US EPA ARCHIVE DOCUMENT

Shaughnessy #: 012301, 035505

Date out of EAB: 5/12/84

Signature: [signature]

MAY 23 1985

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

From: John Jordan, Ph.D., Acting Chief
Registration Standards, Section #3
Exposure Assessment Branch
Hazard Evaluation Division (TS-769)

Attached please find the EAB review of:

Reg./File No.: 352-324, -352, -351, -325

Chemical: Diuron and bromacil

Type Product: Herbicide

Product Name:

Company Name: Dupont

Submission Purpose: Response to standard

Action Code: 660

Date In: other

EAB # 424 and 425

Date Completed: 3/12/84

TAIS (level II) Days

Deferrals To:

Ecological Effects Branch

Residue Chemistry Branch

Toxicology Branch

Reviewer A. Schlosser

Shaughnessy #: 035505

Date out of EAB: 5/23/85

Signature: [illegible]

To: Taylor/Walters
Product Manager # 25
Registration Division (TS-767)

From: John H. Jordon, Chief
Registration Standards, Section #3
Exposure Assessment Branch
Hazard Evaluation Division (TS-769c)

Attached please find the EAB review of:

Reg./File No.: 352-324

Chemical: Diuron

Type Product: Herbicide

Product Name:

Company Name: DuPont

Submission Purpose: Review Response to Registration Standard

ZBB Code: other

Date In : 9/28/84

Date Completed:

Deferrals To:

_____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

ACTION CODE: 650

EAB # 4596

TAIS (level II) Days

Reviewer A Sellosser

2

DYNAMAC
CORPORATION

DIURON ADDENDUM

Final Report

Task 1: Review and Evaluation of Individual Studies

Contract No. 68-01-6679

FEBRUARY 25, 1985

Submitted to:
Environmental Protection Agency
Arlington, VA 22202

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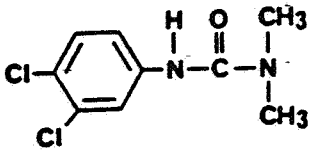
Rockville, MD 20852

3

DIURON, DICHLORFENIDIM, DCMU, DMU, CEKIURON, CRISURON, DAILON, DIATER, DI-ON, DIUREX, DYNEX, KARMEX, UNIDRON, UROX "D", VONDURON



3-(3,4-DICHLOROPHENYL)-1,1-DIMETHYL-UREA

Table of Contents

Study	
1	El-Dib, M.A. and O.A. Aly. 1976. Persistence of some phenylamide pesticides in the aquatic environment-I. Hydrolysis. Water Res. 10(12): 1047-1050. (No MRID)
2	Horowitz, M., and G. Herzlinger. 1973. Soil conditions affecting the dissipation of diuron, fluometuron, and propham from the soil surface. (No MRID)
3	Rapisarda, C. 1984. Degradation of ^{14}C-labeled Krovar Weed Killer in soil. (No MRID)
4	Horsmans, K.J.H., and J.L. v.d. Maas. 1969. Accumulation of diuron in fish. Ghent. Rijksfaculteit Landbouwwetenschappen. Mededelingen 34:428-433. (No MRID)
5	Call, D.J., L.T. Brooke, and J.R. Kent. 1983. Toxicity, bioconcentration, and metabolism of five herbicides in freshwater fish. Prepared for Environmental Research Lab.-Duluth, MN, by University of Wisconsin, Superior. (No MRID)

CASE GS0046 DIURON STUDY 1 PM 06/23/81

CHEM 035505 Diuron

BRANCH EFB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01

El-Dib, M.A. and O.A. Aly. 1976. Persistence of some phenylamide pesticides in the aquatic environment-I. Hydrolysis. Water Res. 10(12): 1047-1050. Unpublished study submitted Aug. 30, 1984 under 352-324,-247 and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Accession No. 254591.

SUBST. CLASS = S.

DIRECT RVW TIME = 4 (MH) START-DATE END DATE

REVIEWED BY: L. Lewis
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CONCLUSION:

Degradation - Hydrolysis

This study is scientifically invalid because: (a) for experiments conducted with phosphate buffer solutions the concentration of diuron used (4662 ppm) exceeded the solubility of diuron in water (42 ppm), and (b) for experiments conducted with NaOH solutions raw data were not provided to support the reported half-lives, and the experiments were not stated to have been conducted in darkness. In addition, this study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance was not characterized, and for NaOH solutions in which degradation occurred degradates were not identified.

MATERIALS AND METHODS:

Diuron (test substance uncharacterized, source unspecified) was added to NaOH solutions of 0.1, 0.5, and 1.0 N (pH 13, 13.7, and 14) and phosphate buffer solutions (pH 5, 7, and 9) at 0.02 M (4662 ppm). Buffer solutions were treated with sodium azide (0.01%) to inhibit microbial transformations. The sodium hydroxide solutions were prepared using CO_2-free distilled water and sodium hydroxide free from carbonate. Buffer solutions were prepared by diluting 0.1 M phosphate buffer to obtain a 0.01 M working solution and adjusted to the desired pH value with sodium hydroxide or phosphoric acid solutions.

Reaction mixtures were maintained in a water bath at 10, 20, 30, and 40 C. The initial concentration of diuron tested (~0.02 M) and its aniline derivative were immediately determined. Samples of pesticide solutions were withdrawn periodically for 30 days, and concentrations of diuron and the aniline derivative (hydrolysis product) were determined colorimetrically. Phenylamide pesticides (such as diuron) undergo rapid hydrolysis in acidic medium at elevated temperatures (150-155 C) to yield aniline derivatives. These derivatives are diazotized and then coupled with 1-naphthol to yield intensely colored azo dyes that are solubilized in alkaline medium for colorimetric measurement. Both phenylamides and aniline derivatives can be determined in a sample in the presence of each other. The sensitivity of the method was 0.02 mg/l (0.02 ppm) and the recovery rate was 95%.

The order of the hydrolysis reaction and its rate constant, half-life, and activation energy were calculated by classical kinetic equations given by Glasston (Text Book of Physical Chemistry, Macmillan, 1951).

REPORTED RESULTS:

No hydrolysis was observed in any of the buffered solutions (pH 5, 7, and 9) held at 20 C for more than 4 months. The initial concentrations of diuron (0.02 M) remained constant, with no detectable hydrolysis products (aniline derivatives).

Measurable hydrolysis of diuron was only observed in the highly alkaline (NaOH) solutions. Hydrolysis rates in NaOH (0.5 N; pH 13.7) at 20 C were reported as 4.60×10^{-3}/day (k_1) and 9.20×10^{-3} liter/mole. day (k_2), with a half-life of 150 hours and an activation energy of 16.5 kcal/mole (raw data on which these calculations were based were not provided). The hydrolysis reaction was found to be second order and comparisons of data with those for other phenylamides led the authors to suggest that the reaction rate was mainly linked with the positive character of the carbonyl carbon atom. The hydrolysis rate was found to approximately double with each 10 C rise in temperature.

