

THE ACUTE TOXICITY OF  
FMBP4A  
(TETRABROMOBISPHENOL A)  
TO THE  
BLUEGILL SUNFISH, Lepomis macrochirus  
Rafinesque

Prepared for

Velsicol Chemical Corporation  
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Prepared by

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Client: Velsicol Chemical Corporation

Date: The test was conducted from January 24, 1978 through January 28, 1978.

Material: FMBP4A (Tetrabromobisphenol A), Lot No. 996-138

UCES Project #: 11506-03-50

Summary: The 96 hour LC<sub>50</sub> of FMBP4A for bluegill sunfish is 0.51 mg/l. This value is based upon nominal concentrations of the chemical in soft reconstituted water.

Species: Bluegill sunfish

Length: 38 mm

Weight: 0.59 grams

Source: Nebraska

96 Hour LC<sub>50</sub>: 0.51 mg/l

95 % Conf. Intervals: 0.43-0.61 mg/l

No Effect Level: 0.18 mg/l

Water Quality: Soft

Temperature: 21.7 ± 0.7°C

pH: 7.47

Total Hardness as CaCO<sub>3</sub>: 44 mg/l

96 Hr. LC<sub>50</sub> Ref. Toxicant p,p'-DDT: 4.03 (3.59-4.52) µg/l

## INTRODUCTION

This study was conducted at the request of the Velsicol Chemical Corporation to determine the static acute toxicity of FMBP4A (Tetrabromobisphenol A) to the bluegill sunfish. The test was performed at Union Carbide Environmental Services' (UCES) toxicity laboratory in Tarrytown, New York. FMBP4A is a white acetone soluble powder.

The bluegill sunfish, Lepomis macrochirus Rafinesque, is a warmwater fish usually found in ponds, lakes and sluggish streams with bottoms of sand, gravel or mud. They feed on a variety of aquatic organisms including fish eggs, small fish, snails, insects and amphipods. Bluegills prefer temperatures above 20°C and can tolerate a wide pH range. Because of their wide geographic distribution, temperature requirements, and importance as a food web organism, the bluegill has been recommended by the Committee on Methods for Toxicity Tests with Aquatic Organisms (1975) as a bioassay organism.

## METHODS

Dilution water used in all basic toxicity tests at the UCES laboratory is obtained from a well on the Tarrytown site, treated with a Continental Reverse Osmosis Water System (Model 3020) and deionized. After treatment, the water is reconstituted to the desired pH and hardness according to the procedures of Marking and Dawson (1973). For this test the soft reconstituted water was characterized as having a pH of 7.47, total hardness of 44 mg/l as CaCO<sub>3</sub>, total alkalinity of 33 mg/l as CaCO<sub>3</sub> and a specific conductance of 150  $\mu$ mhos/cm. Hardness and alkalinity were determined according to standard analytical procedures (American Public Health Association, 1976), pH with an ORION pH meter, conductivity with a YSI conductivity bridge and dissolved oxygen with a YSI oxygen meter.

Five concentrations, a control and solvent control were used in determining the toxicity of FMBP4A (Tetrabromobisphenol A) to bluegill sunfish. Test methodology followed recommended bioassay practices (U. S. Environmental Protection Agency, 1975) with the exception that replicate concentrations were not used. Fresh stock solution for the test was prepared by weight to a precision of 0.1 mg and diluted to volume in volumetric glassware with acetone. The test was conducted in 5 gallon, chemically clean, glass jars containing 15 liters of water.

The test was started by introducing the toxicant into test vessels containing dilution water, thoroughly mixing and then introducing the fish. The amount of solvent in the solvent control equalled that amount used in the highest concentration.

Bluegill sunfish were obtained from a commercial hatchery in Nebraska and were maintained in the UCES laboratory at 22°C according to the procedures of Brauhn, Schoettger and Mueller (1975). Mortalities in the stock culture over a one month period were less than two percent. Bluegill sunfish at the time of testing were approximately 6 months old and had a mean (10 organisms) length of 38 mm and a mean weight of 0.59 grams. Fish used in this test were randomly selected from the stock culture and acclimated to the test water for 24 hours prior to testing. Forty-eight hours before initiating the test the fish were taken off feed. Ten individuals were placed in each of the 5 gallon test vessels. Biological loading was 0.39 g/l.

