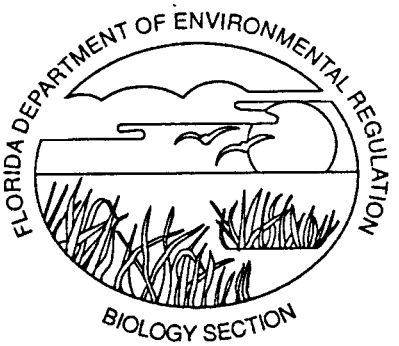


Bioassays of

Naval Coastal Systems Center
Wastewater Treatment Plant

Panama City Beach, Bay County, Florida

NPDES #FL0002551

Sampled 10/11/88

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January 11, 1989

Biology Section
Division of Administrative and Technical Services

Bioassays of

Naval Coastal Systems Center
Wastewater Treatment Plant

Panama City Beach, Bay County, Florida

NPDES #FL0002551

Biology Section
Bureau of Laboratories
January 11, 1989

Executive Summary

Naval Coastal Systems Center, Wastewater Treatment Plant, Panama City Beach, Bay County, Florida, NPDES #FL0002551, on 12 to 14 October, 1988.

The Naval Coastal Systems Center Wastewater Treatment Plant is a high rate trickling filter plant with a design capacity of 200,000 GPD. The plant treats a combination of industrial and municipal wastes from the NCS Center.

The Biology Section performed six static definitive and screening toxicity bioassays on a sample of discharge from the facility on 12 to 14 October, 1988. The Biology Section also performed two Microtox® assasys on the sample on 12 October, 1988.

The chlorinated sample of discharge from outfall #001 of the Naval Coastal Systems Center WWTP was toxic to the bioassay test organisms, *Ceriodaphnia dubia, Daphnia pulex*, and *Notropis leedsi*, producing LC_{50}'s of < 100%. The chlorinated sample suppressed the light output from the Microtox® assay organism, *Photobacterium phosphoreum*, producing an EC_{50} of 12.03%. The dechlorinated sample of discharge from this facility was not toxic to the bioassay test organisms, *C. dubia, D. pulex*, or *N. leedsi*. The dechlorinated sample was stimulatory to the Microtox® assay organism, *P. phosphoreum*.

The total residual chlorine (1.2 mg/l Hach and 1.5 mg/l Iodometric) in the sample was great enough to have caused the observed toxic effects. Chemical analyses of the sample detected the metals, cadmium (0.2 µg/l), lead (4.2 µg/l), and zinc (79.0 µg/l). Several unidentified components sensitive to electron capture and nitrogen/phosphorus detection were detected in the pesticide extractables portion of the organics analyses. These components were not thought to have contributed to the toxicity in the sample.

Introduction

The Naval Coastal Systems Center Wastewater Treatment Plant is located in Panama City Beach in Bay County (Figure 1). The plant is a high rate trickling filter plant with a design capacity of 200,000 GPD. The plant is operating well below design capacity treating 100,000 GPD. The wastewater is a combination of industrial and municipal wastes from the operation of the NSC Center.

In September, 1987, the Biology Section performed 6 (six) separate bioassays and 2 (two) Microtox® assays on a sample from this facility. The dechlorinated sample was toxic to the bioassay test organism, *Ceriodaphnia dubia*, producing an LC_{50} of < 100%. The dechlorinated sample adversely affected the Microtox® assay organism, *Photobacterium phosphoreum*, producing an EC_{50} of 70.11%. The chlorinated sample was toxic to the bioassay organisms, *C. dubia*, *Daphnia pulex*, and *Notropis leedsi*. The chlorinated sample adversely affected the Microtox® assay organism *P. phosphoreum,* producing an EC_{50} of 11.25%. Chemical analyses revealed the presence of the metals, copper, zinc, and chromium. The total residual chlorine in the sample was measured at 0.7 mg/l (Hach) and 0.9 mg/l (Iodometric). The toxicity in the sample was attributed to the presence of the metals and chlorine (FDER 1988).

