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Shaughnessy #: [illegible] No.

Date out of EAB: OCT 02 1985

Signature:

To: R. Taylor
Product Manager # 25
Registration Division (TS-767)

From: Emil Regelman, Acting Chief
Registration Standards, Section #3
Exposure Assessment Branch
Hazard Evaluation Division (TS-769)

Attached please find the EAB review of:

Reg./File No.: 352-UGL

Chemical: Metsulfuron Methyl

Type Product: Herbicide

Product Name: DPX-T 6376, Ally Herbicide

Company Name: E.I. Du Pont de Nemours & Co., Inc.

Submission Purpose: Assessment of Additional Data and Comments submitted by Du Pont (Ac#073593) in response to the initial EAB (& Dynamac) review of Du Pont data on December 6, 1984.

Action Code: 336

EAB # 5710

TAIS (level II)	Days
61	2

Date In: 5/22/85

Date Completed: OCT 1 1985

Deferrals To:

_____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

1. **CHEMICAL:** Metsulfuron Methyl (DPX-T6376)
Methyl 2-[[[[[(4-methoxy-6-methyltriazin-s-yl]amino]-carbonyl] amino] sulfonyl] benzoate

2. **TEST MATERIAL:** Metsulfuron Methyl - Phenyl labeled ^{14}C (DPX-T6376)

3. **STUDY/ACTION TYPE:**

New chemical (herbicide) registration (post emergence) on wheat, barley, and reduced tillage fallow preceeding wheat, barley or oats.

4. **STUDY IDENTIFICATION:**

Please refer to references on pages 16 and 17 of the Dynamac Final Report.

5. **REVIEWED BY:**

John Jordan
Microbiologist
EAB/HED/OPP

Signature: John Jordan

Date: 6/85 OCT 3 1985

6. **APPROVED BY:**

Emil Regelman
Acting Chief
Review Section #3,
EAB/HED/OPP

Signature:

Date: OCT/3/85 1985

7. **CONCLUSIONS:**

EAB cannot concur with the proposed use on wheat, oats and barley because of unsatisfied data requirements in the table below: ok (Hydrolysis data requirement has been satisfied)

Get Paul's Peter x Put these together

Data Required	Status of Completion	Current Data Gaps
① Photolysis in water	One study submitted	All data required constant temp? 25°-30°C
② Photolysis on soil	One study submitted	Photolysis on soil including the triazine moiety
Photolysis in air		Not Required

Data Required	Status of Completion	Current Data Gaps
Aerobic soil ③ metabolism	partial--phenyl o/c labeled completed	Aerobic soil metabolism of triazine moiety
Anaerobic ~~soil~~ aquatic ④ metabolism	No data submitted	*Anaerobic soil metabolism
Leaching adsorption/ ⑤ desorption	partial--unaged phenyl [illegible] soil column only	Aged leaching phenyl and ~~[illegible]~~ triazine moiety and unaged triazine [illegible] need 1) unaged triazine 2) aged phenyl 3) aged triazine
Volatility in lab		Not required
" " field		Not required
Field dissipation ⑥	one steel cylinder study submitted	Field Dissipation
Field dissipation long term		Conditional on Field dissipation results
Rotational crops ⑦		
Confined	partial--phenyl labeled uptake of soybeans, rape, oats and sugarbeet	① Phenyl labeled uptake studies required for root crops and leafy vegetables; ② triazine labeled studies required for root, small grain and leafy vegetable crops.
Field Rotation ⑧ OK →	1 study submitted ~~No data submitted~~ but is confined, not field (deficient)	Conditional on results of the confined study
Fish accumulation	No acceptable study submitted	Conditional on octanol/ water or 1/2 life in water
Non-target organisms	No data submitted	All data may be required; conditional on fish accumulation study

* When the ④ anaerobic aquatic study (No. 3) is complete and acceptable, the anaerobic soil metabolism study will not be required. Anaerobic aquatic study No. 3 is deficient; fate of the triazine moiety is still required. Acceptable anaerobic aquatic study will replace the anaerobic soil data requirement.

8. RECOMMENDATIONS:

The registrant must supply acceptable evidence that field soil treated in situ but confined within an imbedded steel cylinder produces acceptable data in lieu of conventional terrestrial field dissipation studies.

Additional environmental fate data are required as indicated in the table under item 7.

9. BACKGROUND:

Please refer to the Introduction on the page following Table of Contents.

10. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

Please refer to pages 1 through 12 of Dynamac's September 12, 1985 final report.

11. COMPLETION OF ONE-LINER:

One liner has not been completed to date.

12. CBI APPENDIX:

The registrant considers the data to be CBI and, therefore, all personnel authorized to handle the information must treat it as CBI.

MEMORANDUM

TO: James Akerman, Chief
Herbicide/Fungicide Branch
Registration Division (TS-767c)

SUBJECT: Evaluation of DuPont's Field Dissipation Protocol

As a result of the meeting with duPont representatives on July 22, I convened a meeting of all EAB reviewers to discuss duPont's confined field dissipation protocol. The essential conclusion of our deliberations is that there are likely to be situations where we will accept their procedure in place of the standard test protocol in our guidelines, but that there are problems with their procedure which appear to preclude its being routinely accepted.

We are aware of only two cases in EAB files where this procedure was accepted - Glean (November 1980) and Oust (October 1981). All recent reviews for registration actions and registration standards have rejected the protocol on the basis that it did not adequately reflect actual environmental conditions.

We have summarized our comments below, and I recommend that these be sent to duPont for their response. A dialogue on our test protocols is actually quite timely, since we plan to upgrade the entire set in a year or two.

