 DAT	33.8 120 d
				45109001	35.7 120 DAT[1]	35.7 120 d
			Aerobic Aquatic	45109021	30.3 365 DAT	30.3 365 d
MINOR						
AE F143133	Iodo saccharin 6-iodo-1,2-benzisothiazol-3(2H)-one 1, 1-dioxide $C_7H_4INO_3S$ Mol. Wt.: 309.0810		Anaerobic Aquatic	45109023	**2.2** 3 DAT	<LOD 366 d
AE FI45741	methyl 2-[3-(4-hydroxy-6-methyl-1,3,5-triazin-2-yl)16reidosulfonyl-4-iodobenzoate $C_{13}H_{12}IN_5O_6S$ Mol. Wt.: 493.2337		Aerobic Soil	45108934	3.2 4, 7 DAT	1.6 120 d
				45108935	3.4 0 DAT	n.d. 120 d
				45108936	**4.9** 14 DAT	2.2 120 d
				45109001	4.3 64 DAT	3.8 120 d

Bold font indicates the highest percentage observed for a given transformation product.
MW: molecular weight
AR: Applied radioactivity
n.d. not detected <LOD

Table 10. General Chemical Properties and Environmental Fate Properties of Metsulfuron Methyl

Parameter	Value	Reference (MRID #) /Comment
Physical/Chemical Parameters		
Molecular mass	381.4 g/mol	ACC 072767
Vapor pressure (20°C)	2.5×10^{-12} torr	ACC 072767
Henry's Law Constant	2.35×10^{-16}	EPISuite v4.0
Water solubility (25°C)	109 mg/L (in water)	Solubility significantly increases with increasing pH. ACC 072767
Octanol-water partition coefficient (K_{OW})	0.018	ACC 072767
Dissociation Constant (pKa)	3.5	ACC 072767
Mobility		
Soil Partitioning Coefficient (Koc, 1/n) †	214, 134, 226, and 46 mL/goc 0.84, 0.78, 0.84, and 0.87 (1/n values)	44143301 supplemental Data should not be used quantitatively. EPISuite calculated value is 22 mL/g oc.
	0.106 L/kg; 5.3 L/kg_{OC} (silt loam, Hattersheium, Germany, pH 7)	45109016 supplemental
	0.145 L/kg; 7.7 L/kg_{OC} (loam sand, Speyer, Germany, pH 6.0)	
	0.065 L/kg; 15.1 L/kg_{OC} (Tor Sud, Speyer, Germany, pH 6.0)	
	0.5304 L/kg; 24 L/kg_{OC} (loamy sand, Hanhofen, Germany, pH 5.8)	45133410 Supplemental; study was conducted at 10 °C
	0.2413 L/kg; 27 L/kg_{OC} (silt loam, Honville, France pH 6.7)	
Persistence in Water		
Hydrolysis half-life (25°C, pH 5, 7, & 9) †	Stable	ACC 072767
Aqueous photolysis half-life (25°C)†	Stable	ACC 072767
Aerobic aquatic metabolism half-life	No available data	--
Anaerobic aquatic metabolism half-life	35 – 365 days	ACC 260973 41395501
Persistence in Soil		
Soil photolysis†	No available data	--
Aerobic soil metabolism half-life (25°C)	54.2 days 25.9, and 28 days	44491201 ACC 071434
	Triazine amine‡: 240 days	40340317
Anaerobic soil metabolism†	No available data	--

Parameter	Value	Reference (MRID #) /Comment
Field Dissipation		
Terrestrial field dissipation half-life (DT_{50}) †	1 – 10.5 months	42016507 Note: sampling/depth of analysis was insufficient to define the extent of leaching (35 cm).
Aquatic Bioconcentration		
Bioconcentration Factor (BCF) in fish	Low Kow indicates low potential to bioaccumulate.	ACC 072767
‡ Major degradate of metsulfuron † At least one study was under review as of September 11, 2011.		

In summary, iodosulfuron and its environmental transformation products may leach to groundwater and runoff or drift during application to surface water. Once in aquatic environments, iodosulfuron and its environmental transformation products including metsulfuron are expected to remain predominantly in the water phase.

Safeners

Isoxadifen-ethyl, the safener included in corn use formulations (Reg. No. 264-686) of iodosulfuron, is reported to be at concentrations approximately 15-times higher than iodosulfuron; therefore, the field application rate is expected to be 0.03 lb/A. Chemical identifiers for isoxadifen-ethyl are included in **Table 11**. Limited environmental fate data for isoxadifen-ethyl are provided in **Table 12**. Another safener, mefenpyr-diethyl, is included in wheat and triticale formulations (Reg. Nos. 264-1103; 264-820). The reported concentration of the safener is up to 15-times higher than the concentrations of iodosulfuron in the formulated products. The corresponding maximum field application rate is assumed to be 0.045 lb/A. Chemical identifiers for mefenpyr-diethyl are included in **Table 13**. Limited environmental fate data for mefenpyr-diethyl are provided in **Table 14**.

Table 11. Isoxadifen-ethyl Chemical Identifiers

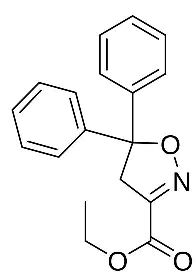
Parameter	Identifier
Chemical Structure	
Chemical Name	ethyl 4,5-dihydro-5,5-diphenyl-1,2-oxazole-3-carboxylate ethyl 4,5-dihydro-5,5-diphenyl-3-isoxazolecarboxylate
SMILES	C1(C(OCC)=O)=NOC(C1)(c1ccccc1)c1ccccc1
CAS Number	163520-33-0

Table 12. Physical/Chemical Parameters of Isoxadifen-ethyl

Parameter	Value	Source/Classification
Molecular mass (molecular formula)	295.34 g/mol ($C_{18}H_{17}O_3N$)	Calculated using EPI Suite
Vapor pressure (25°C)	6.79 x 10^{-5} Pa	Calculated using EPI Suite Modified Grain Method
Aqueous solubility (20°C)	1.26 mg/L	MRID 44739133 (algal toxicity study)
Log octanol-to-water partition coefficient (log K_{OW})	3.8	MRID 44739121
Koc	9777 L/kg	Calculated using EPI Suite Kow method
Hydrolysis	Stable	Calculated using EPI Suite

Table 13. Mefenpyr-diethyl Chemical Identifiers

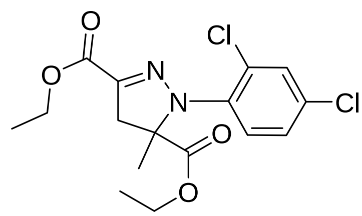
Parameter	Identifier
Chemical Structure	
Chemical Name	1H-Pyrazole-3,5-dicarboxylicacid, 1-(2,4-dichlorophenyl)-4,5-dihydro-5-methyl-, 3,5-diethyl ester 1-(2,4-Dichlorophenyl)-4,5-dihydro-5-methyl-1H-pyrazole-3,5-dicarboxylic acid diethyl
SMILES	CCOC(=O)C2=NN(c1ccc(Cl)cc1Cl)C(C)(C(=O)OCC)C2
CAS Number	135590-91-9

Table 14. Physical/Chemical Parameters of Mefenpyr-diethyl

Parameter	Value	Source/Classification
Molecular mass (molecular formula)	373.24 g/mol ($C_{16}H_{18}Cl_2N_2O_4$)	Calculated using EPI Suite
Vapor pressure (25°C)	4.42 x 10^{-4} Pa	Calculated using EPI Suite Modified Grain Method
Aqueous solubility (25°C)	2.4 mg/L	Calculated using EPI Suite WSKOW v1.41
Log octanol-to-water partition coefficient (log K_{OW})	3.83	Calculated using EPI Suite [Exper. database match (Tomlin, C 1997)]
	4.82	Calculated using EPI Suite (KOWWIN v 1.67)
Koc	740 L/kg	Calculated using EPI Suite Kow method
Hydrolysis	stable	Calculated using EPI Suite

4. RECEPTORS

Table 15 and **Table 16** provide a summary of the aquatic and terrestrial taxonomic groups, respectively, and the most sensitive surrogate species tested to characterize the potential acute and chronic ecological effects of iodosulfuron. The tables provide an overview of the available acute toxicity information on iodosulfuron, and provide the acute toxicity classifications. Based on the available ecotoxicity information, the most sensitive organisms are aquatic and terrestrial plants, however, it is noted that there is some uncertainty with the available terrestrial plant studies because they have been conducted on formulations containing a safener. There are several products that are not formulated with a safener including two for use on turf, which, along with a product for use on wheat (formulated with a safener) have the highest use rates. Because the safener may influence the final toxicity estimation, terrestrial plant toxicity studies for a product formulated for use on turf would reduce the uncertainty in the upcoming analysis.

Table 15. Summary of the Most Sensitive Endpoints from Aquatic Toxicity Studies for Iodosulfuron

Taxonomic Group	Study Type	Surrogate Species and Test Material	Toxicity Value (all units in terms of measured active ingredient)	MRID and Classification	Acute Toxicity Classification
Freshwater fish[1]	Acute	Rainbow Trout (*Oncorhynchus mykiss*) TGAI	LC_{50} > 88.1 mg a.i./L Most sensitive endpoint: none No sublethal effects reported.	45109035 Supplemental classification based on water quality deviations from 850 guideline recommendations.	No more than slightly toxic
	Chronic (Early Life Stage)	Fathead Minnow (*Pimephales promelas*) TGAI	NOAEC 10.2 mg a.i./L LOAEC >10.2 mg a.i./L Most sensitive endpoint: none No sublethal effects reported.	46431804 Acceptable	--
Estuarine/Marine fish	Acute	Sheepshead Minnow (*Cyprinodon variegatus*) TGAI	LC_{50} > 100 mg a.i./L Most sensitive endpoint: none No sublethal effects reported.	45109127 Acceptable	Practically non-toxic
	Chronic	No Data			

Taxonomic Group	Study Type	Surrogate Species and Test Material	Toxicity Value (all units in terms of measured active ingredient)	MRID and Classification	Acute Toxicity Classification
Freshwater invertebrates	Acute	Water Flea (*Daphnia magna*) TGAI	EC_{50} > 86.9 mg a.i./L NOAEC= 28.1 mg a.i./L Most sensitive endpoint: immobilization No sublethal effects reported.	45109103 Supplemental classification based on water quality deviations from 850 guideline recommendations.	No more than slightly toxic
	Chronic	Water Flea (*Daphnia magna*) TGAI	NOAEC = 9.1 mg a.i./L LOAEC = 15.9 mg a.i./L Most sensitive endpoint: reduced number of young per female and dry weight	45109104 Acceptable	--
Estuarine/Marine invertebrates	Acute	Mysid shrimp (*Mysidopsis bahia*)	LC50 = >100 mg a.i./L NOAEC = 100 mg a.i./L No mortality or sublethal effects reported	45109128 Acceptable	Practically non-toxic
	Chronic	No Data			
Aquatic plants and algae	Non-vascular	Green algae (*Pseudokirchneriella subcapitata*) TGAI	EC_{50} = 0.041 mg a.i./L NOAEC = 0.014 mg a.i./L Most sensitive endpoint: cell density	45109105 Acceptable	--
	Vascular	Duckweed (*Lemna gibba*) TGAI	EC_{50} = 0.00070 mg a.i./L NOAEC = 0.00039 mg a.i./L Most sensitive endpoint: cell density	45109111 Acceptable	--
1. Freshwater fish represent surrogates for aquatic-phase amphibians.					

Table 16. Summary of the Most Sensitive Endpoints from Terrestrial Toxicity Studies for Iodosulfuron

Taxonomic Group	Study Type	Surrogate Species and Test Material	Toxicity Value (all units in terms of measured active ingredient)	MRID and Classification	Acute Toxicity Classification
Birds[1]	Acute	Bobwhite quail (*Colinus virginianus*) and Mallard (*Anas platyrhynchos)* TGAI	LD_{50} > 1744 mg/kg-bw Most sensitive endpoint: none. No sublethal effects reported.	45109029/ 45109028 Acceptable	No more than slightly toxic
	Sub-acute dietary	Bobwhite quail (*Colinus virginianus*) TGAI	LC_{50} = > 4360 mg/kg diet Most sensitive endpoint: none. No sublethal effects reported.	45109030 Acceptable	Practically non-toxic
	Chronic	Bobwhite quail (*Colinus virginianus*) TGAI	NOAEC = 372 ppm LOAEC = 1077 ppm Most sensitive endpoint: Adult male weight gain	46431803 Acceptable	--
Mammals	Acute Oral	Laboratory rat (*Rattus norvegicus*)	LD_{50} = 2448 mg a.i./kg	45133404 Acceptable	Practically nontoxic[3]
	Acute Inhalation	Laboratory rat (*Rattus norvegicus*)	LC_{50} = > 2.81 mg/L	45108805 Acceptable	--
	Chronic	Laboratory rat (*Rattus norvegicus*)	NOAEL = 500 ppm LOAEL = 5000 ppm Endpoint: Based on pup mortality	45108818 Acceptable	--
Insects	Acute contact	Honey bee (*Apis mellifera L.*) TGAI	LD_{50} > 150 µg a.i./bee No sublethal effects reported.	45109115 Acceptable	Practically nontoxic[2]
	Acute Oral	Honey bee (*Apis mellifera L.*) TGAI	LD_{50} > 81 µg a.i./bee No sublethal effects reported.	4510914 Acceptable	Practically nontoxic[2]
Terrestrial plants	Vegetative Vigor	Dicot – Lettuce Formulated Corn Product	EC_{25} = 0.00000037 lbs a.i./acre EC_{05}= 0.00000000018 NOAEC = 0.00000066 lbs a.i./acre Endpoint: Shoot length	45109131[4] Acceptable-Supplemental for lettuce and onion	--

Taxonomic Group	Study Type	Surrogate Species and Test Material	Toxicity Value (all units in terms of measured active ingredient)	MRID and Classification	Acute Toxicity Classification
		Monocot – Onion Formulated Corn Product	EC_{25} = 0.0000067 lbs a.i./acre EC_{05}= 0.00000043 NOAEC = 0.0000026 lbs a.i./acre Endpoint: Shoot dry weight		--
Terrestrial plants	Seedling Emergence	Dicot – Tomato Formulated Corn Product	EC_{25} = 0.0000035 lbs a.i./acre EC_{05}= 0.000000035 lbs a.i./acre NOAEC = <0.000084 lbs a.i./acre Endpoint: Shoot length	45109132 Acceptable-Supplemental for tomato	--
		Monocot – Onion Formulated Corn Product	EC_{25} =0.00028 lbs a.i./acre EC_{05}= 0.00000057 lbs a.i./acre NOAEC = 0.000011 lbs a.i./acre Endpoint: Shoot length		

1. Birds represent surrogates for terrestrial-phase amphibians and reptiles.
2. Based on acute contact LD50 (μg a.i./bee) <2 highly toxic; 2-10.99 moderately toxic; ≥11 practically non-toxic
3. Acute Oral (avian/mammal): Based on LD50 (mg/kg) <10 very highly toxic; 10-50 highly toxic; 51-500 moderately toxic; 501-2000 slightly toxic; >2000 practically nontoxic
4. A vegetative vigor study is available (MRID 47731901 with amendment 47746701) but has not been fully reviewed. A preliminary review suggests that the toxicity values are less sensitive than the current endpoints.