DISCUSSION:

1. The concentration of diuron used (4,662 ppm) exceeded the solubility of diuron in distilled water at 25 C (42 ppm). However, the solubility of diuron in the NaOH and phosphate buffer solutions used in this study was not discussed and cannot be determined without further data. In addition, the pH's of the NaOH solutions (>pH 13) are outside the range of environmental conditions.

2. The test substance was not characterized.

3. For NaOH solutions in which degradation occurred, degradates were not identified, no raw data were provided to support the reported half-lives, and the experiments were not reported to have been conducted in darkness.

CASE GS0046 DIURON STUDY 2 PM 06/23/81

CHEM 035505 Diuron

BRANCH EFB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01
Horowitz, M., and G. Herzlinger. 1973. Soil conditions affecting the dissipation of diuron, fluometuron, and propham from the soil surface. Unpublished study submitted Aug. 30, 1984, under 352-324, -247, and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Accession No. 254591.

SUBST. CLASS = S.

DIRECT RVW TIME = 6 1/2 (MH) START-DATE END DATE

REVIEWED BY: K. Patten
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CONCLUSION:

Degradation - Photodegradation on Soil

This study is scientifically invalid because the sampling protocol (1 sampling interval) was inadequate to accurately assess the decline of diuron, no standard curve was developed relating the bioassay results to known concentrations of diuron, the experimental design did not distinguish between photodegradation and volatilization, and there were no dark controls for four of the five treatments. In addition, this study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because a nonspecific analytical method was used, soil and light were not completely characterized, the moisture content of the soils was not specified, the test substance was not technical grade or purer, and the study may not have been typical of conditions existing in the United States.

8

MATERIALS AND METHODS:

Sieved (30-40 mesh) Newe Ya'ar alluvial clay soil (75% clay, 16% lime, 1.7% organic matter, soil not further characterized) was measured into plastic cups, and the samples were divided into six treatment groups based on whether the soil was incubated dry or moist (Table 1). The soils were treated with diuron (80% WP, source unspecified) at 0.6 kg/ha. One set of cups was incubated in plastic bags in the dark, the remainder were incubated in direct sunlight outdoors between July 9 and 24 (light not further characterized).

Following 2 weeks of irradiation, the soil in each cup was mixed and seeded with oats (Avena sativa L. 'Mulga'). The cups were incubated in the greenhouse for 2 weeks, at the end of which the fresh weight of the tops and leaf length of the oat plants were determined. The growth of the oats was compared to growth of oats grown in untreated soil.

REPORTED RESULTS:

Air temperatures during the study ranged from 19 to 38.3 C.

The growth of the oats was most inhibited by the treated soil incubated in the dark (~50% of control) and the treated soil in which diuron was incorporated into the surface 2 cm (~44%) (Table 2). The growth of the oats was less inhibited in the soil exposed to light than in the soil kept in the dark. No growth inhibition was observed in the soil moistened by capillary action prior to the application of diuron.

DISCUSSION:

1. A single sampling interval was inadequate to accurately establish the pattern of decline of diuron in the soil. In addition, no pretreatment samples were analyzed, and no immediate posttreatment samples were analyzed to confirm the application rate of diuron to the soil.

2. No standard curve was developed to relate known concentrations of diuron to inhibition of the growth of oat seedlings.

3. The dry soil which was incubated in the dark was a proper dark control only for the dry soil irradiated for 2 weeks. There were no dark controls either for the moist soils or the dry soil in which diuron was surface-incorporated.

4. A nonspecific bioassay was used; the method could not distinguish between diuron and its degradates.

5. The size of the soil sample, the size of the plastic cups, and the surface area of the soil exposed to sunlight were not specified.

9

6. Complete soil characteristics, including textural analysis, pH, and CEC, were not provided.

7. Complete characteristics of the sunlight, including intensity, hours of light per day and site coordinates, were not provided.

8. The study did not distinguish between photodegradation and volatilization. No attempt was made to minimize volatilization.

9. It could not be determined if 0.6 kg/ha referred to the application rate of the active ingredient or the formulated product.

10. The study was done in Israel with Israeli soils, and results may not be typical of soils and conditions in the United States.

11. Three of the sets of soil were incubated dry, and the moisture content of the remaining soils was not specified.

12. A formulated product rather than a techical or purer grade of diuron was used in the study.

13. Soil temperatures were not specified.

10

Table 1. Soil conditions during incubation.

Moisture status of the soil	Wetting schedule and other incubation conditions	Light conditions
Dry	--	Dark
Dry	--	Light
Moist	Moistened using capillary action prior to the application of diuron	Light
Moist	Sprinkled with 1-mm of water immediately after the application of diuron	Light
Moist	Sprinkled with 1-mm of water after 1-week of irradiation	Light
Dry	Diuron incorporated into the upper 2-cm of soil immediately after application	Light

Table 2. Inhibition of the growth of oats (% of growth of oats grown in untreated soil) in soil treated with diuron at 0.6 lb ai/A.[a]

Treatment[b]	Fresh weight	Leaf length
Dry soil incubated in the dark	49	51
Dry soil incubated in sunlight	85	86
Moistened prior to treatment, incubated in sunlight	95	118
Moistened immediately after treatment, incubated in sunlight	60	69
Moistened after 1 week of irradiation	87	91
Dry soil, diuron incorporated into upper 2-cm, incubated in sunlight.	42	46

[a] Average of 6 samples/treatment.

[b] Treatments detailed in Table 1.

12

CASE GS0046 DIURON STUDY 3 PM 06/23/81

CHEM 035505 Diuron

BRANCH EFB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01

Rapisarda, C. 1984. Degradation of ^{14}C-labeled Krovar Weed Killer in soil. Unpublished study submitted Aug. 30, 1984 under 352-324, -247, and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Accession No. 254591.

SUBST. CLASS = S.

DIRECT RVW TIME = 11 1/2 (MH) START-DATE END DATE

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CONCLUSIONS:

Dissipation - Combination Products and Tank Mix Uses

1. This study is scientifically valid.

2. [^{14}C]Diuron, applied alone at 4 lb ai/A or in combination with [^{14}C]bromacil, each at 4 lb ai/A, dissipated with a half-life of ~2 months from the top 2 inches of a Keyport silt loam soil confined in stainless steel cylinders in a Delaware field plot. At the 0- to 2-inch depth of Myakka fine sand soil cylinders (Florida), [^{14}C]diuron dissipated with a half-life of 0.5-1 month following application with [^{14}C]bromacil (each applied at 3 lb ai/A). 1-Methyl-3-(3,4-dichlorophenyl)urea and 3,4-dichlorophenyl urea were found in soil samples from both field plots, at maximum concentrations of 12.3 and 20.1% of the applied radioactivity, respectively. Movement of radioactivity into lower soil depths (4-14 inches) was minimal (<10.2% of the applied radioactivity). Total radioactivity dissipated from the 14-inch soil cylinders with a half-life of <4 months in both soils treated with [^{14}C]diuron plus [^{14}C]bromacil, and a half-life of >12 months in the Keyport silt loam soil treated with [^{14}C]-diuron alone.