Comments on the DuPont Confined Field Test Procedure

General: the procedure uses a stainless steel cylinder 10 cm in diameter and about 40 cm long which is driven into undisturbed soil. Radiolabelled pesticide may then be applied to the soil within the cylinder and the dissipation of the pesticide followed under presumably natural conditions. The presence of the radiolabel allows convenient analysis of parent pesticide and degradates at very low levels; this is the chief advantage of the procedure, particularly when very low rates of application are envisioned.

The purpose of our field dissipation test requirement is to determine the nature and extent of dissipation of pesticide residues under actual use conditions, as stated in the Pesticide Assessment Guidelines (§164-1). Soil residue data are to be collected until patterns of decline of the test material and patterns of formation and decline of degradation products are established. The duPont procedure appears to achieve this goal, since the test sites are in agricultural fields. However, we have a number of specific comments and questions regarding the extent to which this protocol actually reflects real-world field conditions:

1. Leaching: in cases where there is a potential for leaching, our protocol calls for sampling to a depth sufficient to define the extent of leaching. The procedure briefly described by Harvey (Res. Rev. 85, 149-158 (1983)) collects eluate from the cylinder by means of a flask in a hole beneath the cylinder. Thus no information is generated about deeper movement through the soil; the test seems to be a duplicate of the laboratory column leaching study.

2. Nature of the soil inside the cylinder: implicit in the procedure is the assumption that the soil is in fact in a "natural" condition. However, does the presence of a steel cylinder affect the temperature and moisture regime or the extent of compaction of the soil? We wonder if "wall effects" could influence the status of the soil in the cylinder by any of several mechanisms:

- acting as a rapid conductor for heat from the surface, thus altering the normal temperature of the soil profile
- acting as a channel for water, such that water moving down through the core might actually be following the walls rather than leaching through the soil horizon. Does the act of driving the cylinder create air gaps at the cylinder walls?
- acting to compact the soil as a result of driving the cylinder in
- will the portion of the cylinder protruding from the soil retain a head of water from a rain storm which might result in overflow with loss of radioactive material or which might influence the degree of anaerobicity?

3. Problems with driving the cylinder: it seems likely that in some cases inserting or removing the cylinder will be difficult. The paper by Anderson and Dulka (J. Ag. Food Chem. 33, 596-602 (1985)) describes a site where the cylinder could not be driven into the ground; in this case a hole was dug and the

soil repacked into the cylinders after placing them in the hole. This seems to be a dubious procedure from the point of view of leaving the soil in its natural state.

4. Growing crop in the cylinder: the usual procedure in the §164-1 protocol is to follow proposed label directions which may imply a crop growing in the field during the test. The presence of a crop can influence the dissipation of a pesticide in soil by changes in moisture regime, soil microbial activity, and uptake into roots. The use of the cylinders seems to preclude the growing of actual crop plants (except turf). This would seem to be a particular difficulty when a post-emergence use of a pesticide was to be tested.

5. Formulated product versus active ingredient as the test substance: our guidelines require the use of a typical end-use product, as stated in 40 CFR Part 158, even when the registration of a manufacturing-use product is being sought. This is because the rate of dissipation of the active ingredient can be influenced by the formulation.

6. Soil incorporation: can soil incorporation be mimicked in the cylinders? This is of course of particular importance for evaluating the extent of leaching.

7. Cylinder size and number: we are concerned that the small size of the cylinder and a single cylinder per time point do not adequately reflect the heterogeniety [illegible] agricultural soils.

Based on these and perhaps other questions, we have some doubts about the general acceptability of the duPont protocol. On the other hand, we recognize the desireable feature of being able to use a radioisotope as the basis of the method of analysis, especially where the application rate will be so low that conventional chemical methods will be unable to detect a pesticide even immediately after application. In fact, the only alternative to a radiochemical procedure may be to develop more sensitive analytical methods, such as by the use of immunoassay techniques.

We would like duPont's response to the questions we have posed; perhaps the company scientists have sufficient experience with the protocol to address some of our uncertainities. We suggest also that duPont carry out and submit studies with a few pesticides using both their protocol and the standard §164-1 procedure under identical field conditions, so that we would be able to evaluate the similarity of test results.

It is possible that some combinations of proposed use, low application rate, and pesticide properties (such as lack of leaching potential) will arise such that this protocol will clearly be the method of choice to evaluate field dissipation. Our general concern is that the protocol may give unrealistic results (which could either over- or under-estimate the true rate of dissipation). Pending resolution of our questions (and perhaps even after), we suggest that duPont submit the protocol on a case-by-case basis for consideration.

David J. Severn, Chief
Exposure Assessment Branch
Hazard Evaluation Division

DYNAMAC CORPORATION

ENVIRONMENTAL FATE AND EXPOSURE ASSESSMENT OF METSULFURON METHYL

Final Report

REVIEW AND EVALUATION OF DATA SUBMITTED SUBSEQUENT TO THE INITIAL REVIEW

Contract No. 68-01-6679

SEPTEMBER 12, 1985

Submitted to:
Environmental Protection Agency
Arlington, VA 22202

Submitted by:
Dynamac Corporation
Enviro Control Division
The Dynamac Building
11140 Rockville Pike
Rockville, MD 20852

METSULFURON METHYL

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Scientific Studies

INTRODUCTION

The following is a reassessment of the environmental fate and exposure data submitted by E.I. du Pont de Nemours and Company, Inc. in support of the registration of metsulfuron methyl (DPX-T6376) as a herbicide for postemergent use on wheat and barley and in reduced-tillage fallow systems preceeding wheat, barley or oat planting. This reassessment is based on additional data and comments submitted by du Pont (Accession No. 073593) in response to the initial review of metsulfuron methyl data (Dynamac Corp., December 6, 1984). The initial review contains a complete description of the procedures and results from each study and that information is not fully repeated here. The effect of this recent information on the satisfaction of registration requirements is indicated in the recommendations section.