Effects on Plant Reproduction

EFED's Plant Technical Team (PTT) conducted an analysis of available SU plant reproduction data from the open literature and the registrant-submitted data for chlorsulfuron, a representative SU, and concluded that data from the 850.4150 vegetative vigor guideline study are sufficiently protective of potential impacts to plant reproduction. Acetolactate synthase (ALS) inhibitors primarily affect metabolically active meristem tissues. When plants are exposed at a young, vigorously growing life-stage, effects are expressed primarily as inhibition of vegetative growth (*i.e.*, biomass, shoot length). As plants mature these effects are less pronounced. However, as plants enter their reproductive life-stage, the metabolically active tissue will include flower and seed production. Plants exposed to SU herbicides during the reproductive life stage are likely to exhibit adverse effects on reproduction, generally expressed as reduced seed number or reduced seed weight. Based on the latest data analysis, these effects are expected to occur at similar rates to those effects determined in the guideline vegetative vigor studies (850.4150), so further data are not requested at this time.

Degradate Toxicity

Metsulfuron, another registered herbicide (PC 122010), is a biotransformation product of iodosulfuron in aerobic soils as well as aerobic aquatic environments. The most sensitive terrestrial and aquatic toxicity data are summarized in **Tables 17 and 18** and are discussed in more detail in previous assessments (DP315491, 03/06; D350049, 03/08) and also the recent problem formulation for metsulfuron[5].

Table 17. Aquatic Wildlife Toxicity Profile for Metsulfuron

Taxonomic Group	Study Type	Species (Common Name)	Endpoint (mg ai/L)	Acute Classification	Reference (MRID)
Freshwater Fish	Acute	*Lepomis macrochirus* (Bluegill sunfish)	LC_{50}>150	Practically nontoxic	00125817
	Chronic	*Oncorhynchus mykiss* (rainbow trout)	NOAEC=4.5	--	44122801
Freshwater Invertebrates	Acute	*Daphnia magna* (Water flea)	LC_{50}>150	Practically nontoxic	00125818
	Chronic	*Daphnia magna* (Water flea)	NOAEC = 100[b]	--	44704901
Estuarine/marine Fish		No data			
Estuarine/marine Invertebrates		No data			
Vascular plants	Vascular	*Lemna minor* (duckweed)	EC_{50}=0.00036 NOAEC=0.00016	--	41773902[a]
Nonvascular plants	Non-Vascular	*Pseudokirchneriella subcapitata*	EC_{50}=0.031 NOAEC=0.005	--	40639302[a]

[a] appears to be the most sensitive endpoint for Metsulfuron (pending full review of other studies)
[b] provisional value pending full review.

[5] Kiernan, B. D.; Baris, R. Registration Review: Preliminary Problem Formulation for Environmental Fate and Ecological Risk, Endangered Species, and Drinking Water Assessments for Metsulfuron-methyl (Case 7205) **PC 122010 DP389258** September 22, 2011.

Table 18. Terrestrial Organism Toxicity Profile for Metsulfuron

Taxonomic Group	Study Type	Surrogate Species (Common Name)	Endpoint	Acute Classification/ Chronic effect	Reference (MRID)
Birds	Acute	*Anas platyrhynchos* (Mallard duck)	LD_{50}>2150 mg a.i./kg-bw[a,b]	Practically nontoxic[a,b]	00125819
		Colinus virginianus (Bobwhite quail)	LC_{50}>5620 mg ai/kg diet	Practically nontoxic	00125821
	Chronic	*Anas platyrhynchos* (Mallard duck)	NOAEC=209 mg ai/kg-diet	--	44115702
Mammals	Acute	*Rattus norvegicus* (Laboratory rat)	LD_{50}>5000 mg a.i./kg-bw	Practically nontoxic	47018706
	Chronic	Laboratory rat	LOAEL=5000 mg a.i./kg-diet NOAEC=500 mg ai/kg-diet	Adult body weight gain	00151028
Terrestrial Invertebrates	Acute	*Apis mellifera* (Honey bee)	LD_{50}>25 µg/bee	Practically nontoxic	00141829
Terrestrial Plants	Seedling emergence	Dicot (tomato)	EC_{25} = 0.0000032 lb a.i./A[c] EC_{05} or NOAEC = 0.0000000012 lb a.i./A[c]	--	44050301 [c]
		Monocot (onion)	EC_{25} = 0.0001 lb a.i./A[c] EC_{05} or NOAEC 0.000013 lb a.i./A[c]	--	44050301 [c]
	Vegetative Vigor	--	--	--	44050301[d]

[a]Data under review (provisional data reported here)
[b]Data are incomplete pending passerine submission.
[c]Data under review(provisional data reported here). The previous iodosulfuron assessment used the Seedling Emergence values reported in MRID 44050301, however, the recent problem formulation for metsulfuron identified that MRID 44050301 is under review and may have deficiencies. Therefore, the values for this endpoint are pending study review
[d]Data under review. A cursory review of the Vegetative Vigor study submitted in 4405301 shows the toxicity is similar to the seedling emergence toxicity however, at this time, the provisional data cannot be reported without further review of the data and the supporting statistical analysis.

In general, the toxicity profiles for iodosulfuron and metsulfuron are similar for terrestrial and aquatic animals. Based on the available data, the toxicity to plants is also similar for iodosulfuron and metsulfuron. A total toxic residue approach will be used unless the pending data review shows that metsulfuron is more toxic to plants.

In addition to metsulfuron, there are also five major degradates for iodosulfuron that contain an intact sulfonyl urea (SU) bridge (-NH-CO-NH-SO2-), including: AE F161778, AE 0014966, AE 0014965 (only formed in anaerobic aquatic environments), AE F145740, and AE 0002166 (see structures in **Table 9**). The intact sulfonyl urea (SU) bridge has been identified as an important functional structure of SU toxicity. For degradates AE F161778 and AE 0014966, aquatic toxicity data are available and while the data have not been fully reviewed, the data suggest that both degradates are less toxic than the parent to aquatic vascular plants (*Lemna gibba*) with EC_{50} values of 0.418 mg/L (MRID 46319201) and >10 mg/L (45791502), for AE F161778 and AE 0014966, respectively. Data are not available for AE0014965, however, this transformation product only forms in anaerobic aquatic environments; thus this degradate will only be considered in groundwater simulations (for irrigation). Data are also not available for the other two major degradates that retain an intact sulfonyl urea (SU) bridge (AE F145740 and AE 0002166). In the absence of additional toxicity data, these transformation products will be considered to be as toxic as the parent. In summary, four major degradates (AE F161778, AE 0014966, AE F145740, and AE 0002166) that retain the SU bridge will be included in the TTR along with metsulfuron and the parent.

Safener Toxicity

For isoxadifen-ethyl (AEF122006), the safener added to formulations intended for corn use, a preliminary review of the available acute toxicity data suggests that isoxadifen-ethyl is highly toxic to the bluegill (MRID 44739131; LC_{50} = 0.22 mg /L, NOAEC = 0.09 mg /L) and the rainbow trout (MRID 44739130; LC_{50} = 0.34 mg /L, NOAEC = 0.12 mg /L). For aquatic invertebrates and non-vascular plants the available data reports EC_{50} values of >0.51 mg/L (MRID 44739132) and >100 mg/L (MRID 45360901), respectively. For chronic exposure, data are not available, however, a structure activity screen using ECOSAR (V 1.1-based on “aliphatic amines” as the chemical class/training set) shows a predicted high toxicity to fish, invertebrates, and algae with predicted toxicity values of 0.004, 0.005, and 0.007 mg/L for fish, invertebrates, and algae, respectively. For terrestrial organisms, the available data suggest that isoxadifen has low toxicity to birds and mammals on an acute exposure basis (MRIDs 44739135, 44739126, 44739127). On a chronic exposure basis, data are only available for mammals with a reported NOAEL of 12.6 mg/kg-bw-day (MRID 44995801). See the **Stressors of Concern** discussion below, which discusses a cursory analysis conducted to assess potential exposure of the safener to aquatic animals and plants.

Toxicity data are not available to the EPA for the safener mefenpyr-diethyl (added to formulations for wheat and triticale uses). According to a screen in ECOSAR (using “esters” as the training set), mefenpyr-diethyl is about 1-2 orders of magnitude more toxic to fish and invertebrates than iodosulfuron. On an acute exposure basis, mefenpyr-diethyl is estimated to be moderately toxic to fish (LD_{50}=1.28 mg/L) and highly toxic to aquatic invertebrates (LC_{50}=0.354 mg/L). Chronic toxicity estimates are (0.047mg/L) for fish and (0.084 mg/L) for invertebrates. Toxicity estimates for terrestrial taxa are not available in ECOSAR, however, an evaluation of mefenpyr-diethyl was conducted by the Food and Agriculture Organization of the United Nations[6] and the reported toxicity to birds, mammals and invertebrates can be classified as practically non-toxic. See the **Stressors of Concern** discussion below, which discusses a cursory analysis conducted to assess potential exposure of the safener to aquatic animals.

See **APPENDIX D** for ECOSAR output.

Ecological Incidents

A query of the Ecological Incident Information System (EIIS) database identified six incidents that were linked to exposure to iodosulfuron (**Table 18**). All of the incidents involved alleged damage to corn following a direct application of the herbicide to the crop. One incident, which was assigned a certainty of “probable,” was attributed to misuse of the pesticide. The other four incidents were assigned a certainty of “possible” and were attributed to legal use of the pesticide. Incidents of this nature, in which an herbicide allegedly damaged a crop on which it was directly applied, are no longer entered into EIIS since they have little relevance to risk to nontarget plants growing off the treatment site. No incident in the EIIS database attributes damage to crops or other nontarget plants resulting from spray drift or runoff of iodosulfuron from a treated field. Also, no incident in the EIIS database link exposure to iodosulfuron to any adverse effects to fish, wildlife, or invertebrates.

The Incident Data System (IDS) database was queried for minor ecological incidents that were reported by the pesticide registrants in aggregated incident reports. Nineteen minor ecological incidents were linked to iodosulfuron exposure. All of these incidents were of damage to crops or other nontarget plants.

A search of the Avian Incident Monitoring System (AIMS) database did not provide any additional incident data.

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[6] FAO Specifications and Evaluations for Agricultural Pesticides-Mefenpyr diethyl. Food and Agriculture Organization of the United Nations. 2011. http://www.fao.org/fileadmin/templates/agphome/documents/Pests_Pesticides/Specs/Mefenpyr_diethyl_2011.pdf

Table 18. Ecological Incidents in EIIS Linked to Exposure to Iodosulfuron

Use Site	Species Affected	Date	Exposure	Certainty	Misuse?	ID Number
Corn	Corn	6/16/2003	Direct Application	Probable	Yes	I014216-035
	Corn	6/2/2004	Direct Application	Possible	No	I015291-020
	Corn	6/24/2004	Direct Application	Possible	No	I015291-037
	Corn	7/1/2004	Direct Application	Possible	No	I015406-004
	Corn	7/1/2004	Direct Application	Possible	No	I015406-003

Incidents attributed to exposure to metsulfuron are given in **Table 19** to provide information on the potential risk of this degradation product. It should be recognized, however, that these incidents likely resulted from use of herbicide products containing metsulfuron-methyl as an active ingredient rather than from degradation of iodosulfuron. Nevertheless, the numerous plant damage incidents linked to exposure this ingredient demonstrate that nontarget plants may be harmed if they are exposed to this compound through spray drift, runoff , or carryover of soil residues.

Table 19. Ecological Incidents in EIIS Linked to Exposure to Metsulfuron-Methyl (Degradation Product of Iodosulfuron)

Use Site	**Species Affected**	**Date**	**Exposure**	**Certainty**	**Misuse?**	**ID Number**
Agricultural area (unspecified)	Woody plants	9/1/1991	Spray drift and runoff	Probable	No	I000903-001
	Potatoes and tomatoes	8/25/1993	Spray drift and runoff	Probable	No	I000903-004
	Fish	7/1/1996	Runoff	Unlikely	No	I005925-008
	Hay	4/25/2000	Carryover	Probable	NR	I012366-047
	Wheat	2001	NR	Possible	Yes	I020627-006
Barley	Vegetables	5/16/2008	Carryover	Highly Probable	No	I020340-001
Conservation Reserve Area	Cotton	8/12/2003	Spray drift	Possible	NR	I014415-001
Fence row	Birds, fish, and algae	5/26/1992	Spray drift and runoff	Possible	NR	I000022-001
Residential property	NR	NR	Spray drift	Possible	Yes	I005192-001
	Turf	6/7/2004	Runoff	Possible	NR	I015266-001
Right-of way	Peach	7/15/2004	Spray drift	Probable	No	I015218-001
	Vegetables	9/9/1997	Spray drift	Probable	No	I007371-024
	Cantaloupe, watermelon, and tomato	6/4/2004	Spry drift	Possible	No	I015280-001
	Ornamental plants	7/3/2003	Spray drift	Highly probable	Yes	I014290-001
Wheat	Sweet cherry	4/11/1994	Spray drift	Possible	Yes	I003386-001
	Ornamental plants	4/18/2001	Spray drift	Possible	NR	I020627-007

Use Site	Species Affected	Date	Exposure	Certainty	Misuse?	ID Number
	Wheat	5/17/2005	Treated directly	Possible	No	I06328-036

5. CONCEPTUAL MODEL

The environmental fate properties of iodosulfuron indicate that direct spray, spray drift, leaching to groundwater, and runoff represent potential transport mechanisms. These pathways may result in a wide range of potential aquatic and terrestrial exposure scenarios to both iodosulfuron as well as its environmental transformation products.

6. ANALYSIS PLAN

Ecological Risk Assessment

Stressors of Concern

The exposure assessments will consider the parent, iodosulfuron, the degradate metsulfuron as well as four major degradates that retain an intact SU bridge (AE F161778, AE 0014966, AE F145740, and AE 0002166) using a TTR approach. For more information on the selection of the transformation products included in the TTR analysis see the section above on degradate toxicity. Based on available toxicity data for the two safeners included in some iodosulfuron-methyl formulations, a cursory analysis was conducted to determine if additional information or data are needed to address potential risk concerns associated with formulated products containing the safeners.

