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Contractor	UNION CARBIDE RES DEPT		
Document Title	ENVIRONMENTAL IMPACT PRODUCT ANALYSIS: ACUTE AQUATIC TOXICITY TESTING WITH COVER LETTER DATED 050286		
Chemical Category	2-BUTENAL (4170-90-3)		

8782164 46

UNION CARBIDE CORPORATION OLD RIDGEBURY ROAD DANBURY CT 06817
Corporate Health, Safety and Environmental Affairs Department

Certified Mail
Return Receipt Requested

May 2, 1986

U.S. Environmental Protection Agency
TSCA 8D1
P.O. Box 2060
Rockville, Maryland 20852

Subject: Union Carbide Corp. TSCA Sec. 8(d)
Report, 40 CFR 716.6 & 716.7

Sirs:

With respect to:

40 CFR Secs. 716.6 & 716.7;
Fed. Reg., Vol. 47, pp. 38791 and ff., Sept. 2, 1982;
Amended Jan. 22, 1986,, 716.11(e) and 716.17(a)(13)
and (c)(1).

Union Carbide Corp. herewith submits the following studies (attached) in response to the above-identified amendment to the state rule. These studies are on the following chemicals:

2-Butenal, CAS No. 4170-90-3;
Hydroperoxide, 1-methyl-1-phenylethyl-, CAS No. 80-15-9;
1-Propaneamine, N-propyl-, CAS No. 142-84-7;
1-Propanol, 2-methyl-, CAS No. 78-83-1.

I. 2-Butenal.

I.a. Crotonaldehyde, Treatment of Accidental Spills, Union Carbide Project Report File No. 16663, Jan. 7, 1972. B. Pesetsky. 8782164 43

I.b. Range Finding Tests on Crotonaldehyde, Mellon Institute of Industrial Research Special Report 5-40, March 11, 1942, C.P. Carpenter. 8782164 44

I.c. Water Quality Development, Biomass Toxicity Studies, Union Carbide Project Report File No. 25171, June 13, 1978, G.T. Waggy et al. 8782164 45

I.d. Environmental Impact Product Analysis, Acute Aquatic Toxicity Testing, Union Carbide Project Report File No. 19133, Jan. 25, 1974, G.T. Waggy et al. 8782164 46

I.e. Environmental Impact Analysis, Product Biodegradability Testing, Union Carbide Project Report File No. 19751, Aug. 12, 1974, G.T. Waggy et al. 87821644 7

I.f. Mellon Institute of Industrial Research, Progress Report No. 11-52, March 29, 1948, H.F. Smyth, Jr., et al. 87821644 8

I.g. Mellon Institute of industrial Research, Progress Report No. 5-21, Jan. 31, 1942, H.F. Smyth, Jr., et al. 87821644 9

I.h. Mellon Institute of Industrial Research, Progress Report No. 4-87, Oct. 6, 1941, H.F. Smyth, Jr., et al. 87821645 0

II. Hydroperoxide, 1-Methyl-1-phenylethyl-

II.a. Cumene Hydroperoxide, Range Finding Toxicity Studies, Chemical Hygiene Fellowship Special Report 38-49, May 2, 1975, R.C. Myers et al. 87821645 1

III. 1-Propanamine, N-propyl-

III.a. Range Finding Tests on Di-n-propylamine, Mellon Institute of Industrial Research, Report No. 21-11, Dec. 31, 1957, C.P. Carpenter. 87821645 2

III.b. Same report as in item I.d. (above), entry in Table I for "Dipropylamine". 87821644 6

III.c. Same report as in item I.e. (above), entry in Table I for "Dipropylamine". 87821644 7

See also report I.d., Table V.

See also report I.e., Table I and Table II.

IV. 1-Propanol, 2-methyl-

IV.a. Range Finding Tests on Isobutanol, Mellon Institute of Industrial Research, Report No. 16-100, Nov. 17, 1953, C.P. Carpenter. 87821645 3

IV.b. Quantitative Aspects of Chemical Burns of the Eye, Mellon Institute of Industrial Research Report No. 9-11, Jan. 21, 1946, H.F. Smyth, Jr. 87821645 4

IV.c. Mellon Institute of Industrial Research, Progress Report No. 14-78, Nov. 23, 1951, H.F. Smyth, Jr., et al. 87821645 5

See also report I.d., Table IV and Table VII.

See also report I.e., Table I and Table II.

To the best of our knowledge, the above represents all the studies on the chemicals currently subject to reporting under the above-identified rule.

