

868600034



THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN 48674

April 10, 1986
APR JUN 1986

6/2/86
RHC

868600011 thru 42

Document Control Officer
U.S. Environmental Protection Agency
TSCA-8D1
P.O. Box 2060
Rockville, MD 20852

MAY 3 1986

RE: OPTS-84020A

Dear Sir or Madam:

As required by 40 CFR 716 as amended, effective March 7, 1986, we herewith submit copies of reports which meet the requirements of the referenced rule as Health and Safety Studies.

The reports have been separated into two categories for your convenience. Enclosed are one set each of public file copies and those that contain confidential business information (CBI). The CBI copies are enclosed in the inner envelope along with the Dow confidential information claim.

Each report is marked with an identifying number at the top of the first page of the report, e.g., D1923. Use of this identification number in future correspondence regarding this submission will facilitate handling of questions.

Many of the submitted reports contain information which is not relevant to Health or Safety Studies of listed chemicals, e.g., references to unlisted chemicals, marketing or process data, account numbers, internal document identification codes or distribution lists. Such information has been deleted from all copies submitted.

The index required by 40 CFR 716.4(b) is enclosed. It lists the Dow identification number and title of each report submitted in TSCA order order.

Very truly yours,

R. L. Hagerman
Research Associate
Regulatory and Legislative Issues
Health and Environmental Sciences
1803 Building
(517) 636-6855

lkr

enclosures

00002

000018
001503

THE STATIC ACUTE TOXICITY OF BIS(2-CHLOROETHOXY)
METHANE, DINOSEB, ANILINE, P-CHLORO-M-CRESOL AND SILVEX
TO THE WATER FLEA, DAPHNIA MAGNA STRAUS

ES-721

December 12, 1984

by

F. M. Gersich
P. G. Murphy

Mammalian & Environmental Toxicology
Dow Chemical U.S.A.
Midland, Michigan 48640

Date Study Started: 8/84
Date Study Completed: 12/84

ABSTRACT

The objective of this study was to determine the static acute toxicity of bis(2-chloroethoxy)methane, dinoseb, aniline, p-chloro-m-cresol and silvex to the aquatic invertebrate, Daphnia magna Straus. These data were gathered to fulfill requirements established in the NPDES-Permit No. MI 0000868 issued to Michigan Division of The Dow Chemical Company. The 48 h LC50 values and their 95% confidence intervals are presented below:

<u>Test Material</u>	<u>LC50 (95% C.I.) mg/L</u>
bis(2-chloroethoxy)methane	201(175-231)
dinoseb	0.24(0.21-0.27)
aniline	0.17(0.14-0.21)
p-chloro-m-cresol	2.0(1.7 -2.2)
silvex	>140 mg/L ^a

^aThe LC50 value is greater than the water solubility of the test material (140 mg/L).

00003

Introduction

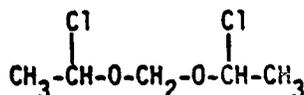
The objective of this study was to determine the 48 h static acute toxicity of bis(2-chloroethoxy)methane, dinoseb, aniline, p-chloro-m-cresol and silvex to the aquatic invertebrate, Daphnia magna Straus. These data were needed to fulfill requirements established in the NPDES (National Pollutant Discharge Elimination System) Permit No. MI 0000868 issued by The State of Michigan to the Michigan Division of The Dow Chemical Company.

Materials and Methods

Test Materials

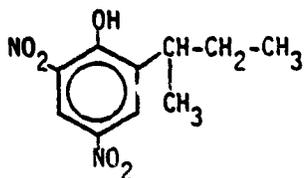
Bis(2-chloroethoxy)methane, dinoseb, aniline, p-chloro-m-cresol and silvex were the chemicals used for toxicity testing. The structural formulas for the test chemicals are as follows:

bis(2-chloroethoxy)methane



Lot # B12370
Supplier: Pfaltz & Bauer, Inc.
CAS # 111-91-1
M.W. 173.04
Water Solubility:
81,000 mg/L at 25°C[1]

dinoseb (synonym 2-sec-butyl-4,6-dinitrophenol)



AGR 186711
Supplier: Dow Chemical Co.
(99.8% pure)
CAS # 88-85-7
M.W. 240.2
Water Solubility:
52 mg/L at 25°C[2]

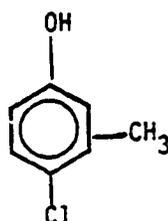
aniline



Lot # 736674
Supplier: Fisher Scientific
(>99% pure)
CAS # 62-53-3
M.W. 93.1
Water Solubility:
34,000 mg/L at 25°C[3]