While the toxicity of the safener, isoxadifen-ethyl, to some species including aquatic organisms may be greater than the parent, aquatic exposure to the safener at levels of toxicological concern are not expected based on the current products registered for use on corn. This was determined by calculating a high-end exposure concentration [0.21µg/L (peak)] using the GENEEC (v. 2.0 August 2, 2001)[7]. Since the high-end estimated exposure concentration is orders of magnitude less than the most sensitive endpoints (freshwater fish acute LC_{50} value of 220 µg/L; freshwater invertebrate acute toxicity estimate = 41 µg/L; fish chronic toxicity estimate = 4 µg/L), risk is not expected. Risk to terrestrial animals is not expected based on a preliminary screen using the TREX model (V 1.5.1).

The same analysis was completed for other safener, mefenpyr-diethyl. The high-end estimated exposure concentration is 3.93µg/L (peak)[8]. Since this high-end exposure concentration is orders of magnitude less than the most sensitive acute endpoints (fish toxicity estimate = 1128 µg/L; invertebrate toxicity estimate = 354 µg/L), risk is not expected on an acute exposure basis. On a chronic exposure basis, risk is also not expected based on the estimated toxicity values (fish

[7] Modeling assumptions: 1 applications at 0.03 lb/a; ground application; high boom; no spray drift buffer; fine spray; no incorporation; solubility 1.3 mg/L; Koc = 9777 L/kg; and stable to degradation.
[8] Modeling assumptions: 2 applications at 0.008 lb/A; 3 d minimum retreatment interval; ground application; high boom; no spray drift buffer; fine spray no incorporation; solubility 2.4 mg/L; Koc = 740 L/kg; and stable to degradation.

toxicity estimate = 47 µg/L; invertebrate toxicity estimate = 84 µg/L). Additionally, there are several aquatic toxicity studies cited in the recent FAO evaluation[9] that suggest the ECOSAR estimates are overestimating the toxicity. A final consideration for this safener is that with a log K_{OW} of 4.82 (highest value reported in EPI Suite), this chemical has the potential to bioaccumulate; however, a fish bioaccumulation study also referenced in the FAO review of mefenpyr diethyl has a reported BCF of 232 which tentatively suggests (until EPA reviews the data) that mefenpyr diethyl is unlikely to bioaccumulate in organisms. If these toxicity/BCF data are made available to the EPA it will be useful to improve our understanding of the toxicity profile for this safener.

Although this cursory analysis indicates a low potential for risk to aquatic organisms from exposures to the safeners at the levels estimated, alternative assumptions on mobility were explored to better understand the potential impact of the estimated Koc value on estimated EECs for the safeners. For isoxadifen-ethyl [Koc =977 L/kg (10X less than the EPI estimate) the estimated peak high-end exposure concentration was estimated to be 0.74 µg/L]. This is considerably lower than the endpoint for the most sensitive species assessed. For mefenpyr-diethyl ([Koc =74 L/kg (10X less than the EPI estimate), the estimated peak high-end concentration was estimated to be 7.1 µg/L]. Again, these results suggest that concentrations at levels of toxicological concern are not like to occur. The results of the GENEEC analysis are provided in **APPENDIX E**.

Measures of Exposure

In order to estimate exposure and potential risks of iodosulfuron exposure to aquatic and terrestrial organisms, all exposure modeling and resulting risk conclusions will be made based on maximum application rates, application methods, and any mitigation measures specifically indicated on the label. The models that will be used to predict the estimated environmental concentrations (EECs) of iodosulfuron are discussed on OPP's model website.[10] These models include: PRZM (Pesticide Root Zone Model) and EXAMS (EXposure Analysis Modeling System), PRZM-groundwater (GW), AgDrift, AgDisp, T-REX, TerrPlant, SIP (Screening Imbibition Program), and STIR (Screening Tool for Inhalation Risk).

The results of running the SIP and STIR models are presented in **APPENDIX B** and **APPENDIX C**. While the SIP model suggests that there are expected concerns for both mammals and birds, the model does not perform well with chemicals that have a high aqueous solubility and have low toxicity to these organisms. This route of exposure is not likely to be significant enough to cause concern. The analysis with STIR indicates no risk to birds or mammals through inhalation of iodosulfuron.

[9] FAO Specifications and Evaluations for Agricultural Pesticides-Mefenpyr diethyl. Food and Agriculture Organization of the United Nations. 2011. http://www.fao.org/fileadmin/templates/agphome/documents/Pests_Pesticides/Specs/Mefenpyr_diethyl_2011.pdf

[10] http://www.epa.gov/opp00001/science/models_pg.htm

Measure of Effects

Ecological effects data are used as measures of direct and indirect effects to biological receptors. Data are typically obtained from registrant-submitted studies or from literature studies identified by ECOTOX. The ECOTOX database provides more ecological effects data in an attempt to bridge existing data gaps. ECOTOX is a source for locating single chemical toxicity data and potential chemical mixture toxicity data for aquatic life, terrestrial plants, and wildlife. ECOTOX was created and is maintained by the USEPA, Office of Research and Development, and the National Health and Environmental Effects Research Laboratory's Mid-Continent Ecology Division.

Integration of Exposure and Effects

Risk characterization is the integration of exposure and ecological effects to determine the potential ecological risk from the use of pesticides and the likelihood of direct and indirect effects to non-target organisms in aquatic and terrestrial habitats. For the assessment of risks, the risk quotient (RQ) method is used to compare exposure and measured toxicity values. EECs are divided by acute and chronic toxicity values. The resulting RQs are then compared to the Agency's Levels of Concern (LOCs) (USEPA 2004). These criteria will be used to indicate when iodosulfuron use, as directed on the label, has the potential to cause adverse direct or indirect effects to non-target organisms. In addition, incident data from the EIIS, IDS, and AIMS will be considered as part of the risk characterization.

Endangered Species Assessments

Consistent with the Agency's responsibility under the Endangered Species Act (ESA), the Agency will evaluate risks to federally listed threatened and/or endangered (listed) species from registered uses of pesticides in registration review.

Endocrine Disruptor Screening Program

Iodosulfuron is not included in the first group of 67 chemicals issued an order to conduct Tier 1 EDSP testing. For additional information on the EDSP program, visit http://www.epa.gov/endo/.

7. PRELIMINARY IDENTIFICATION OF DATA GAPS

Fate

Table 20 identifies the environmental fate studies submitted by the registrant, as well as study classifications and whether or not additional data are needed in order to support the registration review exposure assessments. Rationale for the additional data requested is also presented.

Table 20. Submitted Environmental Fate Data for Chemical Iodosulfuron

OCSPP Guideline	Data Requirement	Submitted Studies (MRID)	Study Classifications	Are data needed to conduct risk assessment?	Comments
835.2120	Hydrolysis	45108623	acceptable	no	
835.2240	Aqueous photolysis	45108624, 45108625	supplemental	no	
835.2410	Soil photolysis	45109003	supplemental	no[1]	The study only investigated the fate of the phenyl ring. The retention of the SU bridge is an indication of the potential toxicity and the cleavage of this bridge can be followed independent of the ring structure labeled; therefore additional data on the phototransformation of triazine labeled iodosulfuron is not being requested at this time. The formation and decline of the transformation products was not clearly established during the course of the study. The formation of one transformation product is increasing at study termination and is approaching 10% of the applied material. Identification of this material is needed; however, if this information is not submitted to EPA it may be considered as part of the total toxic residues. Iodosulfuron is toxic to plants. Knowledge of the persistence of iodosulfuron in soil as well as the identification of transformation products will help the Agency determine and estimate exposure of iodosulfuron and other residues of potential toxicological concern to non-target organisms. The results of this study will be used in the environmental fate assessment, and later on, in the ecological risk characterization.

OCSPP Guideline	Data Requirement	Submitted Studies (MRID)	Study Classifications	Are data needed to conduct risk assessment?	Comments
835.4100	Aerobic soil metabolism	45108934, 45109005	supplemental	no[1]	Several of the studies report high levels of unextracted residues. The extraction methods used in these studies are not considered exhaustive. Identification of the unextracted materials is needed to rule out the potential that these residues are of toxicological concern. In absence of the data, these residues may be considered as part of a TTR approach in modeling to account for this uncertainty. Several of the studies were conducted outside the United States additional information on soil taxonomy would be helpful.
		45108935, 45109006	supplemental		
		45108936, 45109007	supplemental		
		45109001, 45109008	supplemental		
		45108933, 45109004	supplemental		
835.4200	Anaerobic soil metabolism	No data		no[1]	No acceptable study has been submitted. Iodosulfuron is toxic to plants. Knowledge of the persistence of iodosulfuron in soil as well as the identification of transformation products would help the Agency determine and estimate exposure of iodosulfuron and other residues of potential toxicological concern to non-target organisms. The results of this study would be used in the environmental fate assessment, drinking water assessment and later on, in the ecological risk characterization. In absence of this data, the aerobic aquatic metabolism study will be used as a surrogate for identifying residues formed under anaerobic conditions that may be of toxicological concern.

OCSPP Guideline	Data Requirement	Submitted Studies (MRID)	Study Classifications	Are data needed to conduct risk assessment?	Comments
835.4300	Aerobic aquatic metabolism	45109021	supplemental	no[1]	Storage stability data was not provided and is needed to confirm the residues were not degrading during storage. Storage stability studies included as part of this study as well as those conducted for the TFD study (MRID 45109010; differences in storage conditions is not known) indicate that samples are metabolically stable over an eight month time period (recoveries are within guideline criteria). Although samples were stored for up to a year, based on these data samples are expected to be stable during the reported storage period. Identification of the unextracted materials is needed to rule out the potential that these residues are of toxicological concern. In absence of the data, these residues may be considered as part of a TTR approach in modeling to account for this uncertainty. Iodosulfuron is toxic to plants. Knowledge of the persistence of iodosulfuron in soil as well as the identification of transformation products will help the Agency determine and estimate exposure of iodosulfuron and other residues of potential toxicological concern to non-target organisms. The results of this study will be used in the environmental fate assessment, drinking water assessment and later on, in the ecological risk characterization.
835.4400	Anaerobic aquatic metabolism	45109002, 45109009	supplemental	no	
		45109023	supplemental		
835.1230 835.1240	Adsorption/ desorption and leaching	45109015	acceptable	no	
		45109014	supplemental		
835.1410	Volatility – laboratory	No data		no	Iodosulfuron is not expected to be volatile based on the reported vapor pressure.

835.6100	Terrestrial field dissipation	45109010	supplemental	no[1]	The study only looked for one environmental transformation product. In addition, these studies were conducted in Europe and no data was provided on how the sites were representative of locations within the US. Storage stability studies conducted over an eight month time period indicate that iodosulfuron and metsulfuron are relatively stable over the 8 month time period (recoveries are within guideline criteria). Study samples were stored for almost one year; however, based on the submitted storage stability data iodosulfuron and metsulfuron are expected to be stable. Despite these deficiencies, the submitted laboratory studies are expected to have identified residues of toxicological concern and using a total toxic residue approach that includes unextracted and unidentified residues reported in the submitted laboratory studies is expected to be protective. No independent lab validations have been submitted for the environmental chemistry methods for iodosulfuron or metsulfuron in soil. The reported LOQ is 0.02 µg/kg (ppb) for iodosulfuron. Due to the high sensitivity of plants to iodosulfuron it is important that the detection limit for iodosulfuron in soil capture the level of concern for the most sensitive species including listed plants.
850.6100	Analytical method in soil	45108502	incomplete	yes	

835.6200	Aquatic field dissipation	No data		no	No independent lab validations have been submitted for the environmental chemistry methods for iodosulfuron in water. The reported LOQ is 0.1 µg/L (ppb) for iodosulfuron. Due to the high sensitivity of plants to iodosulfuron it is important that the detection limit for iodosulfuron in water capture the level of concern for the most sensitive species including listed plants.
850.6100	Analytical method in water	45108522	incomplete	yes	
850.1730	Fish bioconcentration	No data		no - see comments	Iodosulfuron is not expected to bioaccumulate based on the calculated K_{ow}. The safener mefenpyr diethyl may have the potential to bioaccumulate based on the calculated K_{ow}. However, a fish bioconcentration study is cited in the FAO report referenced earlier in this document.
1. Additional data would reduce uncertainty. See comments.					

Effects

Table 21 and **22** identify the ecological effects studies, as well as study classifications and whether or not further data are needed in order to support risk assessment. Rationale for the additional data requested is presented below the tables.

Table 21. Submitted Aquatic Ecological Effects Data for Iodosulfuron

OCSPP Guideline	Data Requirement	Submitted Studies (MRID)	Study Classifications	Are data needed to conduct risk assessment?	Comments
850.1010	Freshwater invertebrate acute toxicity	45109103	Supplemental	No	--
850.1025 850.1035 850.1045 850.1055	Saltwater invertebrate acute toxicity	45109128	Acceptable	No	--
850.1075	Freshwater fish acute toxicity	45109035	Supplemental	No	--
850.1075	Saltwater fish acute toxicity	45109127	Acceptable	No	--
850.1300	Freshwater invertebrate life cycle	45109104	Acceptable	No	--
850.1350	Saltwater invertebrates life cycle	No Study	--	No	Due to the general low toxicity to fish and invertebrates, the value of these additional data to the ecological risk assessment is likely low.
850.1400	Freshwater fish early-life stage	46431804	Supplemental	No	--
850.1400	Saltwater fish early-life stage	No Study	--	No	Due to the general low toxicity to fish and invertebrates, the value of these additional data to the ecological risk assessment is likely low.
850.1500	Fish life cycle	No Study	--	No	--
850.4400	Aquatic plant growth: Tier II vascular plants	45109111	Acceptable	No	
850.5400	Aquatic Plant Growth: Tier II algae	45109105	Acceptable	No	--

Table 22. Submitted Terrestrial Ecological Effects Data for Iodosulfuron

OCSPP Guideline	Data Requirement	Submitted Studies (MRID)	Study Classifications	Are data needed for risk assessment?	Comments
850.2100	Avian oral toxicity	45109029 45109028	Acceptable Acceptable	No	Low toxicity to other avian species and low use rates suggest that risk to passerine species is unlikely to exceed levels of concern.
850.2200	Avian dietary toxicity	45109030	Acceptable	No	--
850.2300	Avian reproduction	46431803	Acceptable	No	--
Non-guideline	Avian inhalation	45108805	Acceptable	No	--
850.3020	Honey bee acute contact toxicity	45109115	Acceptable	No	--
	Honey bee acute oral toxicity	45109114	Acceptable	No	--
850.3030	Honey bee residue on foliage	No Study	--	No	--
850.3040	Field testing for pollinators	No Study	--	No	--
850.4100	Terrestrial plant toxicity: seedling emergence	45109132 45467604 45467602 46431802 45467601 47731901/ 47731701	Acceptable Acceptable Supplemental Supplemental Acceptable In review In review- (Amendment)	Yes	A Seedling Emergence study is needed for a typical end use product for turf uses. Available toxicity data suggest that terrestrial plants are highly sensitive iodosulfuron, however only formulations that contain a chemical safener have been tested. The safener may influence the final toxicity estimation. In addition, performing a repeat for the tomato for 45109132 would reduce the uncertainty in future assessments.
850.4150	Terrestrial plant toxicity: vegetative vigor	45109131 45467606 45467605 45467603	Acceptable Acceptable Acceptable Supplemental	Yes	A Vegetative Vigor study is needed for a typical end use product for turf uses. Available toxicity data suggest that terrestrial plants are highly sensitive to iodosulfuron, however only formulations that contain a chemical safener have been tested. The safener may influence the final toxicity estimation. In addition, performing a repeat for lettuce and onions for 45109131 would reduce the uncertainty in future assessments.