STUDY I ✓

Friedman, P. 1984. ① Aqueous photolysis of ^{14}C-DPX-T6376. E.I. du Pont de Nemours and Company, Inc. Wilmington, DE. Document No. AMR-102-82. Acc. No. 072767. Reference G-2.

In response to the initial review of this study, the registrant submitted the distribution of the polar compound tentatively identified as an aliphatic, unsaturated carboxylic acid (Table 1). Also provided were acceptable sample HPLC chromatograms and mass spectra. The issue of metsulfuron methyl's pH-dependent hydrolytic stability has been clarified. The river water test systems are considered ancillary, and do not contribute to guideline requirements.

Table 1. Distribution of [^{14}C]polar degradates (% of applied) in aqueous solutions treated with [^{14}C]metsulfuron methyl at 5.0 ppm.

Sampling interval (days)	Dark control	Distilled	Standard reference	River	River with sediment
0	0	0	0	0	0
0.25	0	4	3	2	1
1	0	22	17	0	5
2	1	30	5	7	4
4	1	39	38	17	14
7	0	16	27	8	11
14	1	15	31	23	27

This study indicates that photolysis contributes to the degradation of phenyl-labeled [^{14}C]metsulfuron methyl (98% pure) in distilled water. However, no valid quantitative conclusions can be drawn because the test substance was not incubated at a buffered, constant pH and under sterile conditions.

A study is needed providing information on the photolysis (rate determination and photoproduct identification) of metsulfuron methyl in buffered distilled or deionized water maintained under sterile conditions. Data are also required addressing the fate of the triazine moiety.

STUDY 2

Friedman, P. 1984. ② Photodegradation of ^{14}C-phenyl-DPX-T6376 on soil. E.I. du Pont de Nemours and Company, Inc. Wilmington, DE. Document No. AMR-77-82. Acc. No. 072767. Reference G-3.

In response to the initial review of this study, the registrant supplied acceptable HPLC detection system information and a typical HPLC chromatogram of a methylene chloride soil extract. In addition, the registrant reported that the average temperature at the surface of the irradiated soil was 37-38 C and that the dark controls were maintained under the same incubation conditions but were shielded from light with black cloth. An incubation temperature of 37-38 C is considered unacceptably high for a laboratory study.

Under the conditions of this study, phenyl-labeled [^{14}C]metsulfuron methyl (98% pure) photodegraded on irradiated Keyport silt loam soil with a reviewer calculated half-life of ~43 days ($r^2 = 0.99$), based on first-order kinetics. The calculated half-life of the test substance in the dark control was ~100 days ($r^2 = 1.0$). Within the 30-day irradiation period, 2-(aminosulfonyl) benzoic acid, saccharin, and unextractable compounds gradually increased to 8, 10, and 11%, respectively, of the applied radioactivity. (the $r^2 = 1.0$ dark control has only 3 data points)

A study is needed providing information on the photodegradation of metsulfuron methyl on soil maintained at a constant temperature between 25 and 30 C. Data are also required addressing the photodegradation of the triazine moiety on soil.

STUDY 3

(4.) (substitute for anaerobic soil metabolism)

Friedman, P. L. 1984. Anaerobic aquatic metabolism of [^{14}C-phenyl]-metsulfuron methyl. E.I. du Pont de Nemours and Company, Inc. Wilmington, DE. Document No. AMR-134-83. Acc. No. 072767. Reference G-4.

Uniformly phenyl-labeled [^{14}C]metsulfuron methyl (98% pure) degraded under anaerobic conditions in three nonsterile, pond water/sediment systems, designated Landenberg, Pendleton, and Salina, with reviewer calculated half-lives of 4.2, 10.5, and 10.9 weeks (respective r^2 values = 0.99, 0.89, 0.96), based on first-order kinetics. Degradation in the corresponding sterile systems was markedly slower with calculated, assumed first-order half-lives of 103.0 ($r^2 = 0.53$), 89.0 ($r^2 = 0.69$), and 105.0 ($r^2 = 0.99$) weeks. Major degradates were saccharin, which generally tended to increase through week ~24 then diminish, and 2-(aminosulfonyl) benzoic acid, which increased through ~54 weeks. Although four polar degradates together constituted up to ~40% of the applied, even in concert they will not exceed 0.01 ppm under the proposed labeling. Total radioactivity increasingly partitioned with time into the pond sediment fraction from the pond water. Catabolism of ^{14}C-cellulose by pond microorganisms was not consistently reduced by metsulfuron methyl.

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In response to the initial review of this study, the registrant submitted adequate additional information regarding analytical methodology details, HPLC chromatograms, and TLC autoradiograms. Also provided were the distribution of the methylene chloride (nonpolar) and aqueous (polar) soluble residues in both water and sediment layers of each pond system (Tables 2, 3 and 4). These data show that the extractable radioactivity was similarly distributed in the water and sediment layers, with the exception of the sterile Landenberg pond system (Table 2).

This study partially fulfills data requirements by providing information on the anaerobic aquatic metabolism of phenyl-labeled [^{14}C]metsulfuron methyl. A study is needed addressing the fate of the triazine moiety.

Table 2. Distribution of radioactivity (% of extractable ^{14}C) in water and sediment layers of the Landenberg pond system treated with phenyl-labeled [^{14}C]metsulfuron methyl at ~1.0 ppm.