3. Data requirements for combination products and tank mix uses are currently not being imposed for this Standard.

MATERIALS AND METHODS:

Stainless steel cylinders (4-inch diameter x 15-inch height) were driven into soil cleared of vegetation, leaving ~1-inch above ground level to minimize runoff and splashing. Field plots were located at Newark, Delaware on Keyport silt loam soil (21% sand, 62% silt, 17% clay, 2.75% organic matter, pH 6.4, CEC 8.2 meq/100 g) and at Bradenton, Florida on Myakka fine sand (97% sand, 2% silt, 1% clay, 2.43% organic matter, pH 6.3, CEC 3.9 meq/100 g). Cylinders in the Keyport silt loam soil field plot were treated as follows: 3 cylinders were treated with [^{14}C]diuron (specific activity 4.11 µCi/mg, radiopurity 95.2%, source unspecified) at 4 lb ai/A; 3 cylinders were treated with [^{14}C]bromacil (specific activity 3.96 µCi/mg, radiopurity >99%, source unspecified) at 4 lb ai/A; and 8 cylinders were treated with [^{14}C]diuron plus [^{14}C]bromacil (Krovar I Weed Killer, diuron and bromacil in 1:1 molar ratio, specific activity 4.04 µCi/mg, radiopurity >97%, E.I. du Pont de Nemours and Co.) at 8 lb ai/A. The Myakka fine sand field plot contained 8 cylinders which were treated with [^{14}C]diuron plus [^{14}C]bromacil, at 6 lb ai/A.

The cylinders were removed at intervals up to 18 months after treatment, and the soil samples were divided into 0- to 2-, 2- to 4-, 4- to 6-, 6- to 8-, 8- to 10-, 10- to 12-, and 12- to 14-inch segments. Soil segments were air dried, mixed, and aliquots were combusted. The $^{14}CO_2$ evolved was trapped and quantified using LSC.

Additional aliquots of soil were extracted five times with methylene chloride:methanol:ammonium hydroxide (75:24.9:0.1), followed by three extractions with 0.1 N sodium hydroxide. The extracts were combined, adjusted to pH 7 with dilute hydrochloric acid, and partitioned three times with ethyl acetate in a separatory funnel. The extracted soil was then refluxed with 1 N sodium hydroxide, the extract was neutralized to pH 7, and partitioned with ethyl acetate. All ethyl acetate extracts were then combined, aliquots were analyzed for total radioactivity using LSC, and the remainder was concentrated to a small volume. Aliquots of the concentrated extracts were spotted onto silica gel TLC plates along with known standards, and the plates were developed by two-dimensional TLC using ethyl acetate in the first direction, and methylene chloride: methanol (95:5, v:v) in the second. After development, the TLC plates were autoradiographed, and radioactive areas were scraped from the plates and quantified using LSC. The extracted soil samples were combusted, and the $^{14}CO_2$ evolved was trapped and quantified using LSC.

To confirm the identities of the degradates, a portion of the combined ethyl acetate extract was cleaned up using preparative TLC and Florisil column chromatography, and then analyzed using MS.

REPORTED RESULTS:

Cumulative rainfall at the test sites during the study period is shown in Table 1. In the Keyport silt loam soil, total radioactivity dissipated from the 14-inch soil columns with a half-life of >12 months when [^{14}C]-diuron was applied alone, and 2-4 months when [^{14}C]diuron was applied in combination with [^{14}C]bromacil (Table 2). The majority of the radioactivity recovered at any sampling interval was found in the 0- to 4-inch soil depth; <5.6% of the applied radioactivity was found in any soil segment at lower depths. Total radioactivity dissipated from the Myakka sand soil treated with [^{14}C]diuron plus [^{14}C]bromacil with a half-life of 1-2 months, and <10.2% of the applied radioactivity was found in any soil segment below the 4-inch depth (Table 3).

[^{14}C]Diuron dissipated from the 0- to 2-inch depth of the Keyport silt loam soil with a half-life of ~2 months when applied alone or in combination wtih [^{14}C]bromacil, and had declined to <16.2% of the applied radioactivity by 8 months after treatment (Tables 4 and 5). Dissipation of [^{14}C]diuron from the Myakka sand soil was slightly more rapid, with a half-life of ~0.5-1 month at the 0- to 2-inch depth (Table 6).

The diuron degradates 1-methyl-3-(3,4-dichlorophenyl)urea and 3,4-dichlorophenyl urea (Figure 1) were found in both field plots; maximum concentrations (12.3 and 20.1% of the applied, respectively) were detected at the 0- to 2-inch soil depths (Tables 4-6). Polar origin material (uncharacterized) accounted for <3.2% of the applied radioactivity in any soil sample.

DISCUSSION:

1. The test substances used were not typical end-use products.

2. Field plots of Keyport silt loam soil treated with [^{14}C]diuron alone were not sampled until 2 months after treatment. Pretreatment samples were not taken from any plot.

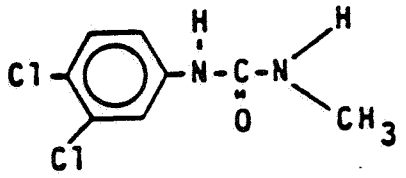
3. Results of diuron dissipation in soil confined to cylinders may not be representative of dissipation under actual use conditions.

4. Field plots of Myakka fine sand soil were treated only with [^{14}C]diuron plus [^{14}C]bromacil; the dissipation of diuron when applied alone and in combination with another pesticide was not compared.

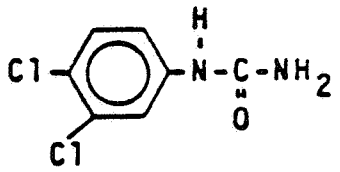
5. Field test data, such as slope of the test site, depth of water table, and soil and air temperatures, were not reported.

6. Sample storage techniques were not reported.

7. No explanation was provided for the increased persistence of total radioactive residues in the Keyport silt loam soil treated with [^{14}C]-diuron alone.



1-Methyl-3-(3,4-dichlorophenyl)urea



3,4-Dichlorophenyl urea

Figure 1. Structures of two diuron degradates.

Table 1. Cumulative rainfall (inches) at test sites.

