UCES Project #: 11506-03-51

THE ACUTE TOXICITY OF FMBP4A (TETRABROMOBISPHENOL A) TO THE RAINBOW TROUT, Salmo gairdneri Richardson

Prepared for

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March 30, 1978

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Client:	Velsicol Chemical Corporation
Date:	The test was conducted from February 9, 1978 through February 13, 1978.
Material:	FMBP4A (Tetrabromobisphenol A) Lot No. 996-138
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Summary:	The 96 hour LC_{50} for FMBP4A is 0.40 mg/l. This value is based upon nominal concentrations of the chemical in soft reconstituted water.
Species:	Rainbow trout
Length:	41 mm
Weight:	0.51 grams
Source:	Washington
96 Hour LC_{50}:	0.40 mg/l
95 % Conf. Intervals:	0.36-0.45 mg/l
No Effect Level:	0.10 mg/l
Water Quality:	Soft
Temperature:	12.3 ± 0.3°C
pH:	7.48
Total Hardness as $CaCO_3$:	40 mg/l
96 Hr. LC_{50} Ref. Toxicant p,p'-DDT:	10.59 (8.31-13.50) µg/l

Five concentrations, a control and solvent control were used in determining the toxicity of FMBP4A (Tetrabromobisphenol A) to rainbow trout. 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.

Rainbow trout used in this test were cultured in the UCES laboratory from eggs obtained from a commercial hatchery in Washington. The fish were maintained at 13°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. Rainbow trout at the time of testing were approximately 3 months old and had a mean (10 organisms) length of 41 mm and a mean weight of 0.51 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 0.34 g/l.

Dissolved oxygen and pH were determined initially and every 48 hours thereafter for the control, solvent control, high, medium and low toxicant concentrations. Water bath temperature was determined initially and at 48 hour intervals subsequent to the initiation of the test. In addition to obtaining the

INTRODUCTION

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

Rainbow trout, Salmo gairdneri Richardson, are found in streams, lakes and reservoirs throughout the United States. They are tolerant of a wide pH range and prefer water temperatures below 20°C. Trout are an extremely valuable aquatic resource both from an ecological and sport fishing standpoint. Because of their wide geographic distribution, temperature requirements and importance as food web organisms, this organism 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 7.48, total hardness of 40 mg/l as $CaCO_3$, total alkalinity of 35 mg/l as $CaCO_3$, and a specific conductance of 135 μmhos/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.

above chemical and physical parameters, abnormal behavioral responses of the test fish were noted and recorded at 24 hour intervals.

The concentration of toxicant lethal to 50 % of the population (LC_{50}'s) and 95 % confidence intervals were determined at 24, 48 and 96 hour exposure periods by the Spearman-Kärber Estimator (Finney, 1971). The LC_{50} determinations were based upon nominal concentrations of the test material in soft reconstituted water. The no effect level was determined at the 96 hour exposure period. This value is based upon observed abnormal behavior and may not necessarily be related to death.

RESULTS

The 96 hour LC_{50} with 95 % confidence intervals for FMBP4A (Tetrabromobisphenol A) to rainbow trout is 0.40 (0.36-0.45) mg/1. Percent mortalities and LC_{50} 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 rainbow trout exposed to concentrations of 0.18 mg/1 and higher became irritated and exhibited twitching, erratic swimming, dark discoloration and labored respiration. It should be noted that LC_{50} values may vary with different species, temperatures and water qualities.

TABLE 2

PHYSICAL AND CHEMICAL PARAMETERS - VELSICOL CHEMICAL CORPORATION
FMBP4A (Tetrabromobisphenol A) - Rainbow trout

Dilution Water:

pH 7.48
Conductivity 135 μ mhos/cm

Total Hardness 40 mg/l as $CaCO_3$
Total Alkalinity 35 mg/l as $CaCO_3$

Average Temperature 12.3°C
Range ±0.3°C

Dissolved Oxygen mg/l

FMBP4A Nominal Conc. mg/l	Control	Solvent Control	Low (0.10)	Medium (0.32)	High (1.00)
Initial	9.4	9.3	9.3	9.5	9.6
48 Hour	8.7	8.6	8.4	7.9	8.7
96 Hour	8.7	5.7	6.2	4.1	*

pH

FMBP4A Nominal Conc. mg/l	Control	Solvent Control	Low (0.10)	Medium (0.32)	High (1.00)
Initial	7.48	7.44	7.46	7.45	7.46
96 Hour	7.26	7.00	6.98	6.90	*

*Data not collected after 100 % mortality.

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TABLE 1

PERCENT MORTALITIES AND LC_{50} VALUES - VELSICOL CHEMICAL CORPORATION
FMBP4A (Tetrabromobisphenol A) - Rainbow trout

Percent Mortality

FMBP4A Nominal Conc. mg/l	Control	Solvent Control	0.10	0.18	0.32	0.56	1.00
24 Hour	0 %	0 %	0 %	0 %	0 %	0 %	80 %
48 Hour	0 %	0 %	0 %	0 %	0 %	20 %	100 %
96 Hour	0 %	0 %	0 %	0 %	10 %	100 %	100 %

LC50 Values

LC50 mg/l		24 Hour	48 Hour	96 Hour
		0.84	0.67	0.40
95 % Confidence Interval	Low	0.72	0.57	0.36
	High	0.98	0.78	0.45

The 96 hour no effect level is 0.10 mg/l.

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REFERENCES

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