Sampling interval (weeks)	Water layer		Sediment layer	
	Methylene chloride	Aqueous	Methylene chloride	Aqueous
		Non-sterile		
0	97	3	90	10
0.4	97	3	86	14
1	96	4	87	13
3	87	13	69	31
6	55	45	27	73
12	18	82	13	87
24	5	95	8	91
26	3	97	7	93
54	3	97	5	95
		Sterile		
0	96	4	14[a]	86[a]
1	98	2	9	91
3	96	4	6	94
12	81	19	17	83
24	67	33	24	76
54	68	32	37	63

[a] These two data sets are shown as presented in the original hardcopy; however, based on the remaining data it appears that they may have been reversed.

Table 3. Distribution of radioactivity (% of extractable ^{14}C) in water and sediment layers of the Salina pond system treated with phenyl-labeled [^{14}C]metsulfuron methyl at ~1.0 ppm.

Sampling interval (weeks)	Water layer		Sediment layer	
	Methylene chloride	Aqueous	Methylene chloride	Aqueous
		Non-sterile		
0	93	7	90	10
0.4	87	13	83	17
1	87	13	78	22
3	65	35	75	25
6	58	42	67	33
12	55	45	75	25
24	33	67	50	50
36	14	86	20	80
53	4	96	13	87
		Sterile		
0	87	13	90	10
1	75	25	85	15
3	70	30	79	21
12	58	42	75	25
24	55	45	67	33
53	51	49	53	47

Table 4. Distribution of radioactivity (% of extractable ^{14}C) in water and sediment layers of the Pendleton pond system treated with phenyl-labeled [^{14}C]metsulfuron methyl at ~1.0 ppm.

Sampling interval (weeks)	Water layer		Sediment layer	
	Methylene chloride	Aqueous	Methylene chloride	Aqueous
		Non-sterile		
0	91	9	95	5
0.4	93	7	83	17
1	93	7	89	11
3	87	13	83	17
6	72	28	77	23
12	76	24	77	23
24	51	49	45	55
53	5	95	15	85
		Sterile		
0	91	9	88	12
1	83	17	83	17
3	82	18	73	27
12	70	30	64	36
24	60	40	62	38
36	55	45	67	33
53	53	47	63	37

STUDY 4 5

Chrzanowski, R.L. 1984. Soil column leaching studies with [^{14}C]-DPX-T6376. E.I. du Pont de Nemours and Company, Inc. Wilmington, DE. Document No. AMR-82-82. Acc. No. 072767. Reference G-5.

The registrant responded to the initial review of this study with the following acceptable information. Uniformly phenyl-labeled [^{14}C]metsulfuron methyl (specific activity 8.62 µCi/mg, radiochemical purity 99%) was used in both direct leaching and aged residue leaching experiments. Column packing techniques and pretreatment conditions have been adequately described. The 30-day aging conditions for the treated soil used in the aged residue leaching experiment have been described. After developing the TLC plates which had been spotted with the leachate from the aged residue soil columns, the radioactivity was eluted from the scraped silica gel with ethyl acetate and quantified by LSC. Soil K_d values for [^{14}C]metsulfuron methyl residues, based on adequately referenced equations, were 0.05, 0.02, 0.15 and 0.27 ml/g for Myakka sand, Fallsington sandy loam, Flanagan silt loam and Keyport silt loam soils, respectively (Table 5).

Table 5. K_d[a] values of [^{14}C]metsulfuron methyl residues on leached columns of four soils.

Soil type	Soil weight (g)	V_B[b] (ml)	V_p/V_B[c]	K_d (ml/g)
Myakka sand	875	290	1.14	0.05
Fallsington sandy loam	820	325	1.05	0.02
Flanagan silt loam	693	225	1.47	0.15
Keyport silt loam	575	345	1.45	0.27

[a] $K_d = [V_p/V_B - 1] \frac{V_B}{\text{Soil weight.}}$

[b] V_B = Breakthrough volume of water (50% Na^{36}Cl).

[c] V_p = Breakthrough volume of water to elute 50% of radioactivity from column.

However, no acceptable data were submitted regarding the characterization of the aged residues in soils before and after leaching. Instead, the registrant referenced aged residue characterizations of soils in field soil dissipation and aerobic soil studies (du Pont Document Nos. AMR-117-83 and AMR-75-82, respectively). The referenced data are not acceptable because the incubation conditions and/or soils were not the same as those used in this study.

This study partially fulfills data requirements by providing information on the mobility of unaged phenyl-labeled [^{14}C]metsulfuron methyl in soil. For the aged leaching study, residues of metsulfuron methyl in soil must be characterized. Data are also required addressing the mobility of the triazine moiety in soil.

STUDY 5 INVALID ✓ Study INVALID

Friedman, P.L. 1984. Adsorption of ^{14}C-DPX-T6376 on soil. E.I. du Pont de Nemours and Company, Inc. Wilmington, DE. Document No. AMR-82-82. Acc. No. 072767. Reference G-6.

This study could not be validated in the initial review, nor can it be in this subsequent review, because no raw data (or graphs) have been submitted to support the reported Freundlich K, coefficient of adsorption per unit organic matter, and slope of log-log plot values. The registrant did respond with additional data characterizing the test substances used in the batch and soil TLC studies, and detailing the LSC and autoradiography techniques. Uniformly phenyl-labeled [^{14}C]metsulfuron methyl with a specific activity of 8.62 µCi/mg and radiochemical purity of 98%, was used in both experiments. Carbonyl-labeled [^{14}C]diuron (specific activity 42 µCi/mg, radiochemical purity 99%) and carbonyl-2-labeled [^{14}C]terbacil (specific activity 9.1 µCi/mg, radiochemical purity 99%) were compared against metsulfuron methyl by soil TLC.