Sampling interval (days)	Keyport silt loam soil (Delaware)	Myakka fine sand soil (Florida)
0	0.0	0.0
0.5	0.6	2.7
1	2.1	6.2
2	6.0	9.0
4	17.1	34.9
8	27.8	43.6
12	42.1	54.1
18	57.9	83.1

Table 2. Total radioactivity (% of applied) in Keyport silt loam soil treated with diuron alone or in combination with bromacil.

Sampling depth (inches)	Sampling interval (months)							
	0	0.5	1	2	4	8	12	18
	[^{14}C]Diuron plus [^{14}C]bromacil, at 8 lb ai/A							
0-2	98.1	66.1	67.7	43.8	32.4	24.2	25.6	16.
2-4	1.9	1.6	11.7	19.7	4.7	12.0	3.0	2.
4-6	ND[a]	0.2	2.4	5.6	3.0	2.9	1.2	0.
6-8	ND	0.1	0.5	3.1	3.2	2.4	1.3	0.
8-10	ND	ND	0.2	1.3	1.7	2.3	0.9	0.
10-12	ND	ND	0.1	0.3	0.8	1.0	0.4	0.
12-14	ND	ND	ND	0.2	0.6	1.0	0.4	0.
Total ^{14}C	100.0	68.0	82.6	74.0	46.4	45.8	32.8	21.
	[^{14}C]Diuron, at 4 lb ai/A							
0-2	--[b]	--	--	68.9	--	50.6	43.9	--
2-4	--	--	--	2.5	--	10.1	10.4	--
4-6	--	--	--	0.2	--	1.4	0.6	--
6-8	--	--	--	0.1	--	0.3	0.2	--
8-10	--	--	--	ND	--	0.2	0.3	--
10-12	--	--	--	ND	--	0.2	0.1	--
12-14	--	--	--	ND	--	0.1	0.1	--
Total ^{14}C	--	--	--	71.7	--	62.9	55.0	--

[a] Not detected; detection limit is 0.1% of the applied radioactivity.

[b] Not sampled.

Table 3. Total radioactivity (% of applied) in Myakka fine sand treated with [^{14}C]diuron plus [^{14}C]bromacil, at 6 lb ai/A.

Sampling depth (inches)	Sampling interval (months)							
	0	0.5	1	2	4	8	12	18
0-2	84.9	66.1	19.6	20.9	17.1	17.6	13.8	7.1
2-4	14.5	19.3	20.7	10.3	6.9	10.8	10.4	8.1
4-6	0.6	9.4	10.2	4.1	7.0	4.6	2.7	4.6
6-8	ND[a]	3.9	5.3	2.1	1.8	2.7	0.6	1.1
8-10	ND	1.1	6.2	3.5	0.8	1.1	0.3	0.2
10-12	ND	0.2	6.0	3.6	0.9	0.9	0.1	0.1
12-14	ND	ND	1.2	1.3	0.6	0.2	ND	ND
Total ^{14}C	100.0	100.0	69.2	45.8	35.1	37.9	27.9	21.3

[a] Not detected; detection limit is 0.1% of the applied radioactivity.

Table 4. Distribution of radioactivity (% of applied) in Keyport silt loam soil treated with [^{14}C]diuron plus [^{14}C]bromacil, at 8 lb ai/A.

Sampling interval (months)	Sampling depth (inches)	Diuron	Degradate I[a]	Degradate II[b]	Polar material	Bromacil residues[c]	Soil bound[d]	Total
0	0-2	46.7	1.6	0.4	0.4	48.1	0.9	98.1
	2-4	0.5	ND[e]	ND	ND	1.3	0.1	1.9
0.5	0-2	27.4	3.6	0.6	0.6	32.6	1.3	66.1
	2-4	0.3	0.1	ND	ND	1.0	0.1	1.6
1	0-2	28.0	5.5	0.7	0.7	30.5	2.3	67.7
	2-4	1.8	0.8	0.2	0.2	8.4	0.3	11.7
	6-8	ND	ND	ND	ND	0.4	ND	0.4
2	0-2	21.1	7.4	1.0	1.3	10.2	2.8	43.8
	2-4	2.5	1.8	0.3	0.2	14.2	0.7	19.7
	6-8	0.1	0.1	ND	ND	2.9	ND	3.1
4	0-2	13.5	10.7	1.0	1.4	2.4	3.4	32.4
	4-6	0.1	0.2	ND	0.1	2.5	0.1	3.0
	8-10	ND	ND	ND	ND	1.6	ND	1.6
8	0-2	9.6	7.6	0.3	0.4	2.4	3.9	24.2
	4-6	0.1	0.2	ND	0.1	2.3	0.2	2.9
	8-10	0.1	ND	ND	ND	2.0	0.1	2.3
	12-14	ND	ND	DN	ND	0.8	0.1	1.0
12	0-2	6.5	12.3	0.9	0.7	2.4	2.8	25.6
	4-6	0.1	0.1	ND	0.1	0.9	ND	1.2
	8-10	ND	0.1	ND	ND	0.7	ND	0.9
18	0-2	2.3	5.4	0.3	3.2	2.1	3.6	16.9
	4-6	0.1	0.3	ND	0.1	0.3	0.1	0.9
	8-10	ND	0.1	ND	ND	0.2	ND	0.4

a 1-Methyl-3-(3,4-dichlorophenyl)urea (structure shown in Figure 1).

b 3,4-Dichlorophenyl urea (structure shown in Figure 1).

c Parent bromacil plus degradates.

d Unextractable radioactivity; determined by combustion analysis.

e Not detected; detection limit is 0.1% of the applied radioactivity.

Table 5. Distribution of radioactivity (% of applied) in Keyport silt loam soil treated with [^{14}C]diuron, at 4 lb ai/A.

Sampling interval (months)	Sampling depth (inches)	Diuron	Degradate I[a]	Degradate II[b]	Polar material	Soil Bound[d]	Total
2	0-2	47.0	1.4	13.5	1.9	5.1	68.9
	2-4	1.3	0.1	0.7	0.2	0.2	2.5
	6-8	ND[d]	ND	ND	0.1	ND	0.1
8	0-2	16.2	2.0	20.1	2.1	10.2	50.6
	12-14	ND	ND	ND	0.1	ND	0.1
12	0-2	12.0	1.7	18.5	2.0	9.7	43.9
	4-6	0.2	ND	0.3	ND	0.1	0.6
	8-10	0.1	ND	0.2	ND	ND	0.3
	12-14	ND	ND	ND	ND	ND	ND

a 1-Methyl-3-(3,4-dichlorophenyl)urea (structure shown in Figure 1).

b 3,4-Dichlorophenyl urea (structure shown in Figure 1).

c Unextractable radioactivity; determined by combustion analysis.

d Not detected; detection limit is 0.1% of the applied radioactivity.

