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Department of  
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September 7, 1995  
RAJ-101-95

**ORIGINAL**

Attn: TSCA Section 8(e) Coordinator  
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U.S. Environmental Protection Agency  
401 M Street, S.W.  
Washington, DC 20460

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Subject: 8EHQ-95-13469

Dear Sir or Madam:

Additional environmental toxicity information has been obtained for 4'-hydroxy-3'-  
[(o-nitrophenyl)azo]acetophenone (CAS no. 93525-19-0).

In a study of toxicity to freshwater green algae, the 96 hour IC<sub>50</sub> was found to be  
0.91 ppm with an NOEC of 0.31 ppm. A copy of the draft report of the study is  
enclosed.

This substance is a chemical intermediate and is currently used under R&D  
conditions.

This submission contains no confidential business information.

If any further information is required, do not hesitate to contact Dr. Richard A.  
Jourdenais, Corporate Manager, Product Stewardship at 908-231-3746.

Sincerely,

Susan Engelman  
Vice President, Environmental, Health &  
Safety Affairs

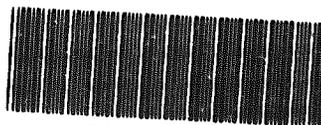
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**Hoechst**

**STUDY TITLE**

C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone]: Acute Toxicity To The Freshwater Green Alga, *Selenastrum capricornutum*, Under Static Test Conditions

**DATA REQUIREMENT**

TSCA Environmental Effects Testing Guideline 797.1050

**AUTHOR**

Flynn J. Cunningham

**STUDY COMPLETION DATE**

Contains No CBI

**SPONSOR**

Hoechst Celanese Corporation  
Route 202-206, P.O. Box 2500  
Somerville, NJ 08876-1258

**PERFORMING LABORATORY**

Toxikon Environmental Sciences  
106 Coastal Way  
Jupiter, Florida 33477

**LABORATORY PROJECT ID**

J9503004c

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**STATEMENT OF GLP COMPLIANCE**

**Test Substance:** C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone]

**Title:** C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone]: Acute Toxicity To The Freshwater Green Alga, *Selenastrum capricornutum*, Under Static Test Conditions

This study was conducted in accordance with published Good Laboratory Practices (GLP) regulations for tests of substances regulated under the Toxic Substances Control Act (TSCA 40 CFR Part 792) by the U.S. Environmental Protection Agency.

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Flynn J. Cunningham  
Study Director

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Date

**STATEMENT OF QUALITY ASSURANCE**

**Test Substance:** C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone]

**Title:** C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone]: Acute Toxicity To The Freshwater Green Alga, *Selenastrum capricornutum*, Under Static Test Conditions

Test data were reviewed by the Quality Assurance Unit to assure that standard operating procedures and the protocol developed for the study were followed. This report is an accurate reflection of the raw data. The dates of all quality assurance audits are documented below.

<u>TYPE OF AUDIT</u>	<u>DATE OF AUDIT</u>	<u>DATE FINDINGS REPORTED TO THE STUDY DIRECTOR AND TO MANAGEMENT</u>
In-Life Audit:		
Study Data Review:		
Draft Report Review:		
Final Report Review:		

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Kelly L. Eyler  
Quality Assurance Manager  
Toxikon Environmental Sciences

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Date

**LIST OF SCIENTIFIC PERSONNEL**

**Test Substance:** C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone]

**Title:** C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone]: Acute Toxicity To The Freshwater Green Alga, *Selenastrum capricornutum*, Under Static Test Conditions

**Study Director:** Flynn J. Cunningham

**Biologists:** Hui (Jeff) Liu  
Leslie D. Hartman

**Aquaculturists:** Jonathan Spalding  
Keith Ferris

### SUMMARY

**Sponsor:** Hoechst Celanese Corporation  
Route 202-206, P.O. Box 2500  
Somerville, NJ 08876-1258

**Study Director:** Flynn J. Cunningham; (407) 575-2477

**Location of Study:** Toxikon Environmental Sciences  
106 Coastal Way  
Jupiter, Florida 33477

**Location of Raw Data and Final Report:** Pathology Associates Incorporated  
Frederick, Maryland

**Test Substance:** C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone);  
Lot No. SN 50978-119-2; Purity: >99%  
by HPLC

**Test Species:** Freshwater green alga (*Selenastrum capricornutum*); 6-day old culture at test initiation

**Source of Organisms:** Toxikon Environmental Sciences  
Jupiter, FL

**Dilution Medium:** Freshwater algal growth medium with an initial pH of  $7.5 \pm 0.1$ ; test temperature ranged from 24.2 to 26.2°C.