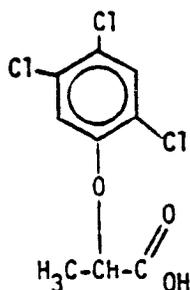
00004

p-chloro-m-cresol



Lot # B10C
 Supplier: Kodak (>99% pure)
 CAS # 59-50-7
 M.W. 142.6
 Water Solubility:
 >500 mg/L at 20°C

silvex [synonym - 2(2,4,5-trichlorophenoxy) propionic acid]



Lot # AGR 127923
 Supplier: Dow Chemical Co.
 (95% pure)
 CAS# 93-73-1
 M.W. 269.5
 Water Solubility:
 140 mg/L at 25°C[2]

Stock solutions of the test chemicals were prepared by dissolving the appropriate amount of chemical in either dilution water or acetone if a solvent carrier was needed. The only chemical used in this study requiring a solvent carrier was dinoseb. When testing with dinoseb, acetone levels did not exceed 0.5 ml/L. All test concentrations reported in this study were nominal. The volatility of the test chemicals was estimated by calculating the Henry's law constants. In all cases the Henry's law constants (H) were indicative of chemicals with moderate to low volatility ($H < 1 \times 10^{-3}$)[4]. As a further safeguard against volatility, all test beakers were covered with watchglasses during the conduct of the tests. The degradation properties of the test chemicals were evaluated by the Environmental Chemistry Laboratory (The Dow Chemical Co., H&ES, Midland, MI.) and were reported as being minimal over 48 h (Dr. Robert E. Bailey, personal communication). Combination of the degradation and volatility properties of the chemicals indicates their stability over the test period.

00005

Dilution Water

Standard laboratory water was used for this study. This water was pumped from the upper Saginaw Bay of Lake Huron off Whitestone Point. The water was limed and flocculated with ferric chloride and filtered by the Midland Water Treatment Plant. The water was carbon filtered, U.V. irradiated and pH adjusted with CO₂ in this laboratory prior to use. During this study the means and standard deviations (n=7) of the water quality variables were as follows: hardness 79 ± 3.8 mg/L (as CaCO₃), alkalinity 51 ± 3 mg/L (as CaCO₃) and conductivity 142 ± 10 µmhos/cm. During these studies the pH of the water ranged from 7.5 to 8.0. Typical detailed analyses of standard dilution water are presented in Table I.

Test Organisms and Culturing Methods

The cladoceran, Daphnia magna Straus, was used as the test organism for this study. The brood stock was maintained in an environmental chamber set at 20 ± 1°C and a light cycle of 16 h daylight (range 970-1250 lux)/8 h darkness. Twenty-four h before testing, multiparous females were isolated and the neonates produced by these adults were used for testing. All daphnids used in this study were from a stock maintained for at least three generations and additionally were from the third or later brood. A more specific treatment of the daphnid culturing method can be found in the detailed standard operating procedure "Daphnia magna Culture"[5].

The daphnid brood stock were fed a diet of the green alga, Selenastrum capricornutum Printz. The feeding rate was the equivalent of 1.25 mg dry wt./L of water on a Monday, Wednesday and Friday basis. Algal size and population distribution were determined with a Coulter Counter.

Acute Toxicity Tests

Acute testing procedures were based on the guidelines recommended by the Committee on Methods for Toxicity Tests with Aquatic Organisms [6], the ASTM Subcommittee on Safety to Aquatic Organisms [7] and those found in the standard operating procedure "Static Acute Daphnid Toxicity Test" [8].

The definitive daphnid static acute tests were conducted in 250 ml glass beakers, in which 200 ml of the appropriate amount of test material and water were added. Testing consisted of exposing groups of 10 neonate (<24 h old) daphnids to various concentrations of the test material, a control and a solvent carrier control where appropriate. All test concentrations and the controls were set in triplicate; however, a fourth beaker was set at the high, middle, low and control concentrations for the purpose of taking dissolved oxygen, pH and temperature measurements and avoiding contamination. The definitive test concentrations used for the five test chemicals were as follows:

bis(2-chloroethoxy)methane - 64.8, 108, 180, 300 and 500 mg/L
dinoseb - 0.16, 0.26, 0.43, 0.72 and 1.20 mg/L
aniline - 0.12, 0.19, 0.32, 0.54, and 0.90 mg/L
p-chloro-m-cresol - 1.6, 2.6, 4.3, 7.2, 12.0, and 20.0 mg/L
silvex - 33.6, 48.0, 68.6, 98.0 and 140 mg/L

The test beakers were kept in an environmental chamber set at $20 \pm 1^\circ\text{C}$ and with a light cycle of 16 h daylight (approximately 970-1250 lux)/8 h darkness.

The duration of the acute tests was 48 h. Mortality of the test organisms as well as dissolved oxygen, pH and temperature of the test concentrations were recorded after 24 and 48 h of exposure. Daphnids were not fed nor were the solutions aerated during the study.