Table 6. Distribution of radioactivity (% of applied) in Myakka fine sand soil treated with [^{14}C]diuron plus [^{14}C]bromacil, at 6 lb ai/A.

Sampling interval (months)	Sampling depth (inches)	Diuron	Degradate I[a]	Degradate II[b]	Polar material	Bromacil residues[c]	Soil bound[d]	Total
0	0-2	39.8	0.7	0.1	0.1	43.9	0.3	84.9
	2-4	6.3	ND[e]	ND	ND	8.0	0.2	14.5
0.5	0-2	34.7	3.2	0.6	0.6	26.6	0.4	66.1
	4-6	1.2	0.2	ND	0.2	7.7	0.1	9.4
	8-10	0.2	0.1	ND	ND	0.8	ND	1.1
1	0-2	12.8	2.0	0.3	0.3	4.2	0.1	19.6
	4-6	1.9	0.5	0.1	0.2	7.5	ND	10.2
	8-10	0.1	0.1	ND	0.2	5.8	ND	6.2
	12-14	ND	ND	ND	ND	1.1	ND	1.2
2	0-2	14.0	3.1	0.3	0.5	2.8	0.2	20.9
	4-6	1.5	0.8	0.1	0.2	1.4	0.1	4.1
	8-10	0.1	ND	ND	0.1	3.2	ND	3.5
	12-14	ND	ND	ND	ND	1.2	ND	1.3
4	0-2	7.8	4.1	0.3	0.5	1.7	2.7	17.1
	4-6	2.6	1.5	0.1	0.2	1.0	1.6	7.0
	8-10	ND	ND	ND	ND	0.4	0.3	0.8
8	0-2	7.9	3.4	0.2	0.2	4.2	1.7	17.6
	4-6	1.4	0.8	0.1	0.1	1.6	0.6	4.6
	8-10	0.1	ND	ND	ND	0.6	0.3	1.1
12	0-2	6.3	5.2	0.3	0.5	0.8	0.7	13.8
	4-6	1.7	1.8	0.1	0.2	0.3	0.5	4.6
18	0-2	2.6	3.4	0.1	0.3	0.3	0.4	7.1
	4-6	1.6	2.1	0.1	0.3	0.3	0.2	4.6

a 1-Methyl-3-(3,4-dichlorophenyl)urea (structure shown in Figure 1).

b 3,4-Dichlorophenyl urea (structure shown in Figure 1).

c Parent bromacil plus degradates.

d Unextractable radioactivity; determined by combustion analysis.

e Not detected; detection limit is 0.1% of the applied radioactivity.

22

(TDR036)

CASE GS0046 DIURON STUDY 4 PM 06/23/81

CHEM 035505 Diuron

BRANCH EFB DISC --

FORMULATION 06 - WETTABLE POWDER (WP OR W)

FICHE/MASTER ID No MRID CONTENT CAT 01
Horsmans, K.J.H., and J.L. v.d. Maas. 1969. Accumulation of diuron in fish. Ghent. Rijksfaculteit Landbouwwetenschappen. Mededelingen 34:428-433. Study submitted Aug. 30, 1984, under 352-324, -247, and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE; Accession No. 2545912.

SUBST. CLASS = S.

DIRECT RVW TIME = 4 1/2 (MH) START-DATE END DATE

REVIEWED BY: K. Patten
TITLE: Staff Scientist
ORG: Dynamac Corp., Enviro Control Division, Rockville, MD
TEL: 468-2500

SIGNATURE: K. Patten DATE: Jan. 22, 1985

APPROVED BY:
TITLE:
ORG:
TEL:

SIGNATURE: DATE:

CONCLUSION:

Field Accumulation - Aquatic Non-Target Organisms

This study is scientifically invalid because the procedures and protocols used were not sufficient for assessment of the accumulation potential of diuron in fish (i.e, the concentration in water was not compared with the concentration in aquatic organisms over time to generate accumulation data). In addition, this study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the fish samples were not fractionated into edible and visceral tissue; the test water and test organisms were not characterized; the test site was insufficiently characterized; a nonspecific method was used; meteorological data were not provided, and a single species of fish was included in the study.

23

MATERIALS AND METHODS:

Fish ponds (0.2 ha surface area, ponds not further characterized) were treated with diuron (Karmex, 80% WP, source unspecified) at 0.1, 0.2, and 0.4 ppm. Yearling carp (fish not further characterized) were added to the ponds. After 3 months of exposure, 8-40 fish were removed from each pond for analysis. At this time, additional fish (>10 fish) were transferred from the pond treated with diuron at 0.4 ppm to a second pond treated with diuron at 0.4 ppm simultaneously with the introduction of the fish. The transferred fish were removed from the second pond after 5 months of additional exposure for analysis.

Whole fish samples were analyzed for diuron residues using either GC or colorimetric analysis. In both methods diuron was converted to 3,4-dichloroaniline (DCA) by alkaline hydrolysis, then the DCA was extracted by distillation and collected in a hydrochloric acid solution. In one method, the DCA was extracted from the acid solution with hexane and analyzed using GC equipped with an electron capture detector. Recovery of diuron from fortified samples using the first method ranged from 50 to 75%. In the second method, DCA was diazotized with sodium nitrite, the product was coupled to N-(1-naphtyl)ethylenediamine dihydrochloride, and the absorbance of the solution was measured at 560 mμ. Recovery of diuron from fortified samples using the second method ranged from 70 to 100%.

In a related study, yearling carp which had been kept in the pond treated with diuron at 0.1 ppm for >5 months were transferred to tanks of untreated water (untreated site not further characterized). The study was conducted initially in late fall and was repeated in early spring. Fish (6-9) were removed from the tanks for analysis at 0, 1, 5, 9, and 11 week intervals after transfer in the late fall study and at 0, 1 day, and 1, 2, and 3 week intervals after transfer in the spring study. The fish were analyzed for diuron residues as described.

REPORTED RESULTS:

Following 3 months of exposure, diuron residues were 1.9 ppm (range 1.7-2.4 ppm) in fish from the pond treated with diuron at 0.1 ppm, 3.1 ppm (range 2.8-3.6 ppm) in fish from the pond treated at 0.2 ppm, and ranged from 6.1 to 7.3 ppm in fish from the pond treated at 0.4 ppm.

Following an additional 5 months of exposure (8 months total), diuron residues averaged 34 ppm and ranged from 14 to 60 ppm in 10 carp exposed to water treated with diuron at 0.4 ppm.