**Nominal Concentrations:** Control, Solvent (DMF) Control, 0.31, 0.63, 1.25, 2.50, 5.00, and 10.0 mg wm/L

**Test Dates:** June 26 to 30, 1995

**Study Length:** 96 hours

**Results:** The 96-hour  $EC_{10}$ ,  $EC_{30}$ , and  $EC_{50}$  of C-1996 to *S. capricornutum* were calculated to be 0.08, 0.91, and 9.82 mg wm/L (based on nominal concentrations), respectively. The NOEC was 0.31 mg wm/L based on the lack of significant inhibitory effects observed at this test concentration.

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## 1.0 INTRODUCTION

A phytotoxicity test was conducted at Toxikon Environmental Sciences, Jupiter, Florida, to determine the effect of C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone)] on the freshwater green alga, *Selenastrum capricornutum*. The criterion for effect was reduction in cell growth. Test results are expressed as 96-hour EC<sub>10</sub>, EC<sub>50</sub>, and EC<sub>90</sub> values, the concentrations of C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone)] estimated to be effective in reducing algal populations by 10, 50, and 90 percent at the specified time, respectively.

## 2.0 MATERIALS AND METHODS

### 2.1 TEST SUBSTANCE

The test substance, C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone)] (Lot No. SN 50978-119-2 and CAS No. 93525-19-0) was received at Toxikon Environmental Sciences on May 8, 1995 in a clear plastic bottle labeled "2-Nitro-2'-Hydroxy-5'-Acetylazobenzene (NPA4HAP)" from the Hoechst Celanese Corporation. The test substance was a red crystalline solid which was stored in the dark at ambient room temperature. The purity of the test substance was reported to be >99% by Hoechst Celanese Corporation. The test substance was also reported to be insoluble in water.

Nominal test concentrations are reported as milligrams (mg) of C-1996 as whole material (wm) per liter (L) of freshwater algal medium.

### 2.2 TEST SPECIES

The freshwater alga tested was the green alga, *Selenastrum capricornutum* (UTEX #1648). The culture originated from an inoculum received from the University of Texas at Austin and maintained at TES since October 4, 1989. The algae were cultured on freshwater algal medium (ASTM, 1990) under continuous illumination yielding approximately 50 to 70 microEinsteins per square meter per second ( $\mu\text{E}/\text{m}^2/\text{s}$ ). Cultures were maintained at approximately  $24 \pm 2^\circ\text{C}$  prior to test initiation and were checked for purity weekly. The inoculum culture was 6 days old at test initiation.

### 2.3 TEST MEDIUM

The base water for the test medium was deionized water. The base water was sterilized and enhanced with reagent-grade nutrients as

described in ASTM (1990). The pH of the test medium was adjusted to a pH of  $7.5 \pm 0.1$  with 0.1 N NaOH or HCl prior to use in the test. The test medium was filtered to  $0.45 \mu\text{m}$  using a membrane filter prior to use.

Chemical characterization of a recent representative batch of the deionized water is presented in Appendix A.

#### 2.4 TEST METHODS

Methods for the test with *Selenastrum capricornutum* were those described in Toxikon Environmental Sciences' test protocol entitled: "C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone): Acute Toxicity To The Freshwater Green Alga, *Selenastrum capricornutum*, Under Static Test Conditions."