STUDY 6 ⑥

Anderson, J.J. and J. Harvey. 1984. Field dissipation study of DPX-T6376 in Delaware, North Carolina, Florida, and Mississippi. E.I. du Pont de Nemours and Company, Inc. Wilmington, DE. Document No. AMR-117-83. Acc. No. 072767. Reference G-7.

Unformulated phenyl-labeled [^{14}C]metsulfuron methyl, applied at 1 lb ai/A to soils confined in steel cylinders that were embedded in fields in Delaware, North Carolina, Florida and Mississippi, dissipated with estimated halflives of ~2-4 weeks. The parent and its three major degradates, saccharin, 2-(aminosulfonyl) benzoic acid, and methyl-2-(aminosulfonyl) benzoate, leached below 8 cm at all locations. this is true but some locations <1% below 8 cm

In response to the initial review of this study, the registrant supplied arguments but no data to support their contention that the dissipation of radiolabeled metsulfuron methyl from soil confined in 10-cm diameter cylinders is representative of dissipation under actual use conditions.

The registrant provided acceptable samples of a TLC plate, mass spectra of TMS derivatives of saccharin from metsulfuron methyl treated soil, and a sample of LSC data of the fractions collected from an HPLC run, and reported that the HPLC was equipped with a UV detection system. Additional data were presented (Tables 6, 7, 8 and 9) that show the distribution of metsulfuron methyl degradates with depth as a function of time.

In order for this study to fulfill data requirements, the registrant must supply evidence that field soil treated in situ but confined within an imbedded steel cylinder produces data similar to that obtained in conventional terrestrial field dissipation studies. Climatic data, including complete air temperature and precipitation data, are needed. Quantification of the unidentified polar and nonpolar degradates and the fate of the triazine moiety must still be addressed.

Table 6. Distribution of radioactivity (% of applied) in Myakka sand soil in confined plots in Bradenton, Florida treated with uniformly phenyl-labeled [^{14}C]metsulfuron methyl at 1 lb ai/A.

Sampling interval (weeks)	Sampling depth (cm)	Metsulfuron methyl	MASB[a]	ASBA[b]	Saccharin	Unextractable	Unknown
0	0-8	88[c]	<1	<1	4	7	2
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
2	0-8	25	4	1	12	22	6
	8-16	3	<1	<1	2	7	1
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
4	0-8	10	3	10	32	9	11
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
8	0-8	4	2	6	16	10	9
	8-16	<1	1	2	1	3	1
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
16	0-8	2	<1	7	3	14	3
	8-16	<1	<1	2	<1	3	2
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
26	0-8	1	<1	1	2	10	1
	8-16	<1	<1	<1	<1	2	<1
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--

[a] Methyl-2-aminosulfonylbenzoate.

[b] 2-Aminosulfonylbenzoic acid.

[c] Not determined.

Table 7. Distribution of radioactivity (% of applied) in Cecil sand soil in confined plots in Clayton, North Carolina treated with uniformly phenyl-labeled [^{14}C]metsulfuron methyl at 1 lb ai/A.

Sampling interval (weeks)	Sampling depth (cm)	Metsulfuron methyl	MASB[a]	ASBA[b]	Saccharin	Unextractable	Unknown
0	0-8	92[c]	<1	<1	1	1	4
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
2	0-8	76	3	3	12	3	12
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
4	0-8	48	2	5	14	5	10
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
8	0-8	2	1	3	5	3	4
	8-16	2	①	②	①	3	1
	16-24	2	--	--	--	--	--
	24-32	2	--	--	--	--	--
16	0-8	2	1	<1	1	3	1
	8-16	<1	<1	②	①	1	2
	16-24	<1	<1	<1	②	1	4
	24-32	<1	<1	<1	②	<1	4

[a] Methyl-2-aminosulfonylbenzoate.

[b] 2-Aminosulfonylbenzoic acid.

[c] Not determined.

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Table 8. Distribution of radioactivity (% of applied) in Keyport silt loam soil in confined plots in Newark, Delaware treated with uniformly phenyl-labeled [^{14}C]metsulfuron methyl at 1 lb ai/A.

Sampling interval (weeks)	Sampling depth (cm)	Metsulfuron methyl	MASB[a]	ASBA[b]	Saccharin	Unextractable	Unknown
0	0-8	83	<1	--[c]	--	1	11
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
1	0-8	52	1	--	--	4	39
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
2	0-8	26	1	16	20	12	13
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
4	0-8	8	1	18	12	9	9
	8-16	4	<1	②	②	1	1
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
8	0-8	5	1	22	7	14	4
	8-16	1	<1	--	--	2	4
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
16	0-8	6	1	8	1	19	2
	8-16	1	①	③	①	4	1
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
26	0-8	2	2	9	1	14	2
	8-16	<1	<1	②	①	3	1
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--

[a] Methyl-2-aminosulfonylbenzoate.

[b] 2-Aminosulfonylbenzoic acid.

[c] Not determined.

Table 9. Distribution of radioactivity (% of applied) in Dundee silt loam soil in confined plots in Scott, Mississippi treated with uniformly phenyl-labeled [^{14}C]metsulfuron methyl at 1 lb ai/A.

Sampling interval (weeks)	Sampling depth (cm)	Metsulfuron methyl	MASB[a]	ASBA[b]	Saccharin	Unextractable	Unknown
0	0-8	98	1	<1	1	--[c]	<1
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
2	0-8	66	9	2	11	--	3
	8-16	--	--	--	--	--	--
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
4	0-8	37	2	5	21	4	6
	8-16	4	<1	<1	1	2	2
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
8	0-8	12	1	2	10	11	7
	8-16	--	--	--	--	--	--
	16-24	4	1	1	2	3	3
	24-32	--	--	--	--	--	--
16	0-8	8	1	9	6	5	4
	8-16	4	<1	4	2	2	3
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--
26	0-8	5	<1	11	2	8	5
	8-16	4	<1	4	1	4	4
	16-24	1	<1	1	<1	2	1
	24-32	--	--	--	--	--	--
52	0-8	<1	<1	1	<1	9	5
	8-16	<1	<1	<1	<1	5	2
	16-24	--	--	--	--	--	--
	24-32	--	--	--	--	--	--

[a] Methyl-2-aminosulfonylbenzoate.