In the depuration study conducted in late fall, diuron residues in the fish were 1.76 ppm at the time of transfer, decreased to 0.61 ppm (range 0.51-0.68 ppm) at the 1 week interval, and ranged from 0.55 to 0.70 ppm

at the remaining sampling intervals up to 11 weeks following the transfer. In the study conducted in early spring, diuron residues in the fish were 0.79 ppm (range 0.72-0.85 ppm) at the time of transfer and ranged from 0.75 to 0.93 ppm at the remaining sampling intervals. Diuron residues in fish in the depuration controls ranged from 0.02 to 0.08 ppm.

DISCUSSION:

1. The fish were analyzed for diuron residues only at the end of the 3 and 8 months (0.4 ppm only) exposure period, rather than during the entire study. Additionally, no water samples were analyzed to confirm the concentration of diuron residues in the water, so no bioaccumulation rate could be determined for the fish.

2. Meteorological data, including air and water temperatures and precipitation amounts, were not provided.

3. Edible portions of the fish were not analyzed separately from the viscera.

4. Characteristics of the water in the ponds, such as pH and COD, were not provided. The fish ponds were not adequately described; it was not specified if the bottom and sides were earthen, if the ponds were exposed or covered, or if water was added during the study. Assuming soil was associated with the ponds, no soil samples were analyzed for diuron. Characteristics of the tanks used during depuration, including water characteristics and location, were not provided. Characteristics of the fish, including species, size, acclimation procedures and observed mortality, were not provided.

5. Neither method was specific for diuron nor its degradates; only diuron residues were measured. Residues were not identified.

6. Only one species of fish was studied; bottom, middle, and surface feeders were not included.

7. According to the reported data from the pond treated at 0.4 ppm, the concentration of diuron residues in the fish ranged from 6.1 to 7.3 ppm, and averaged 8.2 ppm. It could not be determined which numbers were incorrect.

8. There was a depuration period for one (0.1 ppm) of the three treatment rates.

CASE GS0046 DIURON STUDY 5 PM 06/23/81

CHEM 035505 Diuron

BRANCH EFB DISC --

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID No MRID CONTENT CAT 01

Call, D.J., L.T. Brooke, and J.R. Kent. 1983. Toxicity, bioconcentration, and metabolism of five herbicides in freshwater fish. Prepared for Environmental Research Lab.-Duluth, MN, by University of Wisconsin, Superior. Unpublished study submitted Aug. 30, 1984, under 352-324, -247, and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Accession No. 25491.

SUBST. CLASS = S.

DIRECT RVW TIME = 7 (MH) START-DATE END DATE

REVIEWED BY: K. Patten
TITLE: Staff Scientist
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TEL: 468-2500

SIGNATURE: K. Patten DATE: Jan. 22, 1985

APPROVED BY:
TITLE:
ORG:
TEL:

SIGNATURE: DATE:

CONCLUSIONS:

Laboratory Accumulation - Fish

1. This study is scientifically valid.

2. [^{14}C]Diuron residues accumulated within 24 hours of exposure in whole minnows at ~150x the concentration of [^{14}C]diuron in water treated with [^{14}C]diuron at 3.15 or 30.40 µg/l. Following 24 days of exposure, 85% of the [^{14}C]residues in the fish were unextractable, 15% were extractable in ether, and 8.4% of the ether-extractable residues (1.3% of total) were [^{14}C]diuron. More than 75% of the ^{14}C was eliminated from the fish by day 1 of depuration, and ~99% was eliminated by day 21.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance was not characterized, test conditions including water characteristics were incompletely characterized, the fish samples were not fractionated into edible and visceral tissue, residues in the fish tissue were incompletely characterized, and residues in the water were not quantified.

MATERIALS AND METHODS:

Fathead minnows (Pimephales promelas; 30-day-old, test organisms not further characterized) were added to aquariums (27-l) containing water (uncharacterized) which had been treated with [^{14}C]diuron (mixture of radiolabeled and technical grade diuron, test substances not further characterized, DuPont Chemical Co. and California Bionuclear Corp.) at 3.15 or 30.40 µg/l. A flow-through system, which cycled water (1-l) containing the appropriate concentration of [^{14}C]diuron into the aquarium every 15 minutes, was used to maintain a constant concentration of [^{14}C]diuron in the water (Figure 1). The water temperature was maintained at 24.8 ± 1 C (environmental conditions not further described). Five minnows were removed and analyzed separately at 1, 2, 4, 5, 10, 14, 17, 21, and 24 day intervals during the exposure period. Water samples were taken from the aquarium for analysis at the same intervals. After 24 days of exposure the remaining minnows were transferred to a similar flow-through aquarium system which contained untreated water. Water and minnow samples were taken for analysis at 1, 2, 4, 6, 10, 14, 17, and 21 day intervals during the depuration period.

Aquarium water containing the radioactive diuron was filtered through an Amberlite XAD-2 resin column. The column was then washed with distilled water and eluted with methanol. Unfiltered aquarium water and the methanol eluate were analyzed for total radioactivity using LSC. The methanol eluate was concentrated by evaporation analyzed using TLC (TLC methodology not further described). Reported recovery of diuron from fortified water samples averaged 93.2%.

Whole fish samples (1.5-60 g) were homogenized in water, and aliquots were analyzed for total radioactivity. The remaining homogenate was acidified with concentrated hydrochloric acid and extracted three times with ethyl ether. For the fish sampled at the end of the exposure period only, the aqueous layer was centrifuged, and the solid residues analyzed for total radioactivity using LSC following combustion. The supernatant was lyophilized, and the residue dissolved in acetone. The acetone solutions were chromatographed on silica gel thin-layer strips using a toluene:methanol (90:10, v:v) solvent system. Radioactive areas on the strips were located with a radiochromatogram scanner, compared to cochromatographed standard solutions, and quantified using LSC. Reported recovery from fish samples fortified with diuron averaged 91.9%.

REPORTED RESULTS

The average concentration of [^{14}C]diuron in the water during the exposure period was 3.15 µg/l in the pond treated with [^{14}C]diuron at 3.15 µg/l and 30.40 µg/l in the pond treated at 30.40 µg/l (Figure 1). Three metabolites were recovered from the water; all were forms of demethylated [^{14}C]-diuron but only 3,4-dichloroaniline was identified.

An equilibrium had been reached between the concentration of [^{14}C]diuron in the water and [^{14}C]diuron residues in the whole fish tissue by the day 1 sampling interval (Figure 1). At the end of the 24-day exposure period, 85% of the [^{14}C]residues were unextractable and 15% were ether-extractable. [^{14}C]Diuron comprised 8.4% of the ether-extractable (1.3% of the total ^{14}C) radioactivity. The bioconcentration ratio for ^{14}C (^{14}C in fish ÷ ^{14}C in water) was 157.0x for the fish from the pond treated with [^{14}C]diuron at 3.15 µg/l and 143.7x for the fish from the pond treated with [^{14}C]-diuron at 30.40 µg/l.