A static range-finding test was conducted prior to performing the definitive test. The test was conducted at nominal test concentrations of 10.0 and 100 mg wm/L. After 96-hours of exposure, inhibition of cell growth (based on cell number) compared to the pooled control was 27 percent at 10.0 mg wm/L and 59 percent at 100 mg wm/L. During the range-finding test, undissolved compound was noted at both 10.0 and 100 mg wm/L. Based upon these results, nominal test concentrations of 0.31, 0.63, 1.25, 2.50, 5.00, and 10.0 mg wm/L were selected for the definitive test. The definitive exposure was conducted under static conditions in a temperature control room set to provide a test temperature of  $24 \pm 2^\circ\text{C}$ .

Stock solutions were not utilized to prepare the two highest test concentrations, 5.00 and 10.0 mg wm/L, during definitive testing due to the low solubility of this chemical and solvent limitations. Neat test substance (0.0020 and 0.0040 g,

respectively) was added to 0.04 mL of dimethylformamide (DMF) and then the mixture was directly added to 400 mL of dilution water and stirred vigorously. For nominal test concentrations of 0.31, 0.63, 1.25, and 2.50 mg wm/L, a primary stock (25,000 mg wm/L) was prepared by adding 0.2500 g of neat test substance to a 10-mL volumetric flask and bringing to volume with DMF. Three additional stocks were then prepared by performing 50% serial dilutions of the previous stock. Test solutions were prepared by adding 0.040 mL of the appropriate stock solution to 400 mL of dilution water. All test solutions were sonicated for 30 minutes and stirred on a stir plate for 1 hour. A dilution water control and solvent (DMF) control were maintained concurrently with the test solutions. The DMF concentration in the solvent control and all test solutions was 0.1 mL/L. Following sonication and stirring, pH measurements were taken and adjusted to  $7.5 \pm 0.1$  if applicable, and then four 100-mL aliquots of each test solution were transferred to sterilized 250-mL glass Erlenmeyer flasks (including one chemical blank). Three replicates were inoculated with algae while the fourth was established as a chemical "blank" control for each treatment and was not inoculated with algae. All flasks were capped with gas exchange caps.

The 96-hour exposure was initiated on June 26, 1995 with the inoculation of approximately 10,000 cells/mL to each test flask (0.144 mL of an inoculum culture with a cell density of  $696 \times 10^4$  cells/mL). The test chambers were randomly positioned in a temperature-controlled chamber under continuous fluorescent lighting and continuously swirled on an orbital shaker table at approximately 100 rpm (revolutions per minute). Test chambers were impartially re-positioned daily to eliminate position effects. Light intensity ranged between 42.2 and 65.6  $\mu\text{E}/\text{m}^2/\text{s}$  as

measured by a LI-COR, Inc. Model LI-189 light meter equipped with a 2 $\pi$  quantum sensor.

Algal growth was measured at least three times per inoculated flask by direct cell counts using an electronic particle counter (Coulter<sup>®</sup> Counter Model Z1) every 24 hours. Morphological observations were also conducted on each test treatment daily using a compound microscope to detect abnormal cell morphology and coloration as compared to the control. After 96 hours, there were no test concentrations in which algal growth was maximally inhibited (i.e., either no algal growth or a net decrease in algal growth measured by cell number as compared to the initial inoculum), therefore, evaluation for algistatic versus algicidal response was not necessary.

Temperature was measured in one uninoculated flask of test medium daily during the test. The temperature range of the environmentally-controlled chamber was monitored using a minimum/maximum thermometer and the diurnal temperature ranges recorded daily. Light intensity was measured daily during the 96-hour exposure period at the level of the test solutions. The pH was measured at test initiation in the composites and at test termination in all control and test flasks using a Fisher Accumet<sup>®</sup> 1002 pH meter.

## 2.5 CHEMICAL SAMPLING AND ANALYSIS

No water samples were collected or analyzed during the tests. Nominal concentrations were used during both the range-finding and definitive tests.

## 2.6 STATISTICAL ANALYSES

A Student's *t*-Test was used for comparing control and solvent control algal cell growth. If no significant difference was detected between the replicate means of the two controls, the control data were pooled prior to statistical evaluation with the C-1996 treatments. If a significant difference was detected between the two controls, only the solvent control data were used for statistical evaluation with the treatments. The no-observed-effect concentration (NOEC) was determined for cell numbers using variance analysis (ANOVA) and Dunnett's procedure (Dunnett, 1955). All statistical differences were determined at a probability level of 0.05.