Should any additional studies come to our attention as the result of our file searches, we will advise the Environmental Protection Agency immediately. Where in some reports (attached and captioned above) an entry regarding confidentiality appears on the first page, that statement was entered solely for guidance of internal and external dissemination at the time of issuance of the report; Union Carbide asserts no claim of confidentiality for any of the information conveyed in this letter and in the attached reports. We hereby advise the Environmental Protection Agency, however, that the studies that were sponsored by Union Carbide Corporation are the property of Union Carbide for publication purposes.

Any questions regarding this report, or the testing or results therefrom, should be addressed through my office.

Very truly yours,

D.L. Heywood
Assistant Director
Product Safety
203 794-5224

DLH:jsh

BUSINESS CONFIDENTIAL

I. d.

PROJECT REPORT

ORIGINAL COPY

ENVIRONMENTAL IMPACT PRODUCT ANALYSIS
ACUTE AQUATIC TOXICITY TESTING

87821644 6

AUTHORS: G. T. Waggy (15)
J. R. Payne

SUPERVISOR: J. C. Hovious (2)

DATE: January 25, 1974

PROJECT NO.: 910F44

FILE NO.: 19133

SUMMARY The product aquatic-toxicity project of the Environmental Impact Analysis program has been completed and this report summarizes the data collected on 217 products. Definitive test data are presented on 210 products and range-finding values are included on 7 products which were not tested by the definitive procedure. The test data show that, in general, the surfactants are the most toxic family of products evaluated, followed by acrylates, alkylamines, aldehydes, acids, aromatics and esters. Only 17 of the products tested showed aquatic toxicity (LC50) values below 10 mg/l. Since this study was designed to evaluate the immediate effect of accidental or controlled discharges of chemicals on aquatic life, no pH adjustment or supplementary solvents were used. Although most of the values were obtained using adult fathead minnows as the test organism, some comparative test results using fathead fry have been included to show the higher degree of sensitivity exhibited by the young fish. Some toxicity values comparing the sensitivity and reliability of brine shrimp as a test organism with the fathead minnows have been included for guidance in considering the use of brine shrimp as an "off-the-shelf" routine aquatic toxicity test. The aquatic toxicity testing facilities will be maintained at this location for some additional product evaluations and for effluent testing which is being required at several of our plants.

INTRODUCTION The acute aquatic toxicity testing of over 200 Union Carbide products has been one part of the Environmental Impact Analysis (EIA) program in which the total potential environmental effect of producing and marketing the major UCC chemicals is being examined. The information obtained from the EIA program will be utilized in both long-range planning for new and existing units and in service to concerned customers. The product evaluation program is being managed by Dr. G. F. Johnson under the general direction of Mr. H. R. Guest.

RESEARCH AND DEVELOPMENT DEPARTMENT
CHEMICALS AND PLASTICS
UNION CARBIDE CORPORATION
SOUTH CHARLESTON, WEST VIRGINIA

The study reported herein employed fathead minnows and was limited to static acute testing of the fish, i.e. the determination of the short-term, median lethal concentrations of specific compounds. The testing procedures were presented in detail in the initial report on this project (1), and only slight modifications were required as discussed in subsequent reports on the project (2, 3). The bioassay procedures generally followed the techniques recommended in Standard Methods (4) and tentative procedures obtained from research committees working in this field (5, 6, 7). The brine shrimp information included in this report for comparison with fathead minnow values was obtained from a related project completed and reported in March, 1972 (8).

DISCUSSION This report serves as a summary of the bioassay data collected during this program (Tables I and II). The important test conditions are presented in Table III. Fathead minnows (Pimephales promelas) were selected as the test organisms for this study. Initially it was planned to test only fry (young fish) because of the smaller testing equipment and facilities involved. This decision necessitated a culturing system required six to ten months to equip and develop into a productive minnow supply system (9). During this period testing gradually switched to adult fish obtained from commercial suppliers because of the discontinuous supply of fry. The health of the fry was also a factor, since prophylactic medical treatment was not desirable with the younger fish. Comparative test data shown in Table IV indicate a somewhat higher sensitivity for the fry.

The definitive LC50 (lethal concentration, 50%) data are presented in Table I by family classification. A review of these families shows that the TERGITOL surfactants were the most toxic family of products evaluated. This product family is followed closely in toxicity by acrylates, alkylamines, aldehydes, acids, aromatics and esters. Seventeen of the 218 products tested showed LC50 values less than 10 mg/l in Table V. The glycols and glycol ethers represent families of products that can be tolerated by aquatic organisms at relatively high concentrations.