Twenty-four hours after the fish were transferred to the diuron-free water, >75% of the ^{14}C had been eliminated from the fish tissue (83.8 and 76.4% at the 3.15 and 30.40 µg/l treatment levels, respectively). By day 21 of the depuration period, ~99% of the ^{14}C had been eliminated from the whole fish.

DISCUSSION:

1. There was no indication whether the aquarium included sediment or was solely water.

2. The test substance was reported to be a mixture of technical grade non-radioactive diuron (Karmex, purity >98.6%, Du Pont Chemical Co.) and [^{14}C]-diuron, but the relative proportions were not stated. Both carbonyl-labeled-[^{14}C]diuron (specific activity 0.98 mCi/mM, purity unspecified, Du Pont Chemical Co.) and ring-labeled-[^{14}C]diuron (specific activity 12.2 mCi/mM purity unspecified, California Bionuclear Corp.) were reported in the material list, but it was not stated if only one form or a mixture of the forms was used.

3. The TLC solvent system used in the analysis of water was not reported. It was not clear if the reported metabolites in water were from the bioaccumulation study, or from a second study in which fish were injected with [^{14}C]diuro that was reported in the same hardcopy.

4. Characteristics of the water, including pH and COD, were not reported for the bioaccumulation study.

5. The fish were not fractionated into edible tissue and viscera.

6. Residues in the fish tissue were identified only on day 24 of the exposure period, and at that interval only ~8% of the extractable residues were identified.

7. Characterization of the test conditions, including lighting, organism loading rate, observed organism mortality, and acclimation procedures, were not provided.

8. Residue levels (other than diuron) in the water during exposure and depuration were not reported.

9. The detection limits for the methods, and the range of recovery of diuron from fortified fish and water samples, were not reported.

10. The majority of the data was presented only in graphical form.

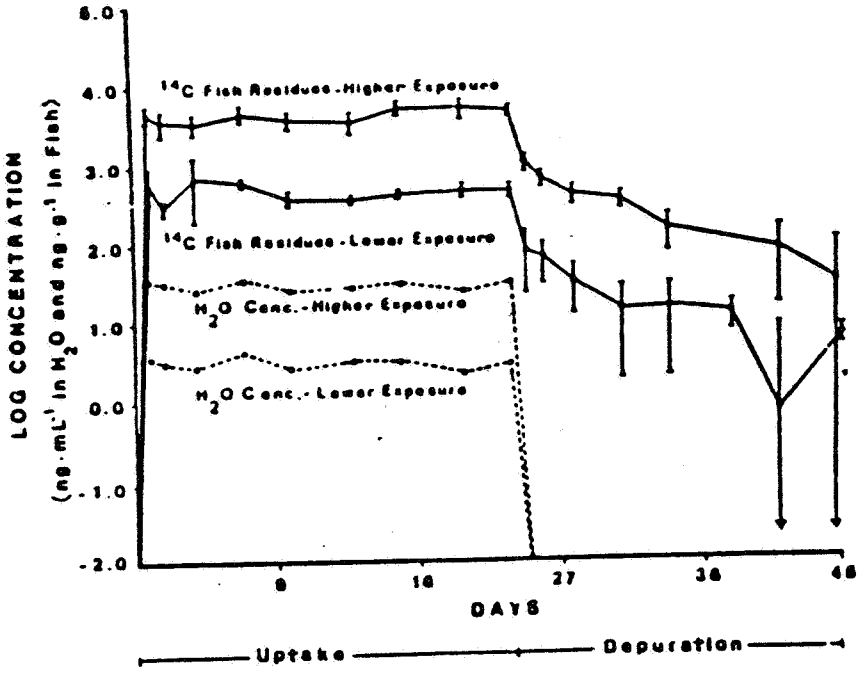


Figure 1. The log of the average concentration of [^{14}C]diuron (ng/ml) in aquarium water treated continuously with [^{14}C]diuron at 3.15 or 30.4 µg/l, and the log of the average (± standard deviation) concentration of total radioactive residues (ng/g) in whole fish tissue during the exposure (days 0-24) and depuration (days 25-45) period.

DYNAMAC
CORPORATION

DIURON ADDENDUM

Initial Draft Report

Task 2: Environmental Fate and Exposure Assessment

Contract No. 68-01-6679

MAY 2, 1985

Submitted to:
Environmental Protection Agency
Arlington, VA 22202

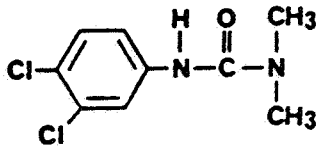
Submitted by:
Dynamac Corporation
Enviro Control Division
The Dynamac Building
11140 Rockville Pike
Rockville, MD 20852

31

Environmental Fate and Exposure Assessment

Diuron Addendum

DIURON, DICHLORFENIDIM, DCMU, DMU, CEKIURON, CRISURON, DAILON, DIATER, DI-ON, DIUREX, DYNEX, KARMEX, UNIDRON, UROX "D", VONDURON



3-(3,4-DICHLOROPHENYL)-1,1-DIMETHYL-UREA

[^{14}C]Diuron (radiopurity 95.2%), applied alone at 4 lb ai/A or in combination with [^{14}C]bromacil, each at 4 lb ai/A, dissipated with a half-life of ~2 months from the top 2 inches of a Keyport silt loam soil confined in stainless steel cylinders in a Delaware field plot (Rapisarda, No MRID). At the 0- to 2-inch depth of Myakka fine sand soil confined in stainless steel cylinders (Florida), [^{14}C]diuron dissipated with a half-life of 0.5-1 month following application with [^{14}C]bromacil (each applied at 3 lb ai/A). 1-Methyl-3-(3,4-dichlorophenyl)urea and 3,4-dichlorophenyl urea were found in soil samples from both field plots, at maximum concentrations of 12.3 and 20.1% of the applied radioactivity, respectively. Movement of radioactivity into lower soil depths (4-14 inches) was minimal (<10.2% of the applied radioactivity). Total radioactivity dissipated from the 14-inch soil cylinders with a half-life of <4 months in both soils treated with [^{14}C]diuron plus [^{14}C]bromacil, and a half-life of >12 months in the Keyport silt loam soil treated with [^{14}C]diuron alone.

[^{14}C]Diuron residues accumulated within 24 hours of exposure in whole minnows at ~150x the concentration of [^{14}C]diuron in water treated with [^{14}C]diuron (purity unspecified) at 3.15 or 30.40 µg/l (Call et al., No MRID). Following 24 days of exposure, 85% of the [^{14}C]residues in the fish were unextractable, 15% were extractable in ether, and 8.4% of the ether-extractable residues (1.3%

of total) were [^{14}C]diuron. More than 75% of the ^{14}C was eliminated from the fish by day 1 of depuration, and ~99% was eliminated by day 21.