Algal growth response (as percent inhibition, I, or stimulation, S, in the test solutions compared to the controls) was calculated as follows:

$$\% I = (C-T)/C \times 100 \text{ or } \% S = (T-C)/C \times 100$$

where C = mean growth of the control

T = mean growth of treated culture

Mean and standard deviation of the algal responses were calculated and plotted for each treatment and control. Based on results of the test (percent inhibition of cell growth), the 96-hour EC<sub>10</sub>, EC<sub>50</sub>, and EC<sub>90</sub> values with their 95 percent confidence limits were calculated using the nominal concentrations. The EC values were estimated using a computer program (U.S. EPA, 1988) for calculating EC values by probit analysis.

## 2.7 ARCHIVES

The final report and all raw data related to this study will be maintained in archive by Hoechst Celanese Corporation at Pathology Associates Incorporated, Frederick, Maryland.

### 3.0 RESULTS AND DISCUSSION

At test initiation, undissolved chemical was present at concentrations  $\geq 5.00$  mg wm/L. At test termination, undissolved chemical or precipitate was visible at concentrations  $\geq 2.50$  mg wm/L indicating that the test substance was not in solution.

As an electronic particle counter, the Coulter® Counter is unable to differentiate between organic and inorganic particles.

Because the test article was insoluble at higher test concentrations, chemical blanks were counted concurrently with each test concentration to establish a background level if any was present. The chemical "blank" replicates consisted of uninoculated test solution and were maintained under test conditions. To eliminate any affect of the undissolved chemical or precipitate that may have occurred during counting, the mean of the treatment blank was subtracted from the appropriate mean cell counts of the coinciding replicates prior to statistical analysis for all treatments and controls.

- which value are given in table 1?

- were they -  
will there particles?

After 96 hours of exposure to C-1996, comparison of cell numbers between the control and solvent control detected no significant difference between the controls and solvent controls. Therefore, percentage inhibition of cell growth was calculated by comparison of treatment cell numbers to the pooled controls. After 96 hours of exposure to C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl)azo]-acetophenone)], the percent decrease of cell numbers compared to the pooled control ranged from 19 percent at 0.31 mg wm/L to 85 percent at 2.50 mg wm/L (Table 1). Daily mean cell counts and standard deviations for the controls and test solutions are presented in Table 1, while individual replicate counts are presented in Appendix B. Growth curves (presented in Figure 1) show that the control flasks exhibited a pattern of exponential

growth during the 96-hour growth period. Observations of cell morphology detected no changes in C-1996 exposed cells as compared to cells in the controls. The 96-hour  $EC_{10}$ ,  $EC_{50}$ ,  $EC_{90}$  values were calculated using the probit method to be 0.08, 0.91, and 9.82 mg wm/L, respectively (Table 2). The NOEC was 0.31 mg wm/L based on the lack of significant inhibitory effects observed at this test concentration.

The measured test temperature during the 96-hour exposure ranged from 24.2 to 26.2°C (Table 3). Prior to pH adjustment, pH values ranged from 7.2 to 7.6 in all control and test solutions. The initial pH of both controls and all test solutions after pH adjustment ranged from 7.4 to 7.6 (Table 4). After 96 hours, the pH ranged from 7.1 to 7.6 in the test solutions and from 7.4 to 7.6 in the controls (Table 4). The higher pH values were generally associated with greater cell growth.

4.0 PROTOCOL DEVIATIONS

One deviation from the test protocol occurred during the conduct of this study.

- 1) The test temperature during the study ranged from 24.2 to 26.2°C slightly exceeding the range stated in the protocol (24 ± 2°C).

In the scientific opinion of the Study Director, this deviation was minor and did not affect the outcome or validity of the test results.