OCSPP Guideline	Data Requirement	Submitted Studies (MRID)	Study Classifications	Are data needed for risk assessment?	Comments
124-1	Terrestrial Plant Field Testing	No Study		No	The November 26, 2002 Notice of Registration for EPA Reg. No. 264-686 identified this study as a requirement. However, a waiver was submitted and accepted, therefore, data are no longer required.
124-2	Aquatic Plant Field Testing	No study		No	The November 26, 2002 Notice of Registration for EPA Reg. No. 264-686 identified this study as a requirement. However, a waiver was submitted and accepted, therefore, data are no longer required.

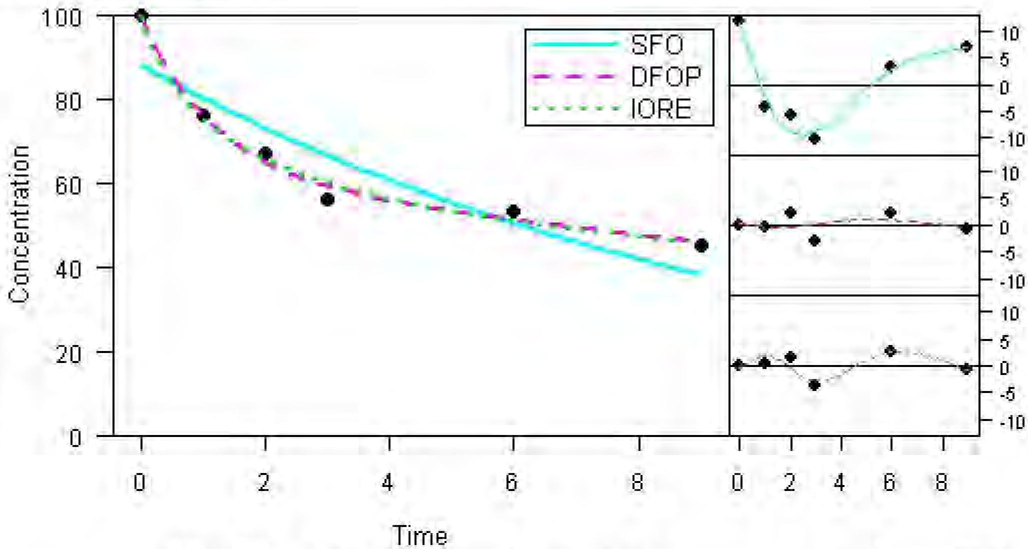
Additional information that may be useful to the EPA includes:

1. ecological incidents (non-target plant damage and avian, fish, reptilian, amphibian and mammalian mortalities) not already reported to the Agency
2. major degradate and safener fate and toxicity data

APPENDIX A
Environmental Fate
Kinetic Analysis Images

soil photo 45109003

day	amount
0	100.
1	75.9
2	67.3
3	56.2
6	53.5
9	45.0

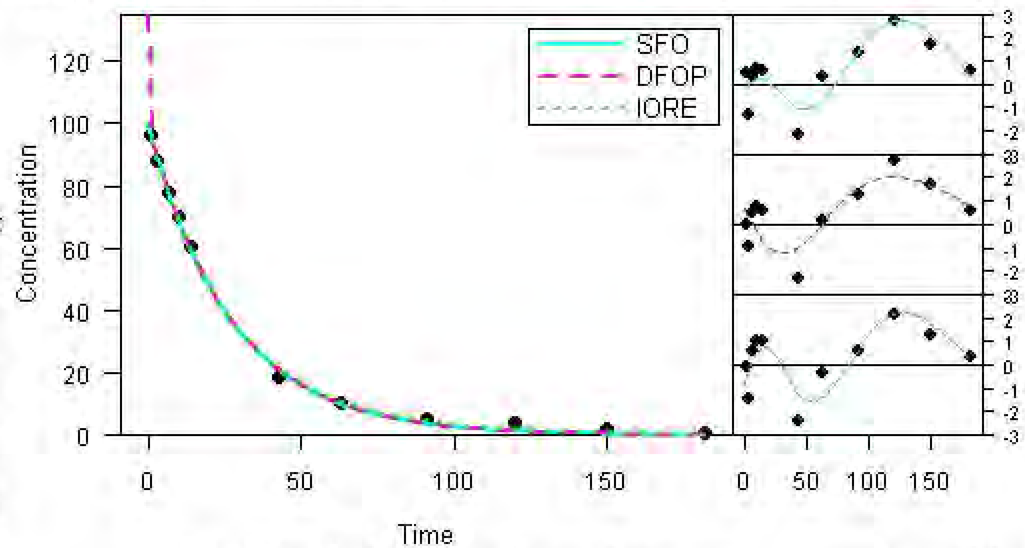


	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	7.46	24.8	9.3	88.1	k = 0.0929
DFOP	6.64	52.8	2.8	100	f = 0.372, k_0 = 0.872, k_1 = 0.0348
IORE	6.36	2439	2.7	100	N = 4.65, k = 2.54e-08

S_C	51.2
S_{SFO}	361
Slow $t_{1/2}$	19.9
$t_{R\ IORE}$	734

Aerobic aquatic metabolism 45109021 Nidda water system

day	amount
1	96.7
3	88.2
7	77.7
10	70.0
14	60.5
43	18.7
63	10.4
91	5.00
120	4.00
150	2.10
182	0.700

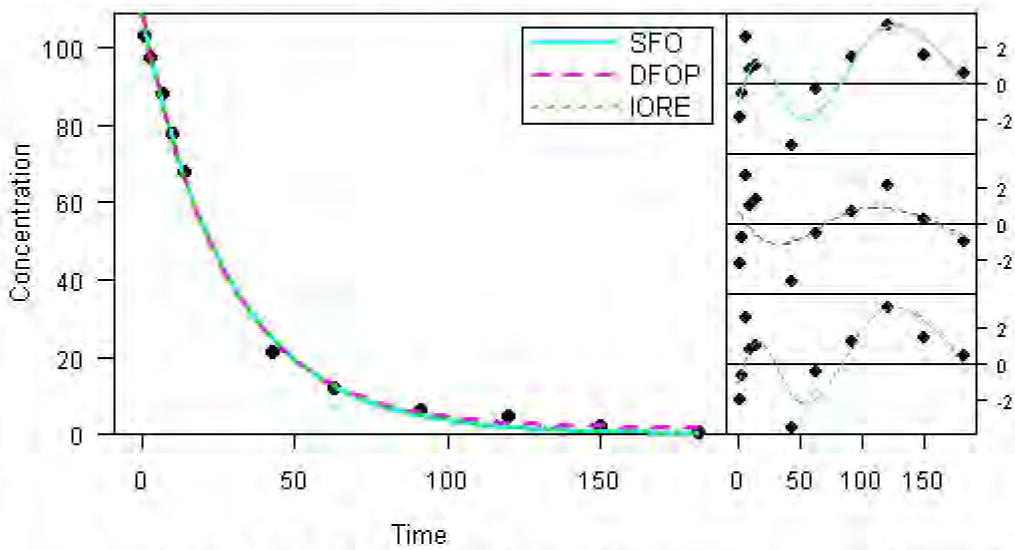


	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	19.1	63.3	2.8	99.8	k = 0.0364
DFOP	10.6	55.2	3	135	f = 0.735, k_0 = 0.0361, k_1 = 3.76
IORE	18.6	65	2.7	101	N = 1.06, k = 0.0283

S_C	23.6
S_{SFO}	19.9
Slow $t_{1/2}$	19.2
$t_{R\ IORE}$	19.6

Aerobic aquatic metabolism 45109021 Nidda total system

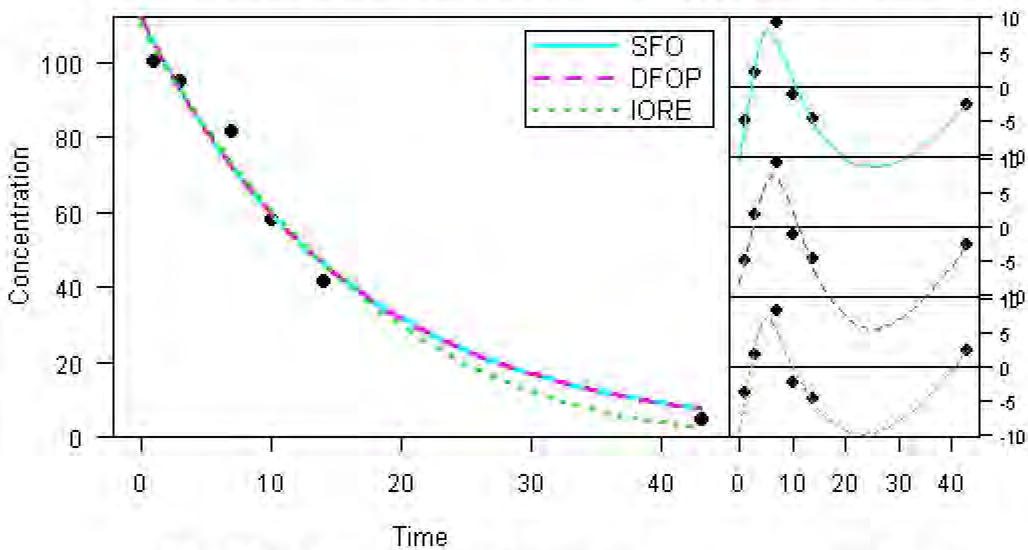
day	amount
1	103.
3	97.4
7	87.9
10	77.8
14	68.1
43	21.2
63	12.1
91	6.10
120	4.90
150	2.10
182	0.700



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	20.1	66.9	3.5	109	k = 0.0344	S_C	51
DFOP	19.8	67.6	3.5	109	f = 0.991, k_0 = 0.0356, k_1 = -0.00237	S_{SFO}	38.6
IORE	20.1	67.1	3.6	109	N = 1.01, k = 0.0335	Slow $t_{1/2}$	-292
						$t_{R\ IORE}$	20.2

Aerobic aquatic metabolism 45109021 Rhine total system

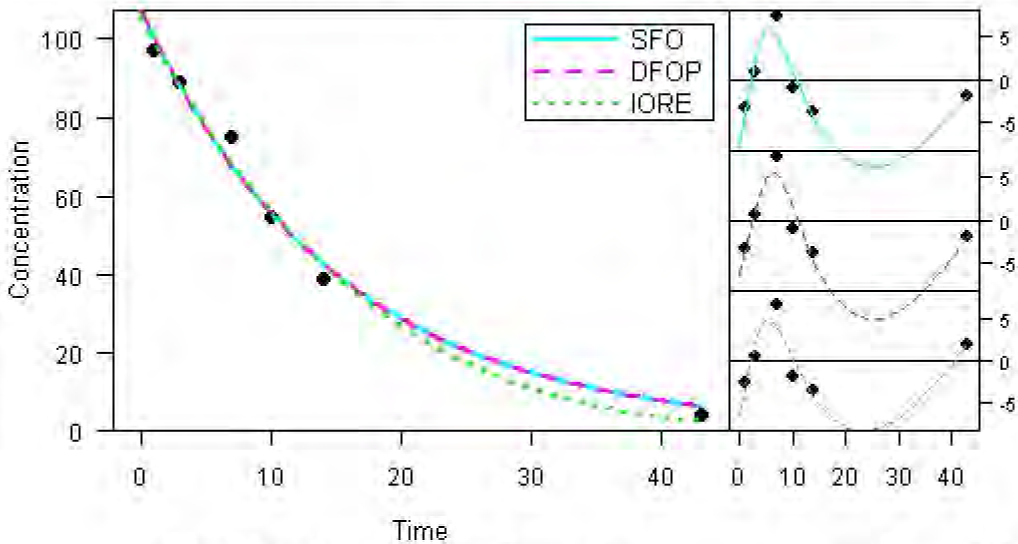
day	amount
1	101.
3	95.0
7	81.7
10	58.5
14	41.8
43	4.80



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	11	36.5	6.2	113	k = 0.0632	S_C	235
DFOP	11	36.5	7.8	113	f = 0.873, k_0 = 0.0632, k_1 = 0.0632	S_{SFO}	147
IORE	11.4	31	6.1	111	N = 0.728, k = 0.198	Slow $t_{1/2}$	11
						$t_{R\ IORE}$	9.34

Aerobic aquatic metabolism 45109021 Rhine water system

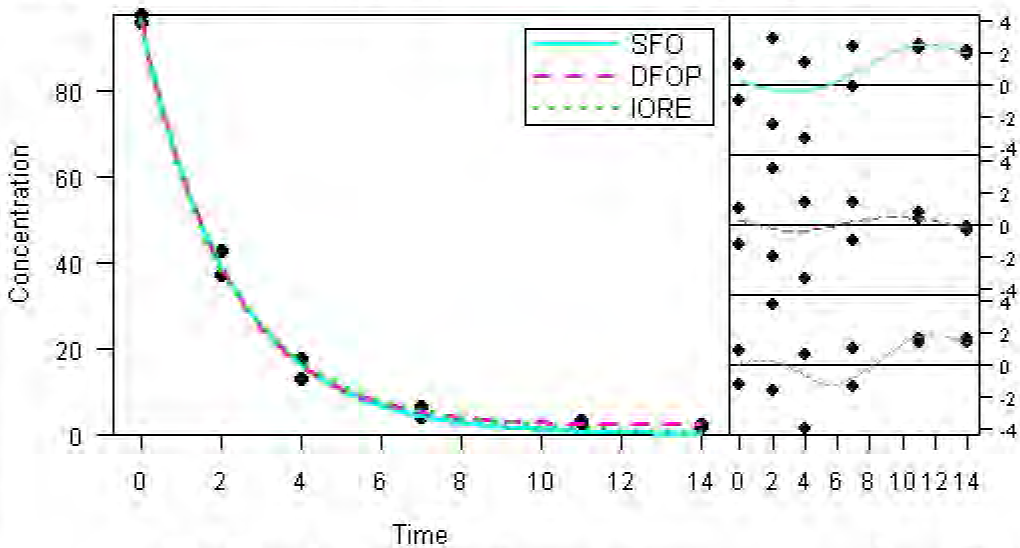
day	amount
1	97.4
3	89.1
7	75.3
10	54.6
14	39.0
43	4.30