Dissolved oxygen and pH were determined initially and every 48 hours thereafter for the control, high, medium and low toxicant concentrations. Water bath temperature was also recorded initially and every 48 hours thereafter. In

addition to obtaining the above chemical and physical parameters, abnormal behavioral responses of the test fish were noted and recorded at 24 hour intervals. The no effect level was determined at the 96 hour exposure period. This value is based upon the absence of abnormal behavior and may not necessarily be related to death.

#### RESULTS

The 96 hour LC<sub>50</sub> with 95 % confidence intervals for FMBP4A (Tetrabromo bisphenol A) to bluegill sunfish is 0.51 (0.43-0.61) mg/l. Percent mortalities and LC<sub>50</sub> values with their respective confidence intervals are presented in Table 1. The chemical and physical parameters monitored during the test are presented in Table 2. Behavioral observations made during the test indicated that bluegill sunfish exposed to concentrations of 0.32 mg/l and higher became irritated and exhibited abnormal sounding and skittering swimming behavior. It should be noted that LC<sub>50</sub> values may vary with different species, temperatures and water qualities.

TABLE 1  
PERCENT MORTALITIES AND LC<sub>50</sub> VALUES - VELSICOL CHEMICAL CORPORATION  
FMBP4 (Tetrabromobisphenol A) - Bluegill sunfish

FMBP4A Nominal Conc. mg/l	Percent Mortality						
	Control	Solvent Control	0.18	0.32	0.56	1.00	1.80
24 Hour	0 %	0 %	0 %	0 %	10 %	100 %	100 %
48 Hour	0 %	0 %	0 %	0 %	70 %	100 %	100 %
96 Hour	0 %	0 %	0 %	0 %	70 %	100 %	100 %

LC<sub>50</sub> Values

LC <sub>50</sub> mg/l	95 % Confidence Interval	24 Hour	48 Hour	96 Hour			
		Low	High	Low	High		
0.72		0.64	0.81	0.51	0.43	0.51	0.61

The 96 hour no effect level is 0.18 mg/l.

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TABLE 2

PHYSICAL AND CHEMICAL PARAMETERS - VELSICOL CHEMICAL CORPORATION  
FMBP4A (Tetrabromobisphenol A) - Bluegill sunfish

## Dilution Water:

pH 7.47 Total Hardness 44 mg/l as CaCO<sub>3</sub>  
 Conductivity 150  $\mu$  mhos/cm Total Alkalinity 33 mg/l as CaCO<sub>3</sub>

Average Temperature 21.7°C  
 Range  $\pm 0.7^\circ\text{C}$

## Dissolved Oxygen mg/l

FMBP4A Nominal Conc. mg/l	Control	Solvent			High (1.80)
		Control	Low (0.18)	Medium (0.56)	
Initial	8.8	8.6	8.7	8.5	8.8
48 Hour	6.6	4.1	2.9	3.1	*
96 Hour	6.7	5.5	3.4	2.2	*

FMBP4A Nominal Conc. mg/l	Control	Solvent		pH Control	High (1.80)
		Control	Low (0.18)		
Initial	7.47	7.91	7.58	7.56	7.50
96 Hour	7.18	7.20	6.94	6.94	*

\*Data not collected after 100 % mortality.

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REFERENCES

American Public Health Association. 1975. Standard Methods for the Examination of Water and Wastewater. 14 Ed. New York. 1193 pp.

Brauhn, J. L., R. A. Schoettger and L. H. Mueller. 1975. Acquisition and culture of research fish: rainbow trout, fathead minnows, channel catfish and bluegills. EPA-660/3-75-001. 45 p.

Committee on Methods for Toxicity Tests with Aquatic Organisms. 1975. Methods for Acute Toxicity Tests with Fish, Macroinvertebrates and Amphibians. EPA-660/3-75-009. 61 p.

Finney, D. J. 1971. Statistical Methods in Biological Assay. 2nd Ed. Griffin. London. 668 p.

Marking, L. L. and V. K. Dawson. 1973. Toxicity of Quinaldine Sulfate to Fish. Invest. Fish Control No. 48. U. S. Fish Wildl. Serv., Washington, D. C. 8 p.

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