REFERENCES

- American Society for Testing and Materials (ASTM). 1990. Standard Guide for Conducting Static 96-Hour Toxicity Tests with Microalgae. ASTM Designation E1218-90.
- Dunnett, C.W. 1955. Multiple Comparison Procedure for Comparing Several Treatments with a Control. J. Amer. Assoc. 50:1096-1121.
- U.S. Environmental Protection Agency (USEPA). 1988. EPA Probit Analysis Program Used For Calculating EC Values, Version 1.4.

Table 1. Cell Numbers (as determined by an electronic particle counter) After 96-Hours of Continuous Exposure of the Green Alga, *Selenastrum capricornutum*, to C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone] Under Static Test Conditions

Nominal Concentration (mg wm/L)	Mean Cell Numbers ( $\times 10^4$ )/mL <sup>a</sup>				Percent Change <sup>b</sup>
	24 hr	48 hr	72 hr	96 hr	
Control	2.63 (0.36)	17.3 (2.54)	99.6 (17.1)	378 (71.6)	---
Solvent Control	2.41 (0.35)	16.9 (0.77)	85.2 (10.4)	319 (31.3)	---
Pooled Control	2.52 (0.34)	17.1 (1.69)	92.4 (14.9)	349 (59.4)	---
0.31	2.25 (0.57)	14.5 (2.17)	75.2 (3.91)	281 (20.3)	-19
0.63	1.72 (0.45)	9.31 (2.76)	58.4 (10.8)	210 (36.4)	-40 <sup>c</sup>
1.25	1.54 (0.23)	5.13 (1.37)	27.4 (7.98)	111 (37.9)	-68 <sup>c</sup>
2.50	1.37 (0.15)	3.34 (0.26)	14.8 (1.04)	53.4 (8.69)	-85 <sup>c</sup>
5.00	1.50 (0.29)	4.62 (0.75)	20.2 (1.26)	83.7 (9.14)	-76 <sup>c</sup>
10.0	1.23 (0.22)	3.47 (0.25)	17.9 (1.66)	54.9 (16.1)	-84 <sup>c</sup>

<sup>a</sup> Values are means and standard deviations of triplicate test chambers; the standard deviations are presented in parentheses. Measurements for individual replicates are presented in Appendix B.

<sup>b</sup> Percent inhibition (-) or stimulation (+) as determined against pooled control cell numbers at 96 hours ( $349 \times 10^4$  cells/mL).

<sup>c</sup> Statistical reduction in cell numbers as compared to the pooled control ( $\alpha = 0.05$ ).

Figure 1. Growth Curves for the Freshwater Green Alga, *Selenastrum capricornutum*, During a 96-Hour Exposure to C-1996 [NPA4HAP (4'-Hydroxy-3' [(o-nitrophenyl) azo]-acetophenone)] Under Static Test Conditions