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	10.5	34.9	5	108	k = 0.0659	S_C	137
DFOP	10.5	34.9	6.4	108	f = 0.804, k_0 = 0.0659, k_1 = 0.0659	S_{SFO}	86.9
IORE	10.9	30.3	4.9	106	N = 0.763, k = 0.176	Slow $t_{1/2}$	10.5
						$t_{R\ IORE}$	9.13

aerobic soil metabolism 45108933 loamy sand

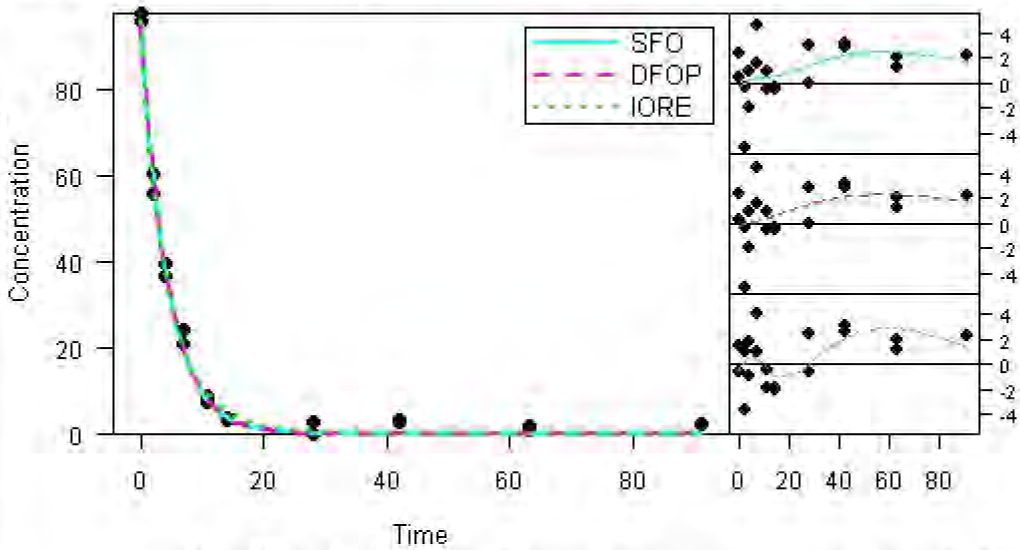
day	amount
0	95.9
2	37.4
4	13.1
7	4.20
11	3.20
14	2.00
0	98.1
2	42.9
4	17.8
7	6.70
11	2.90
14	2.30



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	1.57	5.2	4	97	k = 0.443	S_C	62.5
DFOP	1.53	5.3	2.2	97.1	f = 0.991, k_0 = 0.459, k_1 = -0.0696	S_{SFO}	54.6
IORE	1.5	5.48	3.8	97.2	N = 1.11, k = 0.287	Slow $t_{1/2}$	-9.96
						$t_{R\ IORE}$	1.65

aerobic soil metabolism 45108933 sand

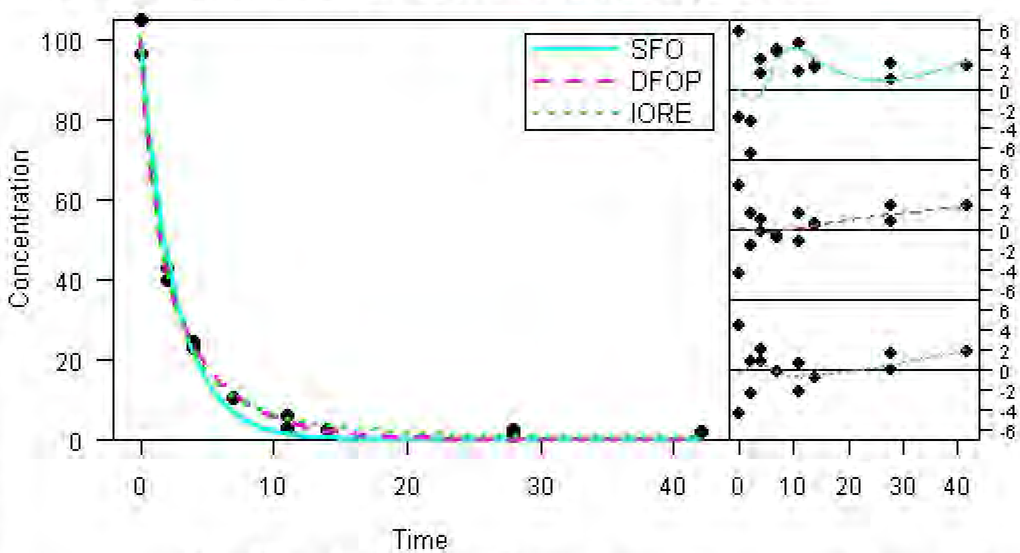
day	amount
0	95.8
2	55.6
4	39.5
7	24.1
11	7.40
14	3.60
28	0.0900
42	2.80
63	1.20
91	2.20
0	97.8
2	60.3
4	36.7
7	21.1
11	8.90
14	3.50
28	3.10
42	3.20
63	2.00



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	3.06	10.2	6.3	95.5	k= 0.226	S_C	96.4
DFOP	3.06	10.2	7	95.5	f= 1.01, k_0= 0.226, k_1= 0.226	S_{SFO}	97.6
IORE	2.9	10.9	6	96.4	N= 1.14, k= 0.131	Slow $t_1/_2$	3.07
						$t_{R\ IORE}$	3.27

aerobic soil metabolism 45108933 sandy loam

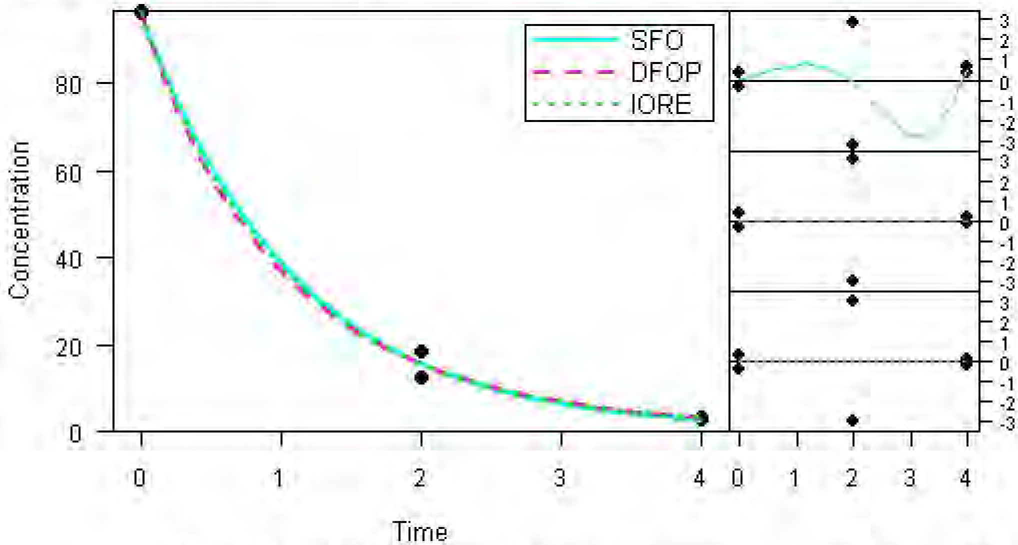
day	amount
0	105.
2	43.2
4	24.6
7	10.7
11	3.30
14	2.80
28	0.900
42	2.30
0	96.4
2	40.0
4	23.3
7	10.8
11	6.00
14	2.70
28	2.50



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	1.82	6.05	9.3	99.4	k= 0.38	S_C	75.6
DFOP	1.47	7.55	3.9	101	f= 0.423, k_0= 1.06, k_1= 0.232	S_{SFO}	181
IORE	1.54	7.43	3.5	101	N= 1.42, k= 0.0755	Slow $t_1/_2$	2.98
						$t_{R\ IORE}$	2.24

aerobic soil metabolism 45108933 silt loam

day	amount
0	96.8
2	18.6
4	3.20
0	96.1
2	12.6
4	2.90

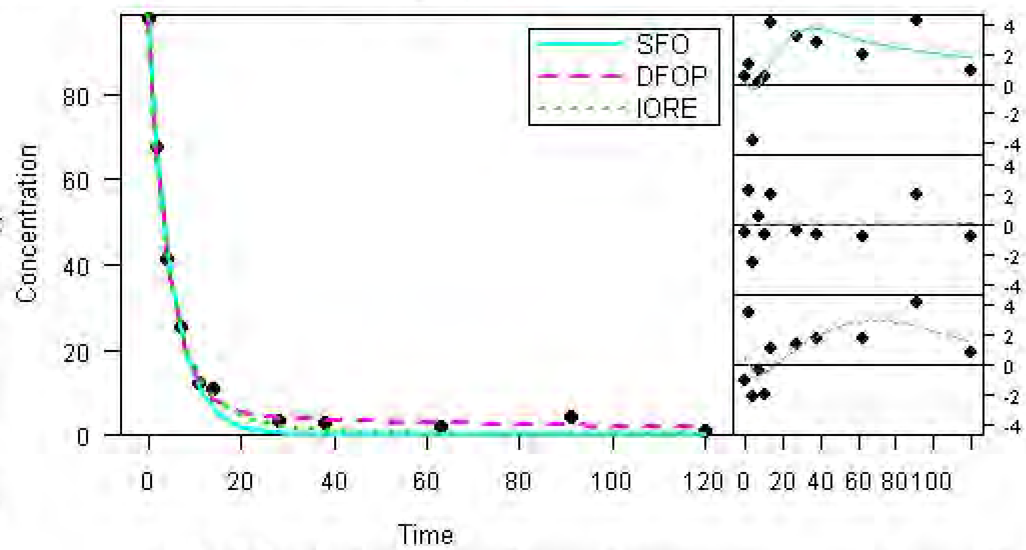


	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	0.765	2.54	0.67	96.4	k = 0.906
DFOP	0.711	2.58	NaN	96.4	f = 0.765, k_0 = 0.798, k_1 = 1.78
IORE	0.734	2.57	Inf	96.4	N = 1.06, k = 0.722

S_C	36.6
S_{SFO}	18.8
Slow $t_{1/2}$	0.868
$t_{R\ IORE}$	0.773

Iodosulfuron 45108934 clay loam

day	amount
0	97.8
2	67.6
4	41.3
7	25.4
11	12.2
14	10.7
28	3.60
38	2.80
63	2.00
91	4.30
120	0.900

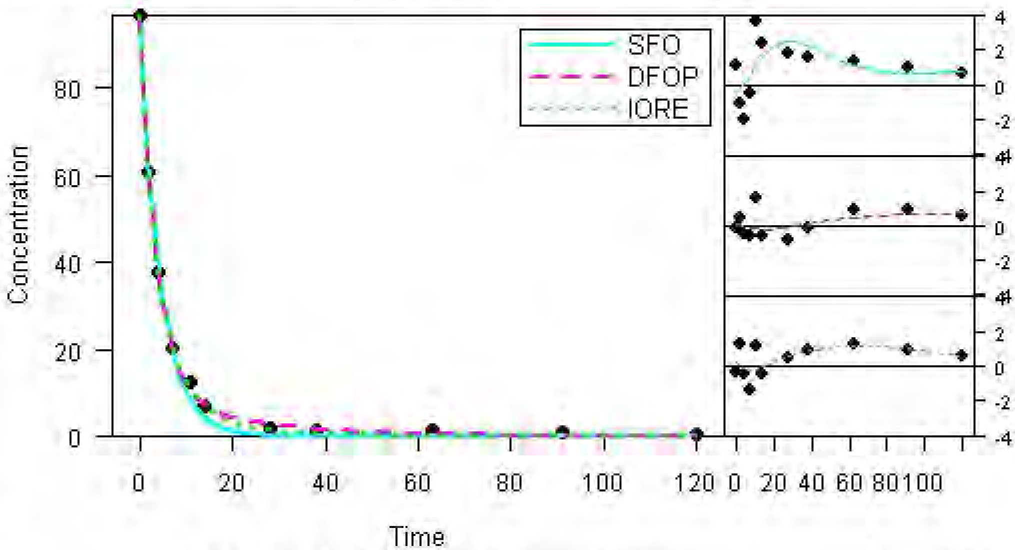


	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	3.6	12	8.6	97.3	k = 0.192
DFOP	3.41	13	5.3	98.4	f = 0.951, k_0 = 0.218, k_1 = 0.00831
IORE	3.31	13.7	7.3	98.9	N = 1.26, k = 0.0697

S_C	66
S_{SFO}	74.3
Slow $t_{1/2}$	83.5
$t_{R\ IORE}$	4.14

Iodosulfuron 45108934 silt loam

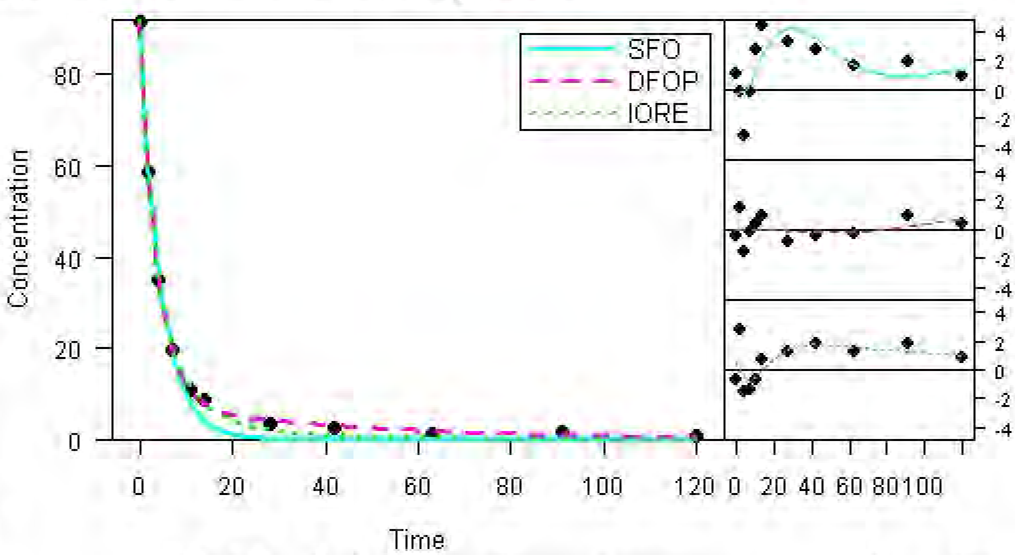
day	amount
0	96.6
2	60.7
4	38.0
7	20.3
11	12.4
14	6.90
28	2.00
38	1.60
63	1.40
91	1.00
120	0.600