To again evaluate the existence and extent of toxicity from this facility, the Biology Section, at the request of the FDER Northwest District Office in Pensacola, performed 6 (six) toxicity bioassays and 2 (two) Microtox® assays on a sample of discharge from outfall #001 of the facility. The results of those tests are presented in this report. Those involved in performing the tests and in preparation of this report were: J. M. Faircloth, R. B. Frydenborg, K. M. Lurding, and S. H. Wolfe.

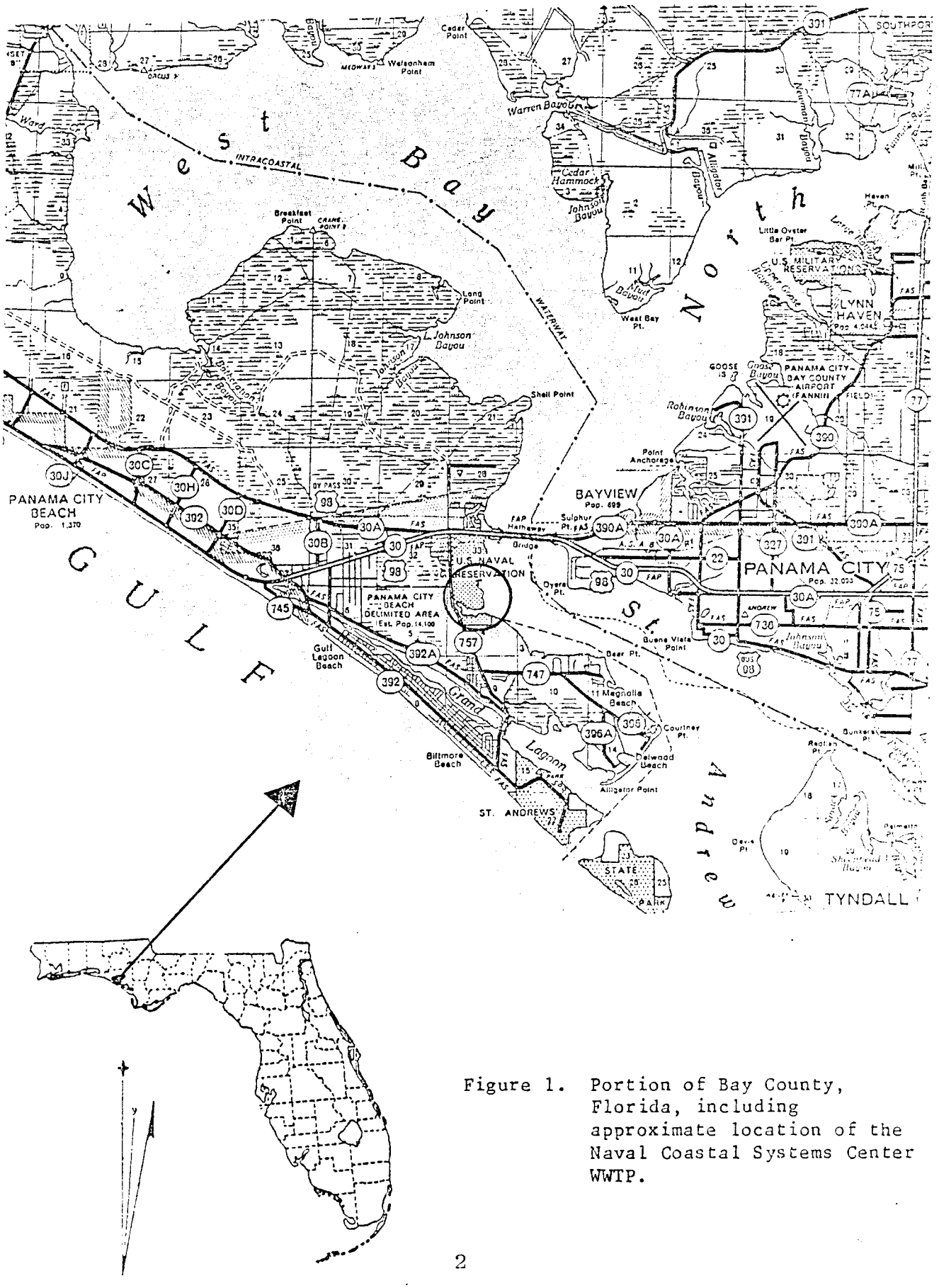


Figure 1. Portion of Bay County, Florida, including approximate location of the Naval Coastal Systems Center WWTP.