00007

Statistical Calculations

The results of the definitive study were statistically analyzed for daily LC50 values and their corresponding 95% confidence intervals. The LC50 value is the statistically determined concentration of the test material at which 50% of the test organisms die within a specified time period. These values were determined with the aid of an LC50 computer program developed by Stephan et al [9].

00008

Results and Discussion

Test Material: bis(2-chloroethoxy)methane

Water Quality Measurements:

Temperature Range	20.3 - 20.7°C
pH Range	7.7 - 7.9
Dissolved Oxygen	>90% saturation

The raw data for the definitive daphnid test (started on 10-2-84) are presented below:

<u>Concentration (mg/L)</u>	<u>Number of Organisms Exposed</u>	<u>Percent Dead</u>	
		<u>24 h</u>	<u>43 h</u>
500	30	70	93
300	30	37	87
180	30	10	40
108	30	0	10
64.8	30	0	0
0 (water control)	30	0	0

LC50 Value and 95% Confidence Interval

24 h	369(317-450) mg/L	probit analysis[10]
48 h	201(175-231) mg/L	probit analysis

00009

Test Material: Dinoseb (2-sec-butyl-4,6-dinitrophenol)

Water Quality Measurements:

Temperature Range	19.5-20.6°C
pH Range	7.6- 8.2
Dissolved Oxygen	>90% saturation

The raw data for the definitive daphnid test (started on 8-21-84) are presented below:

<u>Concentration (mg/L)</u>	<u>Number of Organisms Exposed</u>	<u>Percent Dead</u>	
		<u>24 h</u>	<u>48 h</u>
1.2	30	100	100
0.72	30	100	100
0.43	30	84	100
0.26	30	23	43
0.16	30	23	23
0 (acetone control)	30	10	10
0 (water control)	30	3	10

LC 50 Value and 95% Confidence Interval

24 h	0.29(0.24 -0.33)mg/L	moving average method[11]
48 h	0.24(0.21 -0.27)mg/L	probit analysis

00010

Test Material: Aniline

Water Quality Measurements:

Temperature Range	19.4 - 20.2°C
pH Range	7.7 - 7.9
Dissolved Oxygen	>90% Saturation

The raw data for the definitive daphnid test (started on 9-11-84) are presented below:

<u>Concentration (mg/L)</u>	<u>Number of Organisms Exposed</u>	<u>Percent Dead</u>	
		<u>24 h</u>	<u>48 h</u>
0.90	30	50	97
0.54	30	30	87
0.32	30	57	77
0.19	30	20	70
0.12	30	13	13
0 (water control)	30	0	0

LC50 Value and 95% Confidence Interval

24 h	>0.19 mg/L	
48 h	0.17(0.14-0.21) mg/L	moving average method

00011

Test Material: p-chloro-m-cresol

Water Quality Measurements:

Temperature Range	19.6 - 20.8°C
pH Range	7.5 - 8.0
Dissolved Oxygen	>90% saturation

The raw data for the definitive daphnid test (started on 9-18-84) are presented below:

<u>Concentration (mg/L)</u>	<u>Number of Organisms Exposed</u>	<u>Percent Dead</u>	
		<u>24 h</u>	<u>48 h</u>
20.0	30	100	100
12.0	30	100	100
7.2	30	83	100
4.3	30	47	100
2.6	30	20	73
1.6	30	7	30
0 (water control)	30	7	7

LC50 Value and 95% Confidence Interval

24 h	4.1 (3.6 - 4.8) mg/L	probit analysis
48 h	2.0 (1.7 - 2.2) mg/L	probit analysis

Test Material: Silvex [2(2,4,5-trichlorophenoxy)propionic acid]

Water Quality Measurements:

Temperature Range	19.6 - 20.9°C
pH Range	7.1 - 8.3
Dissolved Oxygen	>90% saturation

The raw data for the definitive daphnid test (started on 8-22-84) are presented below:

<u>Concentration (mg/L)</u>	<u>Number of Organisms Exposed</u>	<u>Percent Dead</u>	
		<u>24 h</u>	<u>48 h</u>
140.0	30	23	37
98.0	30	0	7
68.6	30	3	7
48.0	30	0	0
33.6	30	0	0
0 (water control)	30	0	7

LC50 Value and 95% Confidence Interval

24 h	both LC50 values are greater than the water solubility of the test material; >140 mg/L[2]
48 h	

00013

Table I. TYPICAL DILUTION WATER ANALYSES ($\mu\text{g/L}$)

	Standard Dilution Water 4/4/84 ^a	Standard Dilution Water 7/9/84 ^b
Aluminum	ND (50) ^c	70
Ammonia	ND (5)	ND (5)
Boron	30	110
Calcium	16600	17500
Chromium	ND (5)	20
Copper	ND (5)	ND (10)
Fluoride	90	47
Iron	20	20
Lead	ND (5)	ND (5)
Magnesium	9450	7040
Manganese	ND (5)	ND (5)
Potassium	1070	1000
Silicon	1250	780
Sodium	6010	3540
Sulfur	6500	5230
Zinc	ND (5)	ND (10)
Total Dissolved Solids	106000	170000
Total Organic Carbon	3920 ^d	4460 ^e

^a Date sampled. Emmel, H., Dow Report

^b Date sampled. Emmel, H., Dow Report

^c Not present at or below the level in parenthesis.