The LC50 information generated in this program generally correlates well with the limited number of available literature values. Although partial kills were not obtained in all test series, the LC50 values were considered "definitive" data since all test concentrations were over a rather narrow range.

Since the purpose of this study was to evaluate the environmental effects of accidental and controlled discharges of chemical products, no pH adjustment was employed and no supplementary solvents were used to solubilize products of limited water-solubility. The buffering capacity of the receiving waters certainly would be an important factor in pH-related toxicity problems, especially for potential downstream fish kills as opposed to highly localized toxicity effects.

The initial toxicity testing involved the use of range-finding procedures which used 2 fish in 1.5 liters of dilution water. A broad range (10 to 10,000 mg/l) of product concentrations were set up in about 5 wide mouth half-gallon bottles prior to the introduction of the fish. The test period was about 24 hours under conditions of controlled aeration. This rather quick test allowed the determination of the approximate toxic level of a material so that the definitive test could be conducted over a narrow dosage range. The definitive tests utilized 18.5 liters of dilution water with 10 fish per test vessel under minimal controlled aeration (dissolved oxygen was maintained above 5 mg/l). The test duration was 96 hours. The definitive LC50 data are presented in Table I along with the approximate initial pH of the dilution water at the LC50 chemical concentration. Although range-finding values were determined on all the products tested only a few range-finding values are presented in this report (Table II). These are for those products, which for various reasons, were not evaluated by the definitive procedure.

The test results presented in Table VI indicate a high level of reproducibility for this LC50 data. Of course, the reproducibility of this type of measurement is highest when a single laboratory is doing the work and using fish from the same source. The high values reported for morpholine and monoethanolamine reflect a precipitation problem experienced early in the testing program. Some of the amines were precipitating during the test due to the presence of a small amount of phosphate buffer in the system.

The use of phosphate buffer to adjust the pH of the dilution water arose from the water conditioning method in the fish culturing system which supplied the test water for the early LC50 tests. Once the precipitation problem was noted in the amine tests, the water preparation was changed to simply passing the water through activated carbon to remove the chlorine, followed by pH adjustment using dilute hydrochloric acid and sodium hydroxide. Although this eliminated the precipitation problem, it was necessary to repeat several determinations to insure that the slightly buffered test system had not effected the previous LC50 data to a significant degree. Both amines and acids were included in this retesting which involved about eight to ten products. Any changes in values are reflected in the definitive data presented in this report.

The fathead minnow aquatic toxicity data generated in this program have been compared in Table VII with some previous brine shrimp bioassay data. Although the brine shrimp test is not accepted by any regulatory agency as a measure of toxicity of a material to fresh water organisms, it does appear to yield generally similar values and should have application as a simple, "off-the-shelf" aquatic toxicity indicator for routine checks on effluents or for screening materials for potential problems. In fact, several improvements in the brine shrimp test have been made since these data were generated, and the agreement between the values for the two organisms may improve as these changes are incorporated in future tests.

The aquatic toxicity facilities in Building 785 will be maintained for a limited program of additional product testing and for plant effluent testing. Effluent testing will probably increase, since EPA now requires periodic aquatic toxicity tests on treatment plant effluents.

R/D INFORMATION RETRIEVAL 1982

CONCLUSIONS

1. Definitive LC50 data are now available on about 200 Union Carbide products.

2. Suitable procedures and facilities for range-finding and definitive bioassay tests are now available at this location. Considerable experience has been gained in bioassay techniques and in maintaining a healthy supply of fish for testing.

3. Approximately ten percent of the products tested showed LC50 values of less than 10 mg/l. Only three products showed LC50 of less than 1 mg/l.

4. Based on a comparison of these LC50 values and previous brine shrimp data, the brine shrimp test method could be a suitable technique for screening products and effluents for potential problems. This would be especially useful where fish and fish-bioassay facilities are not readily available.

BIBLIOGRAPHY

(1) Waggy, G. T., Lashley, E. R. and Gossett, R. G., "Environmental Impact Product Analysis, Acute Aquatic Toxicity Testing," R/D Project Report (18497), June 21, 1973.

(2) Waggy, G. T., Worcheck, R. A., "Environmental Impact Product Analysis, Acute Aquatic Toxicity Testing," R/D Project Report (18703), August 27, 1973.