[b] 2-Aminosulfonylbenzoic acid.

[c] Not determined.

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STUDY 7 ⑦ ~~Rotation~~ Confined

Harvey, J. 1984. Crop rotation study with ^{14}C-DPX-T6376 in the greenhouse. E.I. du Pont de Nemours and Company, Inc. Wilmington, DE. Document No. AMR-120-83. Acc. No. 072767. Reference G-8.

^{14}C residues were taken up by sugarbeet, rape, oat, and soybean plants that were planted in a sandy loam soil 120 days after treatment with phenyl-labeled [^{14}C]metsulfuron methyl at 15.6 g/ha (0.22 oz/A). Maximum residues in all species were detected at maturity. For sugarbeet and rape, <4 ppb were detected in foliage or root. In soybean foliage, 41 ppb was reported in foliage, and 2 ppb in the bean (expressed on a fresh weight basis). In mature oats, 8 ppb was detected in foliage, and 2 ppb in straw (expressed on a dry weight basis).

In response to the initial review of this study, the registrant provided additional information that fully describes the analytical procedure for the butanol soybean extracts, and reported temperature, moisture, and lighting data for the rotational crops.

This study partially fulfills data requirements by providing information on the uptake of phenyl-labeled [^{14}C]metsulfuron methyl by soybeans, rape, oats, and sugarbeets planted 120 days after treatment. A study is needed providing information on the uptake of both phenyl- and triazine-labeled metsulfuron methyl in root, small grain, and leafy vegetable crops planted 1 year after treatment.

STUDY 8 ⑧ ✓ small plots = (one square meter) Confined study

Anderson, J.J. 1984. Crop rotation study with ^{14}C-metsulfuron methyl in the field. E.I. du Pont de Nemours and Company, Inc. Wilmington, DE. Document No. AMR-190-84. Acc. No. 072767. Reference G-9.

Residues of phenyl-labeled [^{14}C]metsulfuron methyl (99% pure), applied at 30 g ai/ha to field-grown winter wheat in the boot stage, were absorbed and translocated by rotational oats, soybeans, rape and sorghum planted 362 days after application. Total radioactivity in the crops increased with maturity to <4 ppb in soybeans and sorghum, <9 ppb in oats, 5 ppb in rape straw, and 31 ppb in rape seed.

In response to the previous review of this study, the registrant provided the following acceptable information. The Keyport silt loam test soil (referenced in Study 6) contained 21% sand, 62% silt, 17% clay, 2.8% organic matter, had a CEC of 8.2 meq/100 g, and a pH of 6.4. The soil sample, analyzed for extractable and unextractable radioactivity, was sampled before rotational crop planting. All residue data were expressed on a fresh weight basis. In addition, the registrant provided adequate details regarding test substance application.

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The registrant presented additional arguments to support the review of these data under the topic of field accumulation. However, because treatment was not made with a typical end-use product, and very small (1 m^2) plots were used, this study does not contribute to field accumulation registration requirements.

In order for this study to fulfill data requirements for confined accumulation, climatic data are needed. In addition, studies are needed providing information on the accumulation of phenyl-labeled metsulfuron methyl in a root crop, and on the accumulation of the triazine moiety.

EXECUTIVE SUMMARY

A previously reviewed study demonstrated that metsulfuron methyl was stable to hydrolysis at pH 7 and 9 at both 15 C and 25 C. Estimated half-lives of the parent at pH 5 were 3 weeks (25 C) and >30 days (15 C). The primary degradate was methyl 2-(aminosulfonyl)-benzoate. The hydrolytic stability of the triazine moiety was addressed in a study that showed 4-methoxy-6-methyl-1,3,5-triazine-2-amine was stable at pH 5, 7, and 9.

Although no valid quantitative data were submitted for aqueous photolysis of metsulfuron methyl, the compound photodegradated with a caculated half-life of ~43 days on irradiated Keyport silt loam soil incubated at 37-38 C. The major degradates were 2-(aminosulfonyl)-benzoic acid and saccharin at 8 and 10% of the applied, respectively. The fate of the triazine moiety was not addressed.

③ No new aerobic metabolism studies were submitted. Previously, the estimated aerobic half-life of metsulfuron methyl in a silt loam soil was ~4 weeks. $^{14}CO_2$ was the major metabolite (36%); methyl 2-(aminosulfonyl)-benzoate, 2-(aminosulfonyl)-benzoic acid and saccharin were also identified. The fate of the triazine moiety was not addressed.

Metsulfuron methyl degraded under anaerobic conditions in three simulated pond/sediment systems with calculated half-lives of ~4-11 weeks, based on first-order kinetics. Saccharin was a major but transient degradate while 2-(aminosulfonyl) benzoic acid, the other major degradate, gradually accumulated during the 54-week study. The fate of the triazine moiety was not addressed.

Radioactivity from phenyl-labeled $[^{14}C]$metsulfuron methyl (unaged) was largely (>87%) eluted from 12 inch columns of sandy loam, sand, silty clay loam, and silt loam soils by 20 inches of water.

No conclusions on adsorption could be drawn because the submitted studies contained insufficient raw data to support the reported conclusions. Additionally, the mobility of the triazine moiety was not investigated.