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	3.18	10.6	6.5	95.4	k= 0.218	S_C	12.1
DFOP	2.96	11.8	3	96.7	f = 0.894, k_0 = 0.265, k_1 = 0.047	S_{SFO}	34.8
IORE	2.91	12	3.5	97	N = 1.25, k = 0.0816	Slow $t_{1/2}$	14.7
						$t_{R\ IORE}$	3.62

Iodosulfuron 45108935 loamy sand

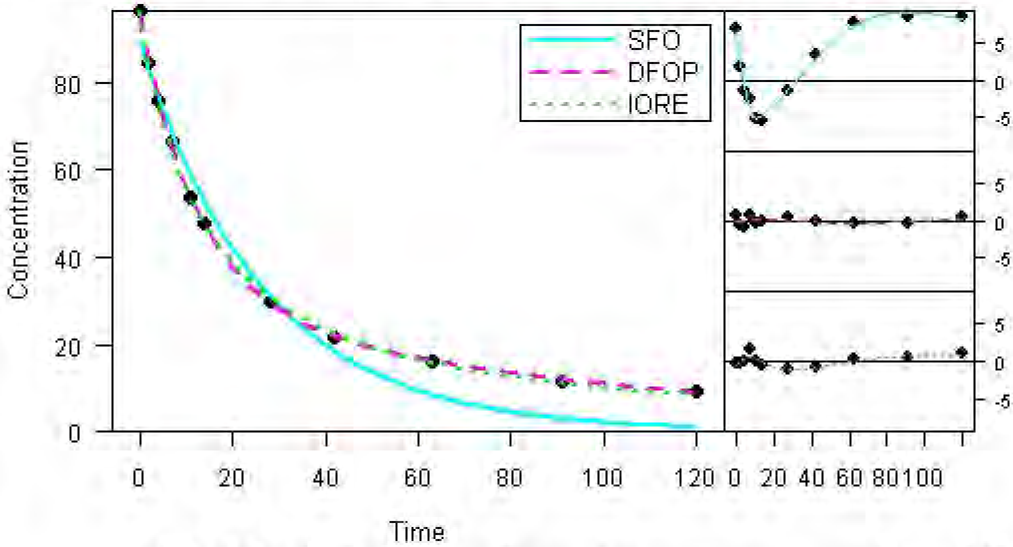
day	amount
0	91.4
2	58.6
4	35.0
7	19.9
11	11.2
14	8.90
28	3.50
42	2.70
63	1.60
91	1.90
120	0.900



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	3.23	10.7	9.1	90.3	k= 0.215	S_C	30.8
DFOP	2.96	12.5	3.4	91.8	f = 0.912, k_0 = 0.264, k_1 = 0.0229	S_{SFO}	63.7
IORE	2.87	13	5.7	92.1	N = 1.35, k = 0.0553	Slow $t_{1/2}$	30.2
						$t_{R\ IORE}$	3.91

Iodosulfuron 45108936 silt loam, 10, 40 mwrc

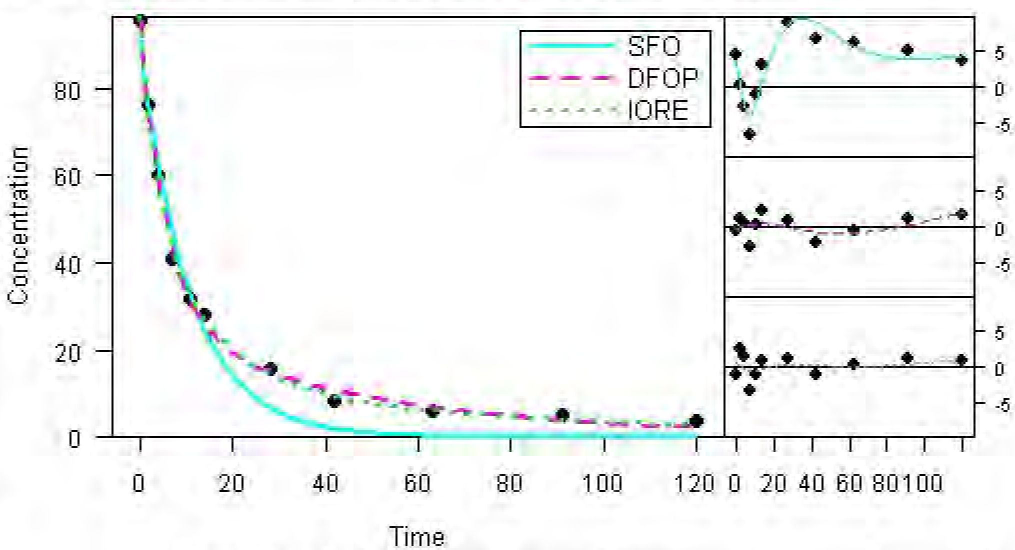
day	amount
0	96.4
2	84.7
4	75.7
7	66.4
11	54.0
14	47.6
28	30.0
42	21.8
63	16.0
91	11.5
120	9.40



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	18.5	61.4	9.4	89.5	k = 0.0375	S_C	7.97
DFOP	13.9	113	1	95.7	f = 0.687, k_0 = 0.0795, k_1 = 0.0101	S_{SFO}	328
IORE	13.8	104	1.3	96.7	N = 1.84, k = 0.00144	Slow $t_{1/2}$	68.3
						$t_{R\ IORE}$	31.3

Iodosulfuron 45108936 silt loam, 20, 30 mwrc

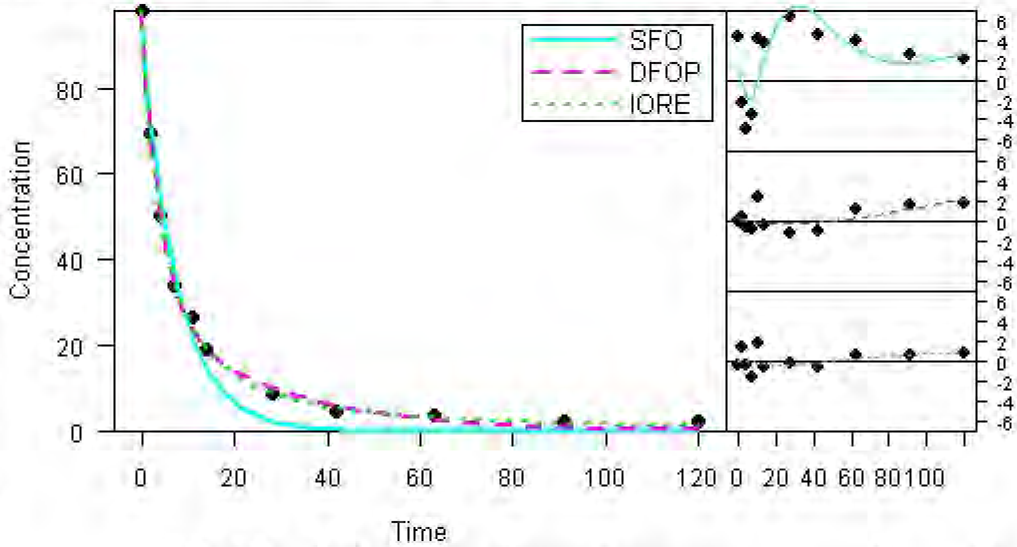
day	amount
0	95.4
2	76.0
4	60.1
7	41.1
11	31.8
14	28.1
28	15.7
42	8.40
63	6.20
91	4.90
120	3.60



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	7.51	24.9	12	91.2	k = 0.0924	S_C	34.9
DFOP	6.09	47.3	3.9	95.9	f = 0.73, k_0 = 0.168, k_1 = 0.0211	S_{SFO}	274
IORE	6.02	41.2	3.9	96.6	N = 1.76, k = 0.00473	Slow $t_{1/2}$	32.9
						$t_{R\ IORE}$	12.4

Iodosulfuron 45108936 silt loam, 20, 40 mwrc

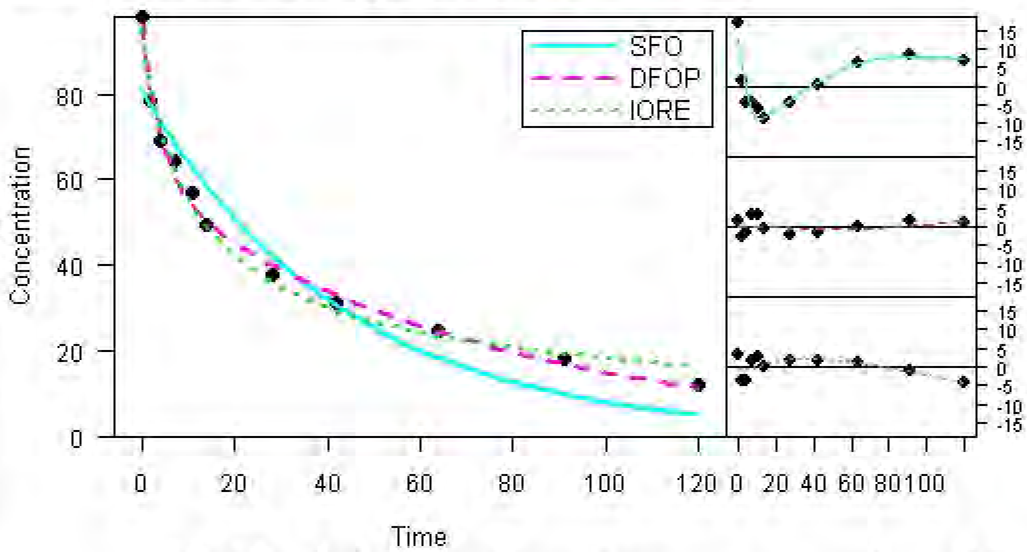
day	amount
0	97.8
2	69.7
4	50.6
7	34.2
11	26.5
14	19.0
28	8.90
42	4.90
63	3.90
91	2.60
120	2.20



	DT_{50}	DT_{90}	χ^2	C_0	Parameters	S_C	14
SFO	5.34	17.7	11	93.4	k = 0.13	S_{SFO}	181
DFOP	4.33	29.1	3.9	97.8	f = 0.703, k_0 = 0.241, k_1 = 0.0376	Slow $t_{1/2}$	18.4
IORE	4.3	26.5	2.8	98.2	N = 1.66, k = 0.00989	$t_{R\ IORE}$	7.96

aerobic aoil 45109001 clay 25 MWC

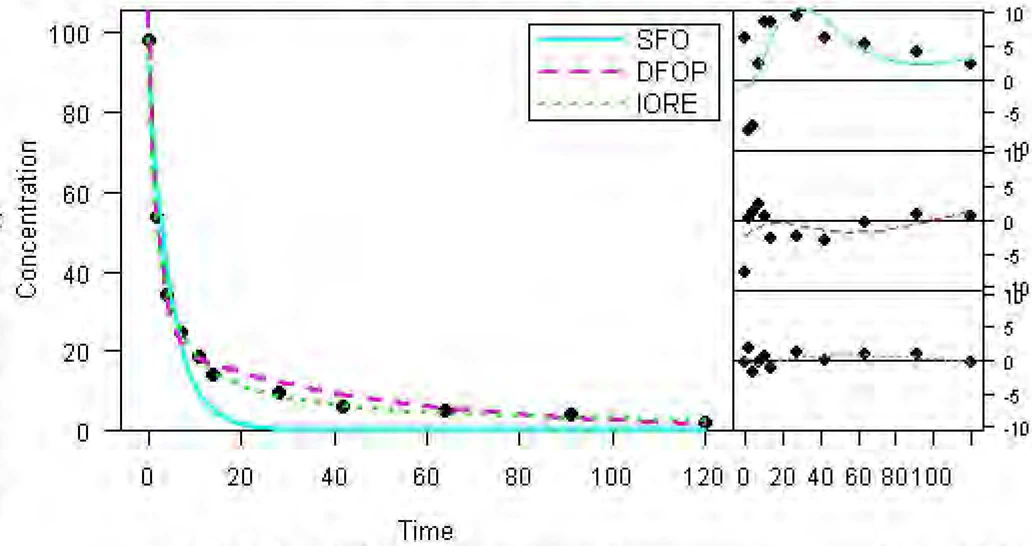
day	amount
0	98.2
2	78.5
4	69.2
7	64.6
11	56.9
14	49.6
28	38.0
42	31.3
64	24.7
91	18.4
120	12.1



	DT_{50}	DT_{90}	χ^2	C_0	Parameters	S_C	95.9
SFO	30	99.7	12	81	k = 0.0231	S_{SFO}	634
DFOP	16.2	132	3.7	96.5	f = 0.388, k_0 = 0.224, k_1 = 0.0137	Slow $t_{1/2}$	50.5
IORE	15.4	303	4.4	95.1	N = 2.62, k = 5.16e-05	$t_{R\ IORE}$	91.3

aerobic aoil 45109001 clay 50 MWC

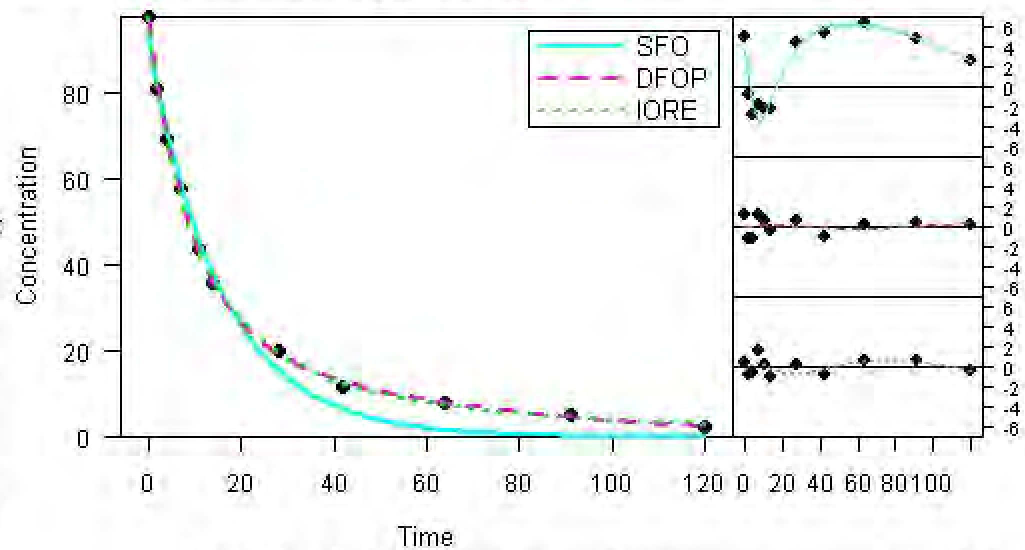
day	amount
0	98.3
2	54.1
4	34.4
7	24.9
11	18.7
14	14.0
28	9.90
42	6.10
64	5.20
91	4.00
120	2.20