Methods and Materials

Test methods used to conduct these static bioassays are extensively described by Peltier and Weber (1985) and the FDER Biology Section (1985). The organisms selected for this study include a species recommended by Peltier and Weber (1985) and the FDER Biology Section (1985). Additionally, the Biology Section maintains cultures of several species of organisms indigenous to the State of Florida. One of these indigenous species was also selected for testing. Life histories of these test organisms and maintenance procedures used to culture them are detailed below.

The Microtox® assay was run according to the manufacturer's protocol described in the Microtox® System Operating Manual (Beckman 1982).

1. History and Maintenance of Bioassay Organisms

Daphnia pulex (water flea)—A breeding culture of *Daphnia pulex* was obtained from the EPA laboratory in Athens, Georgia, in June, 1987. This culture has been maintained since its arrival in 2 1/2 gallon all-glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, once daily on weekends, and are kept at a constant temperature of 22 ±2 °C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess organisms, and then refilling with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances such as: declining populations, ephippia formation, or excessive fungal or bacterial growth.

Ceriodaphnia dubia (water flea)—A breeding culture of *Ceriodaphnia dubia* was obtained from the EPA laboratory in Athens, Georgia, in June, 1985. The culture is maintained in 2-1/2 gallon all-glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow®, Cerophyl® and Fleischmann's® yeast twice daily, once daily on weekends, and are kept at a constant temperature of 26 ±2 °C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess organisms, and then refilling with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances such as: declining populations, ephippia formation, or excessive fungal or bacterial growth.

Notropis leedsi (bannerfin shiner)—Approximately 40 adult bannerfin shiners were obtained from an indigenous population in the upper Suwannee River during October, 1981. The breeding stock is maintained in 125 gallon all-glass aquaria equipped with a flow-through water exchange system. Water for this system is unchlorinated and is pumped from the DER deep well. The bannerfin shiners are reared at 22 ±2 °C under a 16:8 hour light-dark cycle and are fed Aquarian® flake food and frozen *Artemia* (brine shrimp) twice daily, and once daily on weekends. Breeding and egg hatching are encouraged at 25 °C. The eggs are laid between stacked red ceramic tiles separated by a 3mm bead of silicone. Most of the eggs adhere to the tiles and are easily removed to heated, aerated hatching tanks. The narrow space between the tiles eliminates egg predation by adult fish. New hatching tanks are started regularly to segregate fry into even age groups. Newly hatched fry are fed a liquefied blend of Purina Trout Chow® and Cerophyl® twice daily. After one week, feeding is augmented with newly hatched *Artemia* nauplii and finely crushed Aquarian® flake food. The fish used were 18 days old when the test commenced.

Photobacterium phosphoreum, a luminescent marine bacterium, is maintained as a freeze-dried culture, purchased from Microbics Corporation. Lot number M-606 was used in this assay. Immediately prior to the assay, the culture is rehydrated with 1.0 ml of specially purified water (Microtox Reconstitution Solution).

2. Standard Reference Toxicity Assays

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biology Section conducts monthly standard reference toxicant bioassays using sodium lauryl sulfate as the reference toxicant.

3. Test Methods

Methods used to perform acute toxicity bioassays are described by Peltier and Weber (1985) and the FDER Biology Section (1985). Some of the methods described below are more specific than those of Peltier and Weber. These will be noted in more detail.

Sampling Methods and Test Dates

Six separate 48 hour acute toxicity bioassays and two Microtox® assays were performed on a sample from the Naval Coastal Systems Center Wastewater Treatment Plant facility. The tests were performed from 1030 hours on 12 October to 1030 hours on 14 October, 1988.

Separate samples were obtained for chemical and biological testing. Samples for metal analyses were preserved with $HN0_3$. Samples for organic chemical analyses and for the bioassays were unpreserved. The samples were collected by Mr. Mike Clayton of the FDER Northwest District branch office in Panama City at 1315 hours on 11 October, 1988, using standard wastewater sampling procedures. The samples were iced and transported to the DER laboratory in Tallahassee for analyses within 24 hours of collection.