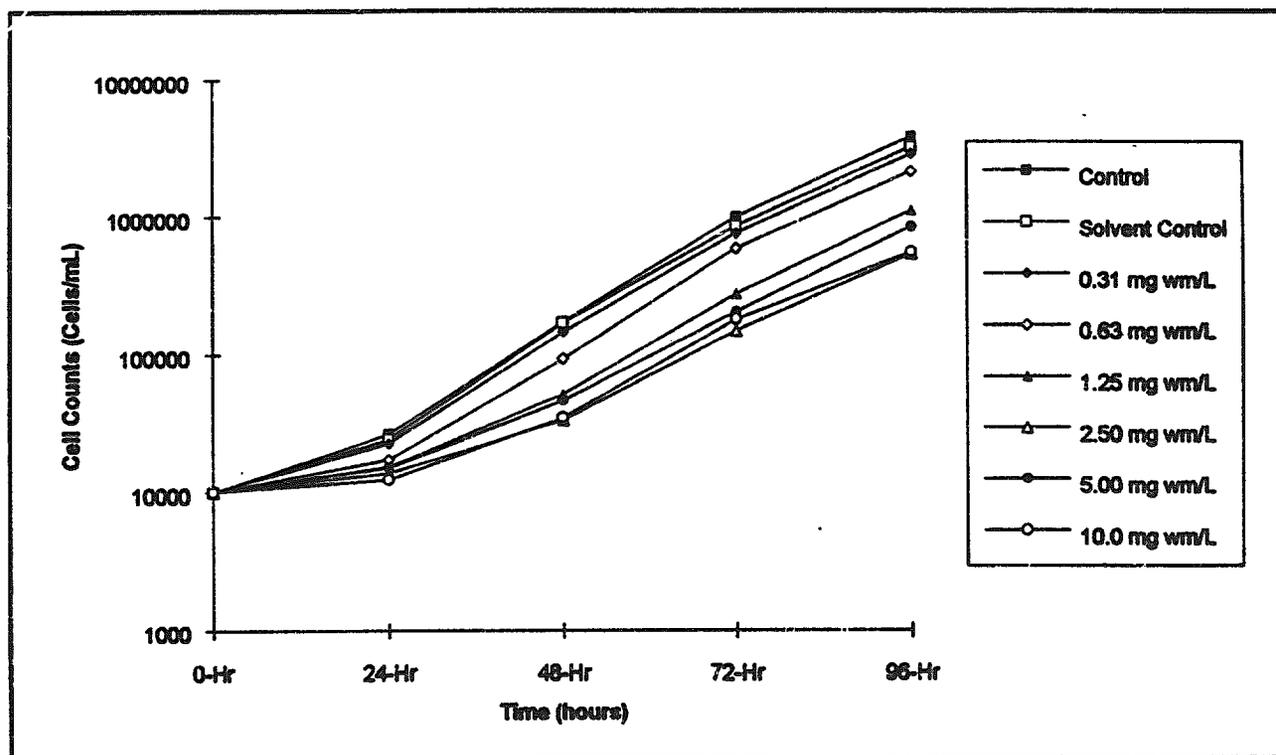


Table 2. Calculated 96-Hour EC Values, Based on Nominal Concentrations, for the Freshwater Green Alga, *Selenastrum capricornutum*, After a 96-Hour Exposure to C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone] Under Static Test Conditions

EC Type	EC Value (mg wm/L)	95-Percent Confidence Limits (mg wm/L)	Statistical Method
EC <sub>10</sub>	0.08	0.03 - 0.16	Probit
EC <sub>50</sub>	0.91	0.63 - 1.22	Probit
EC <sub>90</sub>	9.82	6.14 - 20.7	Probit

Note: The calculated EC values are based on percent inhibition calculated from differences in cell numbers in the test treatments as compared to pooled control cell numbers.

Table 3. Daily Temperature During a 96-Hour Static Exposure of the Green Alga, *Selenastrum capricornutum*, to C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone)]

Exposure Period (Hour)	Temperature <sup>a</sup> (°C)
0	24.2
24	26.0
48	25.9
72	25.8
96	26.2

<sup>a</sup> Temperature measured in an uninoculated test chamber.

Note: The diurnal temperature range of the temperature controlled chamber was 22.2 to 24.4°C during the conduct of the test as measured continuously by a minimum/maximum thermometer.

Table 4. The pH Values During a 96-Hour Static Exposure of the Green Alga, *Selenastrum capricornutum*, to C-1996 (4-Hydroxyphenylmethyl carbinol)

Nominal Concentration (mg wm/L)	Replicate	pH	
		0 Hours	96 Hours
Control	A	7.6 <sup>a</sup>	7.4
	B	---	7.5
	C	---	7.5
Solvent Control	A	7.4 <sup>a</sup>	7.5
	B	---	7.5
	C	---	7.6
0.31	A	7.3 <sup>a</sup> /7.5 <sup>b</sup>	7.6
	B	---	7.5
	C	---	7.6
0.63	A	7.3 <sup>a</sup> /7.5 <sup>b</sup>	7.4
	B	---	7.3
	C	---	7.3
1.25	A	7.4 <sup>a</sup>	7.5
	B	---	7.4
	C	---	7.2
2.50	A	7.2 <sup>a</sup> /7.5 <sup>b</sup>	7.2
	B	---	7.2
	C	---	7.2
5.00	A	7.3 <sup>a</sup> /7.5 <sup>b</sup>	7.2
	B	---	7.2
	C	---	7.1
10.0	A	7.3 <sup>a</sup> /7.5 <sup>b</sup>	7.3
	B	---	7.2
	C	---	7.2

<sup>a</sup> Measurements taken from composite solutions prior to distribution to test flasks but before pH adjustment.