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	3.45	11.5	21	92.2	k= 0.201	S_C	15.4
DFOP	2.06	34.7	10	106	f= 0.213, k_0= 0.0218, k_1= 0.474	S_{SFO}	469
IORE	2.27	24	3.5	98.5	N= 2.13, k= 0.00253	Slow $t_{1/2}$	31.8
						$t_{R\ IORE}$	7.24

aerobic aoil 45109001 clay loam 25 MWC

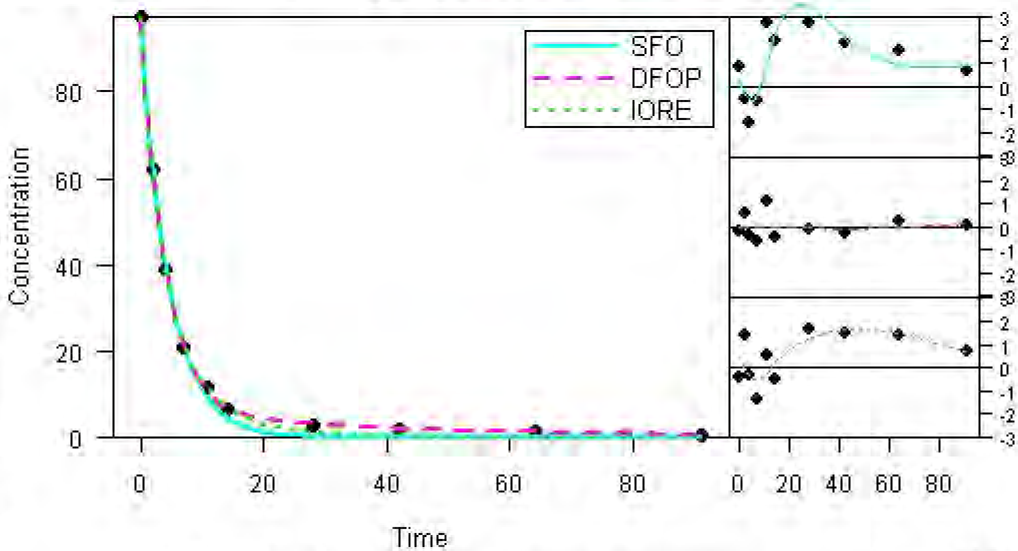
day	amount
0	98.0
2	81.1
4	69.2
7	57.8
11	44.0
14	35.9
28	20.0
42	11.8
64	8.00
91	5.00
120	2.60



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	10.9	36.3	7.9	93	k= 0.0635	S_C	8.24
DFOP	9.27	54.4	1.9	96.9	f= 0.704, k_0= 0.11, k_1= 0.0202	S_{SFO}	165
IORE	9.17	51.4	1.6	97.6	N= 1.57, k= 0.00678	Slow $t_{1/2}$	34.2
						$t_{R\ IORE}$	15.5

aerobic aoil 45109001 clay loam 50 MWC

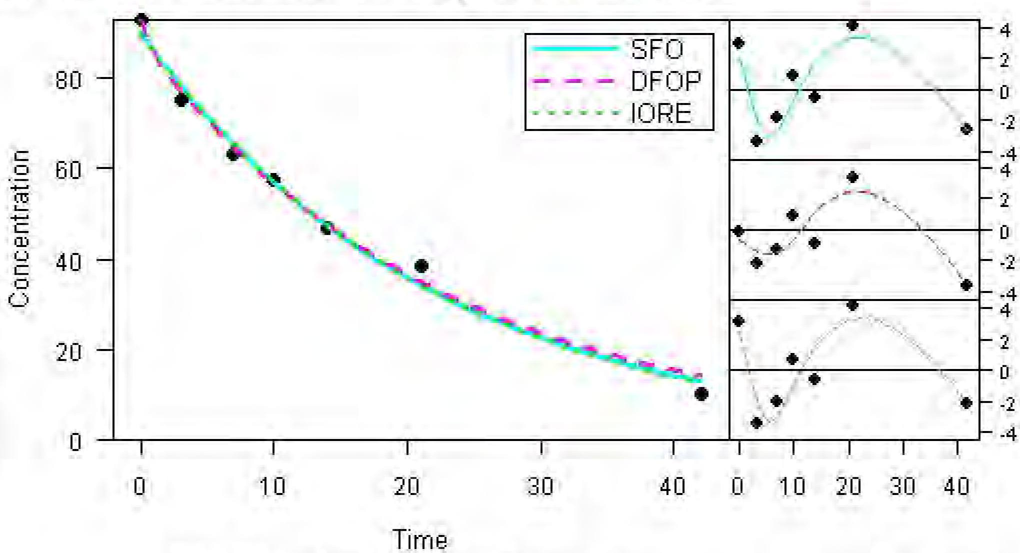
day	amount
0	97.1
2	62.1
4	39.2
7	20.7
11	11.8
14	6.70
28	3.00
42	1.90
64	1.50
91	0.700



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	3.22	10.7	5.6	96.3	k= 0.215	S_C	16.6
DFOP	3.05	11.6	1.8	97.3	f= 0.939, k_0= 0.246, k_1= 0.0241	S_{SFO}	29.2
IORE	3	11.9	3.8	97.6	N = 1.21, k= 0.0941	Slow $t_{1/2}$	28.7
						$t_{R\ IORE}$	3.59

Iodosulfuron 45109002 loamy sand water

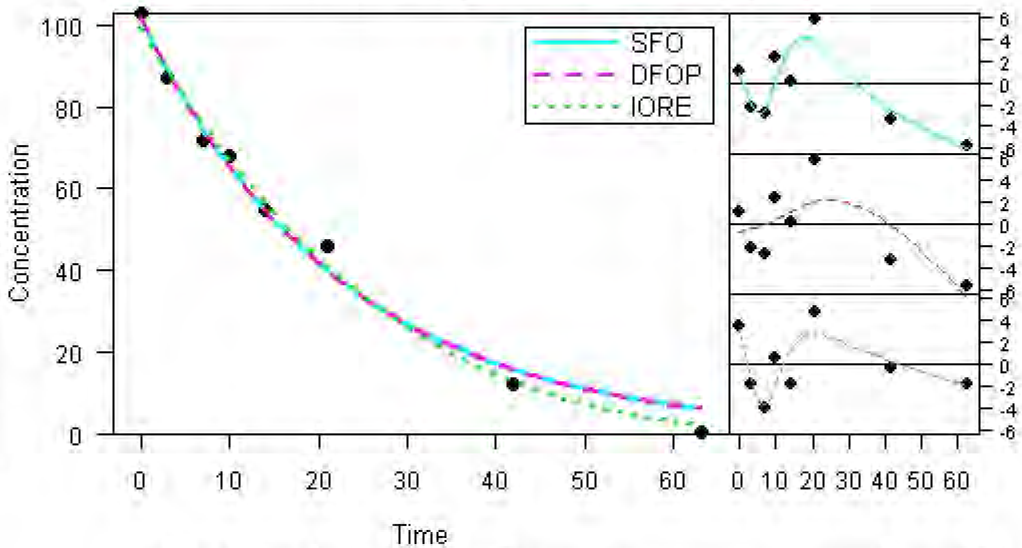
day	amount
0	92.9
3	75.0
7	63.4
10	57.7
14	46.8
21	38.4
42	10.4



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	15.1	50.1	3.8	90	k= 0.046	S_C	82
DFOP	14.5	51.3	3.7	93.1	f= 0.0558, k_0= 1.15, k_1= 0.0437	S_{SFO}	48.4
IORE	15.2	48.8	4.1	89.8	N= 0.956, k= 0.0546	Slow $t_{1/2}$	15.9
						$t_{R\ IORE}$	14.7

Iodosulfuron 45109002 loamy sand total system

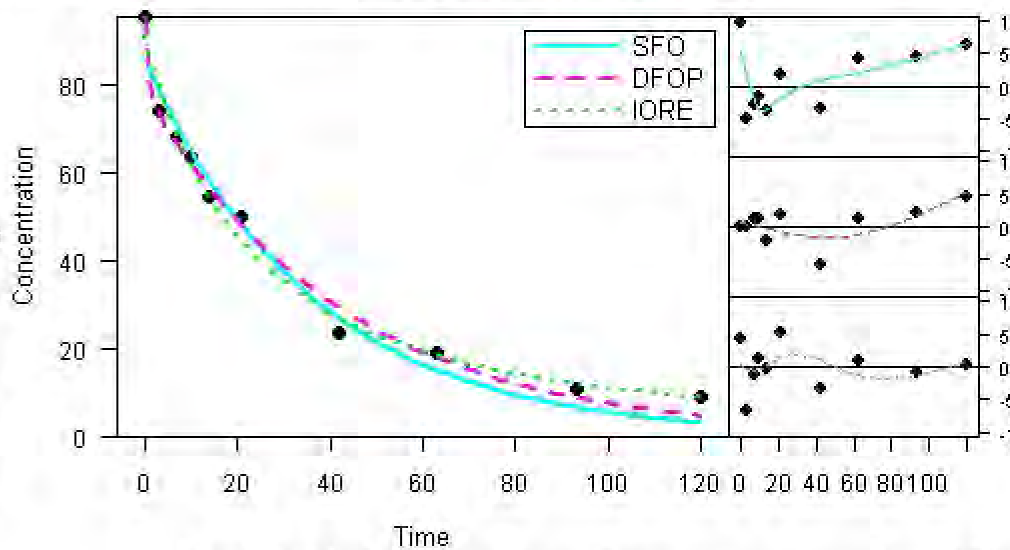
day	amount
0	103.
3	87.0
7	71.9
10	67.8
14	54.9
21	46.0
42	12.5
63	0.500



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	15.6	51.9	5	102	k = 0.0444	S_C	94.6
DFOP	15.6	51.9	5.8	102	f = 0.933, k_0 = 0.0444, k_1 = 0.0443	S_{SFO}	97.8
IORE	17	45.8	4.2	99.5	N = 0.721, k = 0.134	Slow $t_{1/2}$	15.6
						$t_{R\ IORE}$	13.8

Iodosulfuron 45109002 silt loam water

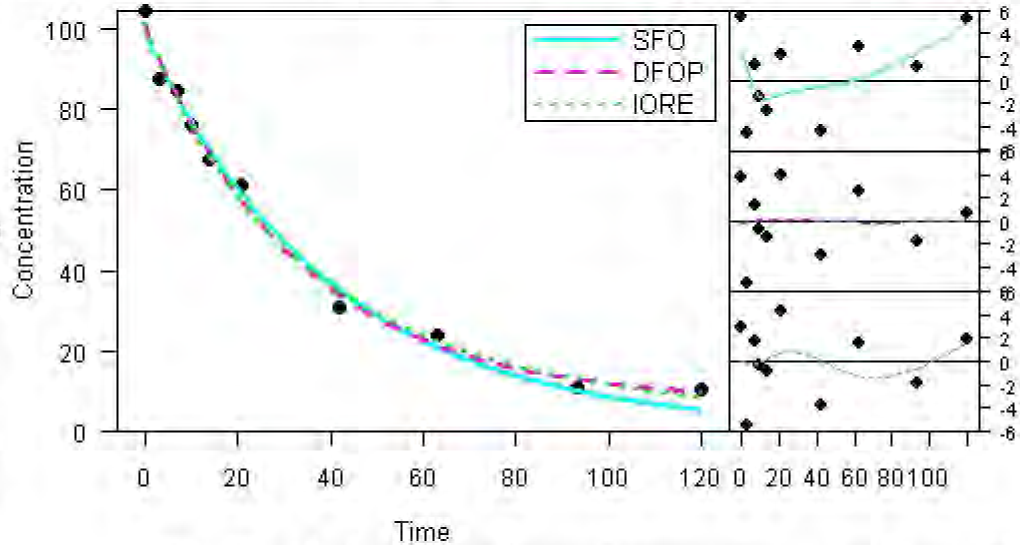
day	amount
0	95.9
3	74.2
7	68.2
10	63.8
14	54.7
21	50.0
42	23.7
63	19.4
93	11.2
120	9.40



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	25.2	83.8	8.3	86.1	k = 0.0275	S_C	150
DFOP	21.3	90.1	5.1	95.9	f = 0.176, k_0 = 1.13, k_1 = 0.0234	S_{SFO}	239
IORE	20.2	118	5.9	91.5	N = 1.61, k = 0.00271	Slow $t_{1/2}$	29.6
						$t_{R\ IORE}$	35.5

Iodosulfuron 45109002 silt loam total system

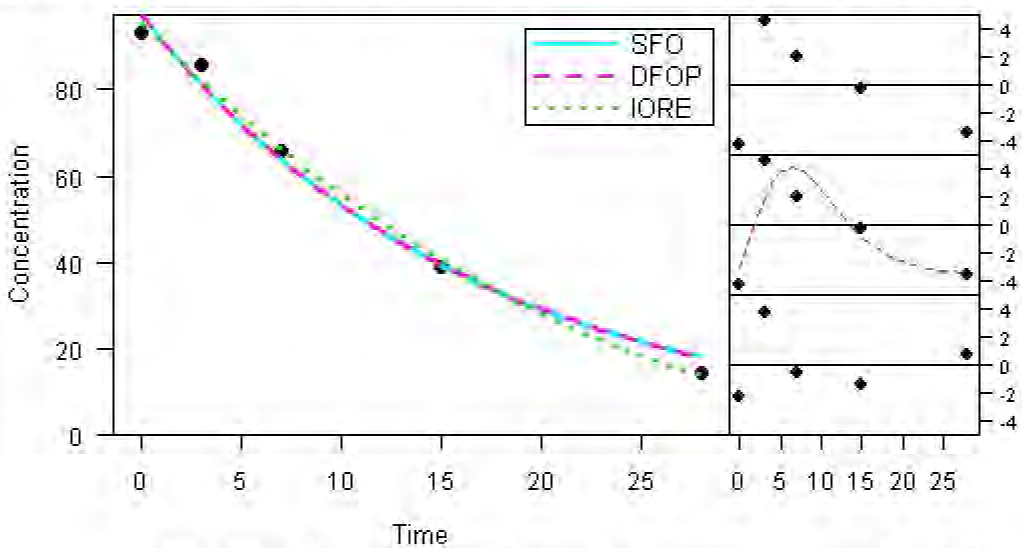
day	amount
0	105.
3	87.5
7	84.7
10	76.0
14	67.5
21	61.3
42	30.9
63	24.0
93	11.2
120	10.4