Test Temperature

Upon arrival of the iced (4 °C) bioassay samples in the Tallahassee laboratory, the containers were placed in warm water and the temperature of the samples allowed to rise to 20 ± 2 °C. Although this temperature may be different than the temperature of the sample during collection, it is the temperature range to which the test organisms are acclimatized and is the range recommended in the above referenced bioassay protocols. This avoids stressful effects caused by exposure to unusually cold or warm samples.

Total Residual Chlorine

Since many reclaimed waters are chlorinated, especially those originating from sewage treatment facilities, it is often desirable to differentiate between the toxicity resulting from chlorine and the toxicity associated with other components of the reclaimed water. To accomplish this, the Biology Section performed concurrent bioassays on a sample of chlorinated reclaimed water in which the chlorine had been neutralized. Dechlorination was accomplished by adding a calculated amount of 0.025N sodium thiosulfate. The total residual chlorine concentrations of the tested sample of reclaimed water are given on the bioassay data forms. A comparison of the results of these tests will distinguish between the toxicity due solely to residual chlorine and the toxicity inherently contained in the reclaimed water.

Method

Freshwater for diluting the water samples being tested was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study is given in Table 1.

Four replicates consisting of 30 ml plastic vials containing 15 mls of the control and each test

transferred into the test chambers. Five individuals were loaded per chamber, resulting in 20 per test concentration. The water fleas were not fed during these tests.

Two replicates of each concentration and a control were used for the *Notropis leedsi* (bannerfin shiner) bioassay. The fish were transferred individually or by twos using a pipette into wide mouth quart jars containing 500 ml each of the appropriate test concentration. Five were loaded per chamber, resulting in 10 per concentration. Fish were not fed during this test.

Test Parameters

Dissolved oxygen (YSI Model 57 oxygen meter), pH (Corning Model 7 pH meter with Orion Ross® combination electrode), temperature (NBS calibrated glass thermometer), and the number of live organisms were recorded for each test concentration at 0 hours, 24 hours, and 48 hours. Total alkalinity and total hardness (measured as $CaCO_3$ using Hach Chemical Company reagents) were recorded at the beginning of the test for the controls and the 100% reclaimed water concentration. The specific conductance (YSI Model 33 S-C-T meter) of each test concentration was recorded at the beginning and end of the test. All instruments were calibrated before use according to manufacturer's recommendations. Ammonia concentrations, including the total and unionized fraction (expressed in mg/l as N and as NH_3, respectively), were recorded in the controls and the 100% reclaimed water test concentration at the beginning of the test. Total ammonia concentrations were determined using an Orion specific ion probe and an Orion Ionalyzer®. The unionized fraction was then calculated based on the total ammonia concentration and the pH, temperature, and salinity of the sample. These values were recorded on the bioassay data forms and are presented in Tables 2 and 3.

Microtox® Test

Upon receipt at the DER laboratory, a 20 ml subsample was collected for Microtox® analysis. The sample was adjusted to 2% salinity with reagent grade dry sodium chloride to maintain the osmotic balance of the test bacterium during the assay. Four two-fold dilutions were made of the test sample resulting in a test range of 99%, 49.5%, 24.75%, 12.38%, and 0%. An incubation temperature of 15 °C was maintained throughout the assay. Ten µl of bacterial suspension was added to each of the 1.0 ml test dilutions. Light output (luminescence) was read after 5 and 15 minutes incubation, using the Microtox® analyzer and recorded on a Perkin-Elmer strip chart recorder. In the presence of a toxicant, the luminescence of the test organisms will decrease. In the presence of a stimulant, the luminescence will increase. Toxicity is calculated as a function of the light lost in the test sample, normalized to the control, and is reported as the effective concentration at which a 50% reduction, of light output is determined in 15 minutes (EC_{50}). Results are given in Table 4.

Results and Discussion

The chlorinated sample of discharge from the Naval Coastal Systems Center Wastewater Treatment Plant was toxic to the bioassay test organisms, *Ceriodaphnia dubia*, *Daphnia pulex*, and *Notropis leedsi*, producing LC_{50}'s of < 100% (Table 2). The chlorinated sample adversely affected the Microtox® assay organism, *Photobacterium phosphoreum*, producing an EC_{50} of 11.03% (Table 4).