<sup>b</sup> Measurements taken from composite solutions prior to distribution to test flasks and after pH adjustment, when applicable.

APPENDIX A  
DEIONIZED WATER CHARACTERIZATION

DEIONIZED WATER CHARACTERIZATION\*

Parameter	Concentration <sup>b</sup>	
Aluminum	0.068	mg/L
Arsenic	<0.005	mg/L
Boron	0.022	mg/L
Beryllium	<0.005	mg/L
Bromide	<0.10	mg/L
Cadmium	<0.001	mg/L
Calcium	<0.55	mg/L
Chloride	<1.0	mg/L
Chromium (hexavalent)	N/A	mg/L
Chromium (total)	<0.01	mg/L
Cobalt	<0.01	mg/L
Copper	<0.001	mg/L
Fluoride	<0.1	mg/L
Iodide	<0.050	mg/L
Iron	<0.030	mg/L
Lead	<0.003	mg/L
Manganese	<0.010	mg/L
Magnesium	<0.55	mg/L
Mercury	<0.0002	mg/L
Molybdenum	<0.010	mg/L
Nickel	<0.008	mg/L
Potassium	<0.55	mg/L
Selenium	<0.003	mg/L
Silver	<0.0001	mg/L
Sodium	<0.55	mg/L
Tin	N/A	mg/L
Zinc	N/A	mg/L
Ammonia (total)	<0.03	mg/L
Cyanide (total)	<0.020	mg/L
Nitrates (total as N)	N/A	mg/L
Nitrites (total as N)	N/A	mg/L
Phosphates (total)	<0.01	mg/L
Sulfide (total)	<0.1	mg/L
Sulfate (total)	<2.0	mg/L
TDS	36	mg/L
TOC	<1.0	mg/L
TSS	<4	mg/L
COD	<5.0	mg/L
Total organophosphorus pesticides	<1.0	µg/L
Total phenoxy herbicides	<1.2	µg/L
Total organochlorine pesticides	<0.01	µg/L
PCBs	<0.10	µg/L

\* The characterized deionized water is Jupiter, Florida, town water which has been deionized by a Continental Water ion exchange system and passed through activated carbon.

<sup>b</sup> Sample of deionized water collected January 24, 1996.

APPENDIX B  
CELL COUNT RAW DATA

Table B-1. Daily Cell Counts of the Green Alga, *Selenastrum capricornutum*, During a 96-Hour Exposure to C-1996 [NPA4HAP (4'-Hydroxy-3'[(o-nitrophenyl) azo]-acetophenone] Under Static Test Conditions

Nominal Concentration (mg wm/L)	Replicate	Cell Numbers ( $\times 10^4$ )/mL			
		24 hr	48 hr	72 hr	96 hr
Control	A	2.98	19.2	107	394
	B	2.66	18.2	111	442
	C	2.26	14.4	80.0	301
Solvent Control	A	2.54	17.5	88.7	355
	B	2.02	16.0	73.5	303
	C	2.68	17.1	93.3	298
0.31	A	2.74	15.9	76.0	287
	B	2.40	15.5	78.6	298
	C	1.62	12.0	70.9	259
0.63	A	1.21	6.12	45.9	188
	B	2.03	11.0	65.7	252
	C	1.94	10.8	63.5	191
1.25	A	1.48	5.22	27.8	107
	B	1.79	6.45	35.2	150
	C	1.35	3.71	19.3	74.6
2.50	A	1.46	3.57	14.8	53.8
	B	1.46	3.05	13.9	44.5
	C	1.20	3.39	15.9	61.9
5.00	A	1.63	5.43	21.5	91.8
	B	1.17	3.95	19.0	85.5
	C	1.70	4.47	20.2	73.8
10.0	A	1.46	3.43	19.6	73.4
	B	1.22	3.74	16.3	47.1
	C	1.01	3.25	17.8	44.2