The following represents the data currently required (EPA Data Requirements for Registering Pesticides) to fully assess the environmental fate and transport of, and the potential exposure to diuron based on the data submitted for the Diuron Registration Standard dated September 30, 1983 and this addendum: hydrolysis studies; photodegradation studies in water and on soil; anaerobic soil metabolism studies; anaerobic and aerobic aquatic metabolism studies; leaching and adsorption/desorption studies; laboratory and field volatility studies; terrestrial, aquatic, and possibly long-term field dissipation studies; accumulation studies on crops, fish, and aquatic nontarget organisms, and reentry studies.

Hydrolysis studies: One study was reviewed (El-Dib and Aly, No MRID) that is scientifically invalid because: (a) for experiments conducted with phosphate buffer solutions, the concentration of diuron used (4662 ppm) exceeded the solubility of diuron in water (42 ppm) and (b) for experiments conducted with NaOH solutions, raw data were not provided to support the reported half-lives and the experiments were not stated to have been conducted in darkness. In addition, this study would not fulfill data requirements because the test substance was not characterized and, for NaOH solutions in which degradation occurred, degradates were not identified. All data are required.

Photodegradation studies in water: No data were submitted for this addendum; however, all data are required.

Photodegradation studies on soil: One study was reviewed (Horowitz and Herzlinger, No MRID) that is scientifically invalid because the sampling protocol (1 sampling interval) was inadequate to accurately assess the decline of diuron, no standard curve was developed relating the bioassay results to known concentrations of diuron, the experimental design did not distinguish between photodegradation and volatilization, and there were no dark controls for four of the five treatments. In addition, this study would not fulfill data requirements because a nonspecific analytical method was used, soil and light were not completely characterized, the moisture content of the soils was not specified, the test substance was not technical grade or purer, and the study may

33

not have been typical of conditions existing in the United States. All data are required.

Photodegradation studies in air: No data were submitted for this addendum; however, this data requirement is not necessary for the purposes of this Standard.

Aerobic soil metabolism studies: No data were submitted for this addendum; however, based on data submitted for the Diuron Registration Standard dated September 30, 1983, all data requirements have been met.

Anaerobic soil metabolism studies: No data were submitted for this addendum; however, all data are required.

Anaerobic aquatic metabolism studies: No data were submitted for this addendum; however, all data are required.

Aerobic aquatic metabolism studies: No data were submitted for this addendum; however, all data are required.

Leaching and adsorption/desorption studies: No data were submitted for this addendum; however, based on data submitted for the Diuron Registration Standard dated September 30, 1983, a study is needed providing information on the mobility of diuron degradation products.

Laboratory volatility studies: No data were submitted for this addendum; however, all data are required.

Field volatility studies: No data were submitted for this addendum; however, all data are required.

Terrestrial field dissipation studies: No data were submitted for this addendum; however, all data are required.

Aquatic field dissipation studies: No data were submitted for this addendum; however, all data are required.

Forestry dissipation studies: No data were submitted for this addendum; however, this data requirement is not necessary for the purposes of this Standard.

Dissipation studies for combination products and tank mix uses: One study was reviewed (Rapisarda, No MRID) and considered scientifically valid; however, no data are required because data requirements for combination products and tank mix uses are currently not being imposed for this Standard.

Long-term field dissipation studies: No data were submitted for this addendum; however, all data may be required if data from aerobic soil metabolism/terrestrial field dissipation studies indicate that 50% dissipation of residues will not occur before a subsequent application to the same use sites.

Confined accumulation studies on rotational crops: No data were submitted for this addendum; however, based on data submitted for the Diuron Registration Standard dated September 30, 1983, all data are needed except those for small grains planted 30-120 days after soil treatment.

Field accumulation studies on rotational crops: No data were submitted for this addendum; however, all data are required.

Accumulation studies on irrigated crops: No data were submitted for this addendum; however, all data are required.

Laboratory studies of pesticide accumulation in fish: One study was reviewed (Call et al., No MRID) that is scientifically valid, but does not fulfill data requirements because the test substance was not characterized, test conditions including water characteristics were incompletely characterized, the fish samples were not fractionated into edible and visceral tissue, residues in the fish tissue were incompletely characterized, and residues in the water were not quantified. All data are required.

Field accumulation studies on aquatic nontarget organisms: One study was reviewed (Horsmans and v.d. Maas, No MRID) that is scientifically invalid because the procedures and protocols used were not sufficient for assessment of the accumulation potential of diuron in fish (i.e., the concentration in water was not compared with the concentration in aquatic organisms over time to generate

accumulation data). In addition, this study would not fulfill data requirements because the fish samples were not fractionated into edible and visceral tissue; the test water and test organisms were not characterized; the test site was in-insufficiently characterized; a nonspecific method was used; meteorological data were not provided, and a single species of fish was included in the study. All data are required.

Reentry studies: No data were submitted for this addendum; however, all data are required.

Label Restriction

Pending the submission of complete crop rotation data, it is suggested that crops other than those with registered diuron uses be restricted from being planted in diuron-treated soil.

References (All Studies Reviewed in this Addendum)

Call, D.J., L.T. Brooke, and J.R. Kent. 1983. Toxicity, bioconcentration, and metabolism of five herbicides in freshwater fish. Prepared for Environmental Research Lab.-Duluth, MN, by University of Wisconsin, Superior. Unpublished study submitted Aug. 30, 1984, under 352-324, -247, and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Accession No. 25491. (No MRID)

El-Dib, M.A. and O.A. Aly. 1976. Persistence of some phenylamide pesticides in the aquatic environment-I. Hydrolysis. Water Res. 10(12): 1047-1050. Unpublished study submitted Aug. 30, 1984 under 352-324,-247 and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Accession No. 254591. (No MRID)

Horowitz, M., and G. Herzlinger. 1973. Soil conditions affecting the dissipation of diuron, fluometuron, and propham from the soil surface. Unpublished study submitted Aug. 30, 1984, under 352-324, -247, and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental

Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Accession No. 254591. (No MRID)

Horsmans, K.J.H., and J.L. v.d. Maas. 1969. Accumulation of diuron in fish. Ghent. Rijksfaculteit Landbouwwetenschappen. Mededelingen 34:428-433. Study submitted Aug. 30, 1984, under 352-324, -247, and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE; Accession No. 2545912. (No MRID)

Rapisarda, C. 1984. Degradation of ^{14}C-labeled Krovar Weed Killer in soil. Unpublished study submitted Aug. 30, 1984 under 352-324, -247, and -199. In E.I. du Pont de Nemours and Company Response to Diuron Registration Standard Environmental Fate. Submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Accession No. 254591. (No MRID)