The dechlorinated sample was not toxic to the bioassay organisms, *C. dubia*, *D. pulex*, and *N. leedsi* (Table 3). The dechlorinated sample was stimulatory to the Microtox® assay organism, *P. phosphoreum*. Due to an accident, one of the four *C. dubia* controls was spilled, resulting in the loss of 5 (five) control organisms. This was not a factor in the test results.

Chemical analyses of the sample detected a total residual chlorine content (1.2 mg/l Hach and 1.5 mg/l Iodometric) sufficient to have caused the observed toxicity. Further chemical analyses detected the metals, cadmium (0.2 µg/l), lead (4.2 µg/l), and zinc (79.0 µg/l). Several unidentified components sensitive to electron capture and nitrogen/phosphorus detection were detected in the pesticide extractables portion of the organics analyses. Those components were not thought to have contributed to the toxicity in the sample.

In conclusion, the chlorinated fraction of the sample from this facility was toxic on 11 October, 1988; whereas, the dechlorinated sample was not toxic.

Biology Section Recommendations

The Biology Section recommends that this facility consider installing a dechlorination unit to reduce the total residual chlorine in the discharge from the facility. The Biology Section also recommends that this facility continue to be periodically monitored for toxicity.

Table 1. Concentration Series and Volumes Used for These Static Bioassays.

Ceriodaphnia dubia (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	15.0 ml	0.0 ml	15ml
10.0%	13.5 ml	1.5 ml	15 ml
30.0%	10.5 ml	4.5 ml	15 ml
50.0%	7.5 ml	7.5 ml	15 ml
70.0%	4.5 ml	9.5 ml	15 ml
85.0%	2.25 ml	12.75 ml	15 ml
100.0%	0.0 ml	15.0 ml	15 ml

Daphnia pulex (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	15.0 ml	0.0 ml	15 ml
100.0%	0.0 ml	15.0 ml	15 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Sample	Total Volume
Control	500 ml	0 ml	500 ml
10.0%	450 ml	50 ml	500 ml
30.0%	350 ml	150 ml	500 ml
50.0%	250 ml	250 ml	500 ml
70.0%	150 ml	350 ml	500 ml
85.0%	75 ml	425 ml	500 ml
100.0%	0 ml	500 ml	500 ml

Table 2. Data recorded during the 48 hour static acute bioassay of a chlorinated sample of discharge from outfall #001 of the Naval Coastal Systems Center WWTP, Panama City Beach, Bay County, Florida, NPDES #FL0002551 on 12 to 14 October, 1988.

Facility:	**Naval Coastal Systems Center WWTP**		**NPDES # FL0002551**	Facility Type:	**Federal Government**
Location:	Panama City Beach		Contact/District:	M. Clayton / NW	
County:	Bay		Test type:	Static Screen	
Sample Collection Date:	**10/11/88**	Time: 1315	# tests:	6	Receiving Water: St. Andrews Bay
Test Beginning Date:	10/12/88	Time: 1030	Chlorination Type:	**Chlorinated**	
Test Ending Date:	10/14/88	Time: 1030			**Page 1 of 1**

Total Residual Cl2	mg/l	Method
Field:	1.6	Hach DR 100
Lab:	1.2	Hach
Lab:	1.5	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	0.19	0.02
100% Sample:	0.40	0.00

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	122	130
Cond. Control Water (daphnids):	128	130
100% Sample:	30	90

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Organism: ***Ceriodaphnia dubia*** Life stage: neonate
LC50: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	-	7.9	8.5	-	8.2	8.2	-	20.0	20.1	-	-	-
Control	5	5	-	8.0	8.5	-	8.2	8.3	-	-	-	-	-	-
Control	5	5	-	8.2	8.7	-	8.2	8.3	-	-	-	-	-	-
Control	5	5	-	8.2	8.6	-	8.2	8.3	-	-	-	-	220	225
100%	5	0	-	8.0	8.9	-	6.8	7.7	-	19.8	20.0	-	-	-
100%	5	0	-	8.0	8.9	-	6.8	7.7	-	-	-	-	-	-
100%	5	0	-	8.1	8.9	-	6.8	7.6	-	-	-	-	-	-
100%	5	0	-	8.2	8.9	-	6.8	7.6	-	-	-	-	305	0