The field dissipation data confirm that metsulfuron methyl dissipated within 2 to 4 weeks of application and leached through silt loam and sand soils confined in stainless steel cylinders. However, unknown polar and nonpolar degradates were not identified. The fate of the triazine moiety was not addressed.

A confined crop study indicates that residues may be taken up by sugarbeet, rape, oat and soybeans planted in sandy loam soil 120 days after treatment.

Residues are also taken up by oats, soybeans, rape and sorghum planted in silt loam soil 362 days after treatment at 30 g ai/ha. Total residues were generally 3-9 ppb, but rape seed contained 31 ppb. Uptake of triazine-bearing residues were not addressed.

Tentative conclusions from a previously reviewed study (that does not meet data requirements) suggest that metsulfuron methyl does not bioaccumulate in bluegill sunfish.

INFORMATION ON PREVIOUSLY REVIEWED STUDIES

Friedman, P. 1982. Hydrolysis of ^{14}C-phenyl DPX-T6376. Document No. AMR-62-82. Acc. No. 071434.

This study was reviewed by EAB (E. Regelman) on 5/20/83. It was determined that the study did not satisfy data requirements because it did not address the fate of the triazine moiety.

Friedman, P. 1983. Hydrolysis of ^{14}C-4-methoxy-6-methyl-1,3,5-triazin-2-amine. Document No. AMR-136-83. Acc. No. 252492.

This study was reviewed by EAB (E. Regelman) on 7/12/84. It was concluded that this study addresses the EAB's concerns on the fate of the triazine moiety when metsulfuron methyl is hydrolysed.

Rapisarda, C. 1981. Microbial degradation of ^{14}C-DPX-4189 in soil. Document No. AMR-43-81. Acc. No. 250928. The registrant has requested that this study be withdrawn without prejudice (E. Regelman, Memorandum of Meeting, 10/17/84).

Friedman, P. 1982. Aerobic soil metabolism of ^{14}C-phenyl-labeled-DPX-T6376. Document No. AMR-75-82. Acc. No. 071434.

This study was reviewed by EAB (E. Regelman) on 5/20/83. It was concluded that the study inadequately defined metsulfuron methyl metabolism because there was no monitoring of the triazine moiety.

Han, J. C-Y. 1981. ^{14}C-DPX-W4189. Soil disappearance studies in the field. Document No. AMR-54-81. Acc. No. 250928.

This study was reviewed by EAB (E. Regelman) on 7/12/84. This review concluded that the field dissipation of the aminotriazine moiety was not adequately defined by this study for full registration. EAB has since (E. Regelman, Memorandum of Meeting, 10/17/84) deferred assessment of the significance of residual levels of the moiety to the Residue Chemistry and Toxicological Branches.

Han, J. C-Y. 1982. Residue studies with [^{14}C]-DPX-T6376 in bluegill sunfish. Document No. AMR-81-82. Acc. No. 252492.

This study was reviewed by EAB (E. Regelman) on 7/12/84. Insufficient analytical and procedural details were provided to allow the study to fulfill data requirements. A submission of raw data for review was also requested.

RECOMMENDATIONS

Available data are insufficient to fully assess the environmental fate of metsulfuron methyl as well as the potential for exposure of humans and nontarget organisms to metsulfuron methyl. The submission of data to fulfill registration requirements (Subparts N and K) is summarized below:

Hydrolysis studies: Two previously submitted and reviewed studies were cited in this submission. One study (Friedman, 1982, Document AMR-62-82, Acc. No. 071434) was scientifically valid, and partially fulfilled data requirements, but did not address the fate of the triazine moiety. The second study (Friedman, 1982, Acc. No. 252492) supplied appropriate information. Data requirements are satisfied; no further hydrolysis data are required.

Photodegradation studies in water: One study (Friedman, 1984, Document No. AMR-102-82, Acc. No. 072767) was submitted and reviewed. This study does not fulfill data requirements because it was not conducted at a constant pH under sterile conditions. All data are required.

Photodegradation studies on soil: One study (Friedman, 1984, Document No. AMR-134-83, Acc. No. 072767) was reviewed but does not fulfill data requirements because the incubation temperature was too high. A study is needed providing information on the photodegradation of metsulfuron methyl on soil maintained at a constant temperature between 25 and 30 C. Data are also required addressing the photodegradation of the triazine moiety on soil.

Photodegradation studies in air: No studies were submitted, but no data are required because of the low vapor pressure of metsulfuron methyl.

Aerobic soil metabolism studies: Two previously submitted and reviewed studies were cited in this submission. One study (Rapisarda, C. 1981, Acc. No. 250928) was not considered because it has been withdrawn by the registrant. The second study (Friedman, 1982, Document AMR-62-82, Acc. No. 071434) partially satisfies data requirements by providing information on the aerobic metabolism of phenyl-labeled [^{14}C]metsulfuron methyl. Data are required addressing the aerobic soil metabolism of the triazine moiety.

Anaerobic soil metabolism studies: No data were provided; however, this data requirement will be waived when a valid anaerobic aquatic metabolism study is submitted.

Anaerobic aquatic metabolism studies: One study (Friedman, 1984, Document No. AMR-134-83, Acc. No. 072767) was reviewed, is scientifically valid, and partially fulfills data requirements by providing information on the anaerobic aquatic metabolism of phenyl-labeled [^{14}C]metsulfuron methyl. A study is needed addressing the fate of the triazine moiety.

Aerobic aquatic metabolism studies: No data were submitted, but these studies are not required because metsulfuron methyl does not have an aquatic or aquatic impact use.