(3) Waggy, G. T., Worcheck, R. A., "Environmental Impact Product Analysis, Acute Aquatic Toxicity Testing," R/D Project Report (18857), October 15, 1973.

(4) Standard Methods for the Examination of Water and Wastewater, 13th Edition, 1971, Published by APHA, AWWA, and WPCF.

(5) Unpublished tentative procedure from an Ad Hoc industrial-regulatory committee working on bioassay procedures.

(6) Biological Water Quality Committee, "ORSANCO 24-Hour Bioassay Procedure," 1973.

(7) Pickering, Q. H. and Henderson, C., "Acute Toxicity of Some Important Petrochemicals to Fish," Journal Water Pollution Control Federation, 38, 1419-29 (1966).

(8) Price, K. S., "Technology Program - Group I Physical Distribution, Evaluation of Deep-Water Disposal of Tanker Washings," R/D Project Report (16948), March 16, 1972.

(9) Gossett, R. G., and Waggy, G. T., "Environmental Impact Product Analysis, Development of a Fathead Minnow Stock Culture Unit," R/D Project Report (18717), September 4, 1973.

G. T. Waggy

Attachments
7 Tables

Manuscript Date: January 18, 1974
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TABLE I

DEFINITIVE STATIC ACUTE TOXICITY
DATA USING FATHEAD MINNOWS AS TEST ORGANISMS

Product Tested	Initial pH Range[a]	LC50, mg/l[b] (Dosage Basis) 24-hr	48-hr	96-hr

(a) Initial pH range of the test system at concentrations close to the LC50 value.

(b) These data were collected using procedures generally discussed in this report and presented in detail in previous reports on this project (1, 2, 3). Test conditions are summarized in Table III. Ten fathead minnows used for each test concentration in a test volume of 18.5 liters. LC50 is the chemical concentration in mg/l that kills 50 percent of the fish in the specified test period (24, 48 and 96 hr). LC50 and TL_m are identical in meaning.

TABLE I (Continued)

Product Tested	Initial pH Range	LC50, mg/l (Dosage Basis) 24-hr	48-hr	96-hr
Crotonaldehyde	7.5-7.6	2.8	2.8	2.8

TABLE III

SUMMARY OF TEST CONDITIONS

Test Conditions	Range Finding System, 24-hrs	Definitive Test System 24-96 hrs
Test species	Fathead	Fathead
Number of organisms/ concentration	2	10
Size of fish, cm	2.5 to 5	2.5 to 5
Temperature of water, °F	71 to 76	71 to 76
pH of Dilution water, units	7.2 to 7.6	7.2 to 7.6
Total alkalinity, mg/l	30-40	30-40
Total hardness, mg/l	30 to 60	30 to 60
Dissolved oxygen, mg/l(a)	7.5 to 9.0	7.5 to 9.0
Volume of test solution, liters	1.5	18

(a) Dissolved oxygen in test vessels maintained above 5 mg/l throughout the test period by use of controlled aeration. This minimal aeration was started after the first four hours of the test. This 4-hr delay was to avoid potential air-stripping during the initial contact period.

TABLE IV

COMPARISON OF CHEMICAL TOLERANCE OF
ADULT FATHEAD MINNOWS AND FATHEAD FRY

Chemical Tested	LC50, mg/l[(a)] Using Adult Fathead 24-hr	48-hr	96-hr	Using Fathead Fry 24-hr	48-hr	96-hr
Isobutanol	1,620	1,620	1,620	375	375	375

(a) Acute toxicity values determined by the definitive procedures discussed in this report and previous reports on this project.

TABLE V

PRODUCTS HAVING LC50 VALUES LESS THAN 10 MG/L

Product	LC50, mg/l (Dosage Basis) 24-hr	48-hr	96-hr
Crotonaldehyde	2.8	2.8	2.8
Dipropylamine	8.6	8.6	8.6

TABLE VII

COMPARISON OF LC50 DATA USING FATHEAD MINNOWS AND BRINE SHRIMP AS BIOASSAY TEST ORGANISMS

Chemicals Tested	24-hr LC50, mg/l(a)	
	Brine Shrimp	Fathead Minnows
Isobutanol	1,400	1,600

(Continued)

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TABLE VII (Continued)

Chemicals Tested	24-hr LC50, mg/l[a]	
	Brine Shrimp	Fathead Minnows

(a) LC50 data using brine shrimp taken from a previous project reported in 1972 (4). Fathead minnow data were obtained from this present project.

CERTIFICATE OF AUTHENTICITY

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