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	28.2	93.7	5.1	99.1	k = 0.0246	S_C	117
DFOP	25.9	NA	4.6	101	f = 0.94, k_0 = 0.0295, k_1 = -0.00121	S_{SFO}	123
IORE	25.6	108	4.4	102	N = 1.28, k = 0.00823	Slow $t_{1/2}$	-574
						$t_{R\ IORE}$	32.6

Anaerobic aquatic metabolism 45109023 phenyl water

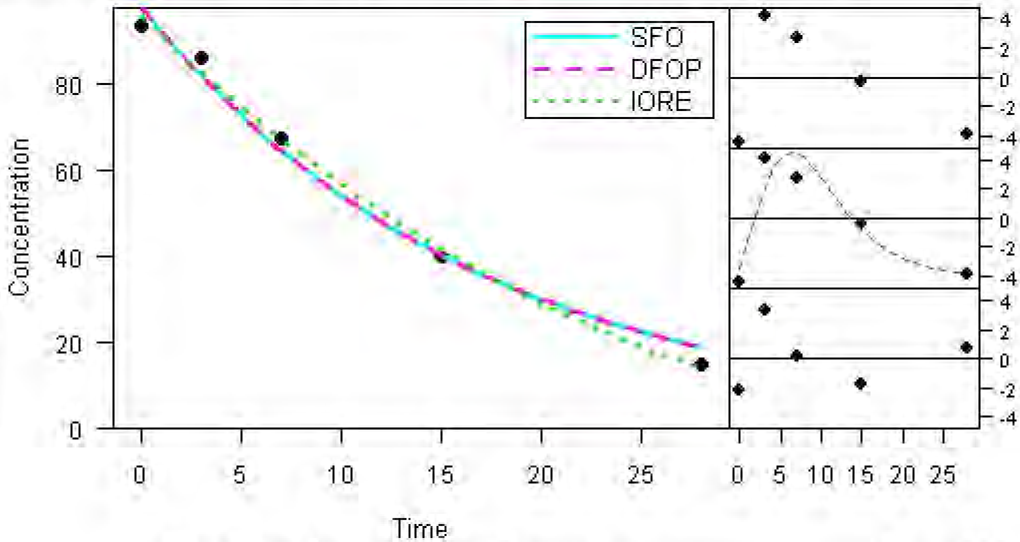
day	amount
0	93.3
3	86.0
7	65.9
15	39.2
28	14.5



	DT_{50}	DT_{90}	χ^2	C_0	Parameters		
SFO	11.5	38.2	4.5	97.6	k = 0.0603	S_C	58.8
DFOP	11.5	38.2	6.4	97.6	f = 0.538, k_0 = 0.0603, k_1 = 0.0603	S_{SFO}	55.4
IORE	12.5	31.3	3.2	95.6	N = 0.607, k = 0.29	Slow $t_{1/2}$	11.5
						$t_{R\ IORE}$	9.43

Anaerobic aquatic metabolism 45109023 phenyl

day	amount
0	93.3
3	86.0
7	67.4
15	40.0
28	14.9



	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	11.8	39.1	4.6	97.7	k = 0.0589
DFOP	11.8	39.1	6.5	97.7	f = 0.621, k_0 = 0.0589, k_1 = 0.0589
IORE	12.9	31.4	3	95.5	N = 0.568, k = 0.333

S_C	51.5
S_{SFO}	58.9
Slow $t_{1/2}$	11.8
$t_{R\ IORE}$	9.46

APPENDIX B
SIP Analysis

Table 1. Inputs

Parameter	Value
Chemical name	Iodosulfuron
Solubility (in water at 25^{o}C; mg/L)	25000
Mammalian LD_{50} (mg/kg-bw)	2448
Mammalian test species	laboratory rat
Body weight (g) of "other" mammalian species	
Mammalian NOAEL (mg/kg-bw)	500
Mammalian test species	laboratory rat
Body weight (g) of "other" mammalian species	
Avian LD_{50} (mg/kg-bw)	1744
Avian test species	mallard duck
Body weight (g) of "other" avian species	
Mineau scaling factor	1.15
Mallard NOAEC (mg/kg-diet)	
Bobwhite quail NOAEC (mg/kg-diet)	372
NOAEC (mg/kg-diet) for other bird species	
Body weight (g) of other avian species	
NOAEC (mg/kg-diet) for 2nd other bird species	
Body weight (g) of 2nd other avian species	

Table 2. Mammalian Results

Parameter	Acute	Chronic
Upper bound exposure (mg/kg-bw)	4300.0000	4300.0000
Adjusted toxicity value (mg/kg-bw)	1882.9051	384.5803
Ratio of exposure to toxicity	2.2837	11.1810
Conclusion*	**Exposure through drinking water alone is a potential concern for mammals**	**Exposure through drinking water alone is a potential concern for mammals**

Table 3. Avian Results

Parameter	Acute	Chronic
Upper bound exposure (mg/kg-bw)	20250.0000	20250.0000
Adjusted toxicity value (mg/kg-bw)	905.5291	39.5430
Ratio of exposure to acute toxicity	22.3626	512.1011
Conclusion*	**Exposure through drinking water alone is a potential concern for birds**	**Exposure through drinking water alone is a potential concern for birds**

*Conclusion is for drinking water exposure alone. This does not combine all routes of exposure. Therefore, when aggregated with other routes (*i.e.*, diet, inhalation, dermal), pesticide exposure through drinking water may contribute to a total exposure that has potential for effects to non-target animals.

APPENDIX C

STIR Analysis Results

Application and Chemical Information		
Enter Chemical Name	Iodosulfuron	
Enter Chemical Use	Crop	
Is the Application a Spray? (enter y or n)	y	
If Spray What Type (enter ground or air)	ground	
Enter Chemical Molecular Weight (g/mole)	529.24	
Enter Chemical Vapor Pressure (mmHg)	5.03E-11	
Enter Application Rate (lb a.i./acre)	0.0089	
Toxicity Properties		
Bird		
Enter Lowest Bird Oral LD_{50} (mg/kg bw)	1744	
Enter Mineau Scaling Factor	1.15	
Enter Tested Bird Weight (kg)	0.178	
Mammal		
Enter Lowest Rat Oral LD_{50} (mg/kg bw)	2448	
Enter Lowest Rat Inhalation LC_{50} (mg/L)	2.81	
Duration of Rat Inhalation Study (hrs)	4	
Enter Rat Weight (kg)	0.35	
Output		
Results Avian (0.020 kg)		
Maximum Vapor Concentration in Air at Saturation (mg/m^3)	1.43E-06	
Maximum 1-hour Vapor Inhalation Dose (mg/kg)	1.80E-07	
Adjusted Inhalation LD_{50}	1.12E+01	
Ratio of Vapor Dose to Adjusted Inhalation LD_{50}	1.61E-08	Exposure not Likely Significant
Maximum Post-treatment Spray Inhalation Dose (mg/kg)	9.40E-04	
Ratio of Droplet Inhalation Dose to Adjusted Inhalation LD_{50}	8.43E-05	Exposure not Likely Significant
Results Mammalian (0.015 kg)		
Maximum Vapor Concentration in Air at Saturation (mg/m^3)	1.43E-06	
Maximum 1-hour Vapor Inhalation Dose (mg/kg)	2.26E-07	
Adjusted Inhalation LD_{50}	1.67E+02	
Ratio of Vapor Dose to Adjusted Inhalation LD_{50}	1.35E-09	Exposure not Likely Significant
Maximum Post-treatment Spray Inhalation Dose (mg/kg)	1.18E-03	
Ratio of Droplet Inhalation Dose to Adjusted Inhalation LD_{50}	7.07E-06	Exposure not Likely Significant

APPENDIX D

ECOSAR Results for the Safeners Isoxadifen-ethyl and Mefenpyr-diethyl

Isoxadifen-ethyl

ECOSAR Version 1.10 Results Page
SMILES : C2(C(=O)(OCC))=NOC(C2)(c3ccccc3)c1ccccc1
CHEM :
CAS Num:
ChemID1:
MOL FOR: C18 H17 N1 O3
MOL WT : 295.34
Log Kow: 5.660 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: (deg C, PhysProp DB exp value for Wat Sol estimate)
Wat Sol: 0.1917 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: (PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 5.660 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.1917 (mg/L, EPISuite WSKowwin v1.43 Estimate)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Measured Duration	End Pt	mg/L (ppm)	Ecosar Class	Reference
163520-33-0	Daphnid	48-hr	LC50	NES	Aliphatic Amines	OPP Pesticide Ecotoxicity DB

ECOSAR v1.1 Class-specific Estimations

Aliphatic Amines

ECOSAR Class	Organism	Predicted Duration	End Pt	mg/L (ppm)
Aliphatic Amines	: Fish	96-hr	LC50	0.223 *
Aliphatic Amines	: Daphnid	48-hr	LC50	0.041
Aliphatic Amines	: Green Algae	96-hr	EC50	0.014
Aliphatic Amines	: Fish		ChV	0.004
Aliphatic Amines	: Daphnid		ChV	0.005
Aliphatic Amines	: Green Algae		ChV	0.007
Neutral Organic SAR	: Fish	96-hr	LC50	0.125
(Baseline Toxicity)	: Daphnid	48-hr	LC50	0.133
	: Green Algae	96-hr	EC50	0.126
	: Fish		ChV	0.018
	: Daphnid		ChV	0.025
	: Green Algae		ChV	0.167

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Mefenpyr-diethyl

ECOSAR Version 1.10 Results Page
SMILES : CCOC(=O)C2=NN(c1ccc(CL)cc1CL)C(C)(C(=O)OCC)C2
CHEM :
CAS Num:
ChemID1:
MOL FOR: C16 H18 CL2 N2 O4
MOL WT : 373.24
Log Kow: 4.818 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.83 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 51.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 15.03 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 20 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 4.818 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 20 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Esters

ECOSAR Class	Organism	Predicted Duration	End Pt	mg/L (ppm)
Esters	: Fish	96-hr	LC50	1.128
Esters	: Daphnid	48-hr	LC50	1.734
Esters	: Green Algae	96-hr	EC50	0.472
Esters	: Fish	ChV		0.047
Esters	: Daphnid	ChV		0.527
Esters	: Green Algae	ChV		0.302
Esters	: Fish (SW)	96-hr	LC50	1.444
Esters	: Mysid	96-hr	LC50	0.354
Esters	: Fish (SW)	ChV		0.344
Esters	: Mysid (SW)	ChV		0.084
Esters	: Earthworm	14-day	LC50	600.663 *
Neutral Organic SAR	: Fish	96-hr	LC50	0.903
(Baseline Toxicity)	: Daphnid	48-hr	LC50	0.815
	: Green Algae	96-hr	EC50	0.769
	: Fish	ChV		0.120
	: Daphnid	ChV		0.134
	: Green Algae	ChV		0.679

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

APPENDIX E
GENEEC Results for the Safeners Isoxadifen-ethyl and Mefenpyr-diethyl

Isoxadifen-ethyl

```
RUN No.   2 FOR isoxadifen-ethyl ON   corn         * INPUT VALUES *
  --------------------------------------------------------------------
   RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
    ONE(MULT)    INTERVAL    Koc   (PPM )   (%DRIFT)   (FT)     (IN)
  --------------------------------------------------------------------
  .030(   .030)   1   1    9777.0    1.3   GRHIFI(  6.6)     .0    .0


  FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
  --------------------------------------------------------------------
  METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
   (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)   (POND)     (POND)
  --------------------------------------------------------------------
     .00        2         N/A       .00-     .00      .00       .00


  GENERIC EECs (IN NANOGRAMS/LITER (PPTr))     Version 2.0 Aug 1, 2001
  --------------------------------------------------------------------
     PEAK      MAX 4 DAY    MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
     GEEC      AVG GEEC      AVG GEEC      AVG GEEC      AVG GEEC
  --------------------------------------------------------------------
    207.50     201.57       168.83        118.11        93.90



RUN No.   4 FOR isoxadifen-ethyl ON   any          * INPUT VALUES *
  --------------------------------------------------------------------
   RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
    ONE(MULT)    INTERVAL    Koc   (PPM )   (%DRIFT)   (FT)     (IN)
  --------------------------------------------------------------------
  .030(   .030)   1   1     977.0    1.3   GRHIFI(  6.6)     .0    .0


  FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
  --------------------------------------------------------------------
  METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
   (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)   (POND)     (POND)
  --------------------------------------------------------------------
     .00        2         N/A       .00-     .00      .00       .00


  GENERIC EECs (IN NANOGRAMS/LITER (PPTr))     Version 2.0 Aug 1, 2001
  --------------------------------------------------------------------
     PEAK      MAX 4 DAY    MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
     GEEC      AVG GEEC      AVG GEEC      AVG GEEC      AVG GEEC
  --------------------------------------------------------------------
      742.59     739.67       722.64        686.17        660.49
```

Mefenpyr-diethyl

```
RUN No.   1 FOR mefenpyr-diethyl ON   any          * INPUT VALUES *
  --------------------------------------------------------------------
   RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
    ONE(MULT)    INTERVAL    Koc   (PPM )   (%DRIFT)   (FT)     (IN)
  --------------------------------------------------------------------
  .045(   .135)   3   3     740.0    2.4   GRHIFI(  6.6)     .0    .0

  FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
  --------------------------------------------------------------------
  METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
   (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
  --------------------------------------------------------------------
      .00        2          N/A       .00-    .00      .00       .00

  GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
  --------------------------------------------------------------------
     PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
     GEEC      AVG GEEC      AVG GEEC      AVG GEEC      AVG GEEC
  --------------------------------------------------------------------
      3.93       3.92          3.84          3.69          3.57

  RUN No.   2 FOR mefenpyr-diethyl ON   any          * INPUT VALUES *
  --------------------------------------------------------------------
   RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
    ONE(MULT)    INTERVAL    Koc   (PPM )   (%DRIFT)   (FT)     (IN)
  --------------------------------------------------------------------
  .045(   .135)   3   3      74.0    2.4   GRHIFI(  6.6)     .0    .0

  FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
  --------------------------------------------------------------------
  METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
   (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
  --------------------------------------------------------------------
      .00        2          N/A       .00-    .00      .00       .00

  GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
  --------------------------------------------------------------------
     PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
     GEEC      AVG GEEC      AVG GEEC      AVG GEEC      AVG GEEC
  --------------------------------------------------------------------
      7.14       7.14          7.12          7.08          7.04
```