Leaching and adsorption/desorption studies: Two studies were submitted and reviewed. One study (Friedman, 1984, Document No. AMR-82-82, Acc. No. 072767) could not be validated because the requested supportive raw data to support the reported conclusions and models were not provided. The remaining study (Chrzanowski, 1984, Document No. AMR-82-82, Acc. No. 072767) partially fulfills data requirements by providing information on the mobility of unaged phenyl-labeled [^{14}C]metsulfuron methyl in soil. For the aged leaching experiment, residues of aged metsulfuron methyl in soil must be characterized. Data are also required addressing the mobility of the triazine moiety in soil.

Laboratory and field volatility studies: No data were submitted, but no data are required because of the low vapor pressure of metsulfuron methyl.

Terrestrial dissipation studies: One study (Anderson and Harvey, 1984, Document No. AMR-117-83, Acc. No. 072767) was submitted and reviewed. In order for this study to fulfill data requirements, the registrant must supply evidence that field soil treated in situ but confined within an imbedded steel cylinder produces data similar to that obtained in conventional terrestrial field dissipation studies. Climatic data, soil temperature data, quantification of the unidentified polar and nonpolar degradates, and the fate of the triazine moiety must still be addressed. One previously submitted and reviewed study was cited in this submission. The review of this study (Han, 1981, Acc. No. 250928) concluded that the field dissipation of the aminotriazine moiety was not adequately defined. Assessment of the significance of residual levels of this group has been deferred (E. Regelman Memorandum of Meeting, 10/17/84) to the Residue Chemistry and Toxicological Branches.

Aquatic field dissipation studies: No data were submitted, but no data are required because metsulfuron methyl does not have an aquatic or an aquatic impact use.

Forestry dissipation studies: No data were submitted, but no data are required because metsulfuron methyl does not have a forestry use.

Long-term field dissipaton studies: No data were submitted. Requirements for these data depend upon the results from the terrestrial field dissipation data.

Confined accumulation studies on rotational crops: Two studies were reviewed. One study (Harvey, 1984, Document No. AMR-120-83, Acc. No. 072767) partially fulfills data requirements by providing information on the uptake of phenyl-labeled [^{14}C]metsulfuron methyl by soybeans, rape, oats, and sugarbeets planted 120 days after treatment. The second study (Anderson, 1984, Document No. AMR-190-84, Acc. No. 072767) does not fulfill data requirements because climatic data were not reported. Additional data are also needed showing phenyl-labeled metsulfuron methyl uptake in a root crop planted 1 year after treatment and on the accumulation of the triazine moiety.

Field accumulation studies on rotational crops: No data were submitted. Data requirements are dependent upon confined accumulation studies on rotational crops.

Accumulation studies on irrigated crops: No data were submitted; however, data are not required because metsulfuron methyl has no aquatic food crop or aquatic noncrop use, is not used in and around holding ponds used for irrigation purposes, and has no uses involving effluents or discharges to water used for crop irrigation.

Laboratory studies of accumulation in fish: One previously submitted and reviewed study (Han, 1982, Acc. No. 252492) was cited in this submission. The study did not fulfill data requirements because insufficient analytical and procedural details were provided. All data are required.

Field accumulation studies on nontarget organisms: No data were submitted; requirements for these studies depend upon the results from laboratory studies of accumulation in fish and toxicological data.

References

Anderson, J.J. 1984. Crop rotation study with ^{14}C metsulfuron methyl in the field. Document No. AMR-190-84. Acc. No. 072767.

Anderson, J.J. and J. Harvey. 1984. Field dissipation study of DPX-T6376 in Delaware, North Carolina, Florida and Mississippi. Document No. AMR-117-83. Acc. No. 072767.

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Chrzanowski, R.L. 1984. Soil column leaching studies with [^{14}C]-DPX-T6376. Document No. AMR-82-82. Acc. No. 072767.

Friedman, P. 1982. Hydrolysis of ^{14}C-phenyl-DPX-T6376. Document No. AMR-62-82. Acc. No. 071434. (Included by reference not reviewed here).

Friedman, P. 1983. Aerobic soil metabolism of phenyl-labeled. DPX-T6376. Document No. AMR-75-82. Acc. No. 071434. (Included by reference not reviewed here).

Friedman, P. 1983. Hydrolysis of ^{14}C-4-methoxy-6-methyl-1,3,5-triazin-2-amine. Document No. AMR-136-83. Acc. No. 25492. (Included by reference not reviewed here).

Friedman, P. 1984. Aqueous photolysis of ^{14}C-DPX-T6376. Document No. AMR-102-82. Acc. No. 072767.

Friedman, P. 1984. Photodegradation of ^{14}C-phenyl-DPX-T6376 on soil. Document No. AMR-77-82. Acc. No. 072767.

Friedman, P.L. 1984. Anaerobic aquatic metabolism of [^{14}C-phenyl]-metsulfuron methyl. Document No. AMR-134-83. Acc. No. 072767.

Friedman, P.L. 1984. Adsorption of ^{14}C-DPX-T6376 on soil. Document No. AMR-82-82. Acc. No. 072767.

Han, J. C-Y. 1981. ^{14}C-DPX-W4189. Soil disappearance studies in the field. Document No. AMR-54-81. Acc. No. 250928. (Included by reference not reviewed here).

Han, J. C-Y. 1982. Residue studies with [^{14}C]-DPX-T6376 in bluegill sunfish. Document No. AMR-81-81. Acc. No. 252492. (Included by reference not reviewed here).

Harvey, J. 1984. Crop rotation study with ^{14}C-DPX-T6376 in the greenhouse. Document No. AMR-120-83. Acc. No. 072767.

Rapisarda, C. 1981. Microbial degradation of ^{14}C-DPX-4189 in soil. Report No. AMR-43-81. Acc. No. 250928.