Organism: ***Daphnia pulex*** Life stage: neonate
LC50: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	-	7.8	8.7	-	8.2	8.2	-	20.0	20.0	-	-	-
Control	5	5	-	8.0	8.7	-	8.2	8.2	-	-	-	-	-	-
Control	5	5	-	8.0	8.7	-	8.2	8.2	-	-	-	-	-	-
Control	5	5	-	8.2	8.7	-	8.2	8.2	-	-	-	-	220	250
100%	5	0	-	8.2	8.9	-	6.8	7.6	-	19.5	20.0	-	-	-
100%	5	0	-	8.1	8.9	-	6.8	7.5	-	-	-	-	-	-
100%	5	0	-	8.2	8.9	-	6.8	7.5	-	-	-	-	-	-
100%	5	0	-	8.3	9.0	-	6.8	7.5	-	-	-	-	305	340

Organism: ***Notropis leedsi*** Age: 18 days
LC50: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
*Control	5	5	-	8.2	8.4	-	7.8	8.1	-	21.0	19.8	-	-	-
*Control	5	5	-	8.3	8.4	-	7.8	8.1	-	-	-	-	220	225
100%	5	0	-	8.4	8.9	-	6.8	7.2	-	19.8	19.5	-	-	-
100%	5	0	-	8.4	8.9	-	6.8	7.2	-	-	-	-	315	325

Dechlorinated N. leedsi controls were used for the chlorinated test due to a shortage of test organisms.

Table 3. Data recorded during the 48 hour static acute bioassay of a dechlorianted sample of discharge from outfall #001 of the Naval Coastal Systems Center WWTP, Panama City Beach, Bay County, Florida, NPDES #FL0002551, on 12 to 14 October, 1988.

Facility: **Naval Coastal Systems Center WWTP** NPDES # **FL0002551** Facility Type: **Federal Government**
Location: Panama City Beach Contact/District: M. Clayton / NW
County: Bay Test type: definitive
Sample Collection Date: **10/11/88** Time: 1315 # tests: 6 Receiving Water: St. Andrews Bay
Test Beginning Date: 10/12/88 Time: 1030 Chlorination Type: **dechlorination**
Test Ending Date: 10/14/88 Time: 1030 **Page 1 of 2**

Total Residual Cl2	mg/l	Method
Field:	1.6	Hach DR 100
Lab:	1.2	Hach
Lab:	1.5	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	0.19	0.02
100% Sample:	0.40	0.00

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	122	130
Cond. Control Water (daphnids):	128	130
100% Sample:	30	90

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Organism: ***Ceriodaphnia dubia*** Life stage: neonate
LC50: - Binomial: - Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	0	0	8.6	-	8.8	8.4	-	8.3	19.9	-	20.0	-	-
Control	5	5	5	8.6	-	8.7	8.4	-	8.4	-	-	-	-	-
Control	5	5	5	8.6	-	8.7	8.4	-	8.4	-	-	-	-	-
Control	5	5	5	8.6	-	8.8	8.4	-	8.4	-	-	-	215	255
10%	5	5	5	8.4	-	8.8	8.4	-	8.4	20.2	-	20.0	-	-
10%	5	5	5	8.4	-	8.8	8.4	-	8.4	-	-	-	-	-
10%	5	5	5	8.4	-	8.8	8.4	-	8.4	-	-	-	-	-
10%	5	5	5	8.4	-	8.8	8.4	-	8.4	-	-	-	230	270
30%	5	5	5	8.5	-	8.9	8.2	-	8.3	20.2	-	20.1	-	-
30%	5	5	5	8.6	-	8.8	8.2	-	8.3	-	-	-	-	-
30%	5	5	5	8.6	-	8.8	8.2	-	8.3		-	-	-	-
30%	5	5	5	8.6	-	8.8	8.2	-	8.3	-	-	-	255	290
50%	5	5	5	8.2	-	8.8	7.9	-	8.1	20.2	-	20.1	-	-
50%	5	5	5	8.1	-	8.8	7.9	-	8.1	-	-	-	-	-
50%	5	5	5	8.2	-	8.8	7.9	-	8.1	-	-	-	-	-
50%	5	5	5	8.3	-	8.8	7.9	-	8.1	-	-	-	275	310
70%	5	5	5	8.2	-	8.8	7.7	-	7.9	20.0	-	20.1	-	-
70%	5	6	6	8.3	-	8.8	7.7	-	7.9	-	-	-	-	-
70%	5	5	5	8.3	-	8.8	7.7	-	7.9	-	-	-	-	-
70%	5	5	5	8.3	-	8.8	7.7	-	7.9	-	-	-	295	330
85%	5	5	5	8.2	-	8.8	7.4	-	7.7	20.1	-	20.1	-	-
85%	5	5	5	8.3	-	8.8	7.4	-	7.7	-	-	-	-	-
85%	5	5	5	8.3	-	8.8	7.4	-	7.7	-	-	-	-	-
85%	5	5	5	8.3	-	8.8	7.4	-	7.7	-	-	-	305	345
100%	5	5	5	8.3	-	8.8	7.0	-	7.4	20.0	-	20.2	-	-
100%	5	5	5	8.3	-	8.8	7.0	-	7.4	-	-	-	-	-
100%	5	5	5	8.3	-	8.8	7.0	-	7.4	-	-	-	-	-
100%	5	5	5	8.3	-	8.8	7.0	-	7.4	-	-	-	320	361