^d As determined by P. G. Murphy, databook

^e As determined by P. G. Murphy, databook

*Internal
Codes
Deleted*

00014

References

1. U.S. E.P.A. Ambient Water Quality Criteria for Chloroalkyl Ethers. U.S. E.P.A. 440/5-80-030 (1980).
2. Herbicide Handbook Committee (C. E. Beste-Chairman). Herbicide Handbook, 5th Ed., Weed Society of America, Champaign, IL (1983).
3. Verschueren, Karel. Handbook of Environmental Data on Organic Chemicals, Van Nostrand Reinhold Company, New York, N. Y. (1983).
4. Thomas, R. G. Volatilization from Water. Lyman, W. J., W. F. Reehl and D. H. Roseblatt, Eds. Handbook of Chemical Property Estimation Methods. McGraw-Hill Book Co., New York, N. Y., (1982).
5. Cowgill, U. M., Environmental Sciences Research Culture Method, "Daphnia magna Culture", Culture Method No. ESR-ES-31, Environmental Sciences Research Laboratory, Dow Chemical U.S.A., Midland, MI (September 12, 1984).
6. Committee on Methods for Toxicity Tests with Aquatic Organisms. Methods for Acute Toxicity Tests with Fish, Macroinvertebrates and Amphibians. U.S. EPA-660/3-75-009. (1975).
7. American Society for Testing and Materials. ASTM Standard E729-80, Standard Practice for Conducting Acute Toxicity Tests With Fishes, Macroinvertebrates and Amphibians (1980).
8. Dill, D. C. (revised F. M. Gersich). Environmental Sciences Research Test Method, "Static Acute Daphnid Toxicity Test", Test Method No. ESR-ES-15, Environmental Sciences Research Laboratory Dow Chemical U.S.A., Midland, MI (September 13, 1984).
9. Stephan, C. E., K. A. Busch, R. Smith, J. Burka, and R. W. Andrew. 1978. A computer program for calculating an LC50. U.S. Environmental Protection Agency, Duluth, MN, pre-publication manuscript, August, 1978. (and as revised by C. E. Stephan, personal communication, letter to L. Bahner, September 10, 1982).
10. Finney, D. J. Statistical Methods in Biological Assay. Cambridge University Press. (1952).
11. Thompson, W. R. Use of moving averages and interpolation to estimate median-effective doses. Bacteriol. Rev., 11:2, 115-145 (1947), modified to use arcsin transform (B. M. Bennett, J. of Hygiene 50, 157-64, 1952), confidence limits of the resulting moving average-angle method (E. K. Morris, Biometrics 15, 424-32, 1959) and implemented as a BASIC computer program with a slight refinement of the arcsin function to improve fitting at near 0 and 100% mortality (C. Stephan, personal communication 1978, 1982).

00015

TITLE OF STUDY: THE STATIC ACUTE TOXICITY OF BIS(2-CHLOROETHOXY)METHANE,
DINOSEB, ANILINE, P-CHLORO-M-CRESOL AND SILVEX TO THE
WATER FLEA, DAPHNIA MAGNA STRAUS

In compliance with Good Laboratory Practice Regulations, this study was inspected by the Quality Assurance Unit, and the results of these inspections reported to Management and the Study Director on the dates listed below. The report accurately reflects the data generated in accordance with the regulations and the standard operating procedures of the Laboratory. All data and the reports are located at the submitting laboratory.

Study Started: 08/84

Dates of Inspection: 12/04/84

Report Issued Date: 12/12/84

W. M. McCarty 12/12/84

W. M. McCarty
Quality Assurance
Health and Environmental Sciences
1702 Building
Dow Chemical U.S.A.
Midland, MI 48640

00016

This report, ES- 701, has been written and approved by the following personnel.

F. M. Garsich 12-12-84

F. M. Garsich
Senior Research Biologist

P. G. Murphy 12/12/84

P. G. Murphy
Chemist/Biologist

APPROVED BY:

I. T. Takahashi 12/12/84

I. T. Takahashi
Group Leader
Mammalian & Environmental Toxicology
Health & Environmental Sciences
Dow Chemical U.S.A., 1702 Building
Midland, Michigan 48640