Organism: ***Daphnia pulex*** Life stage: neonate
LC50: - Binomial: - Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	5	8.1	-	8.7	8.3	-	8.2	20.0	-	20.2	-	-
Control	5	5	5	8.0	-	8.7	8.3	-	8.2	-	-	-	-	-
Control	4	4	4	8.1	-	8.7	8.3	-	8.2	-	-	-	-	-
Control	5	5	5	8.2	-	8.7	8.3	-	8.2	-	-	-	220	260
100%	5	5	5	8.2	-	8.7	7.0	-	7.5	20.0	-	20.2	-	-
100%	5	5	5	8.1	-	8.7	7.0	-	7.5	-	-	-	-	-
100%	5	5	5	8.2	-	8.7	7.0	-	7.5	-	-	-	-	-
100%	5	5	4	8.3	-	8.7	7.0	-	7.5	-	-	-	320	378

Table 3. Continued.

Facility:	**Naval Coastal Systems Center WWTP**		**NPDES #**	**FL0002551**	Facility Type: **Federal Government**
Location:	Panama City Beach		Contact/District:	M. Clayton / NW	
County:	Bay		Test type:	definitive	
Sample Collection Date:	**10/11/88**	Time: 1315	# tests:	6	Receiving Water: St. Andrews Bay
Test Beginning Date:	10/12/88	Time: 1030	Chlorination Type:	**dechlorination**	
Test Ending Date:	10/14/88	Time: 1030			**Page 2 of 2**

Total Residual Cl2	mg/l	Method
Field:	1.6	Hach DR 100
Lab:	1.2	Hach
Lab:	1.5	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	0.19	0.02
100% Sample:	0.40	0.00

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	122	130
Cond. Control Water (daphnids):	128	130
100% Sample:	30	90

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Organism: ***Notropis leedsi*** Age: 18 days

LC50: - Binomial: - Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	5	8.2	8.4	8.0	7.8	8.1	8.3	21.0	19.8	19.8	-	-
Control	5	5	5	8.3	8.4	8.0	7.8	8.1	8.1	-	-	-	220	225
10%	5	5	5	8.3	8.3	8.0	7.6	8.0	8.2	21.0	19.8	19.5	-	-
10%	5	5	5	8.3	8.3	8.0	0.6	8.0	8.2	-	-	-	235	235
30%	5	5	5	8.3	8.3	7.9	7.5	7.9	8.0	21.0	19.7	19.4	-	-
30%	5	5	5	8.3	8.3	7.9	7.5	7.9	8.0	-	-	-	255	255
50%	5	5	5	8.2	8.0	7.7	7.4	7.8	7.9	21.0	19.6	19.4	-	-
50%	5	5	5	8.2	8.0	7.7	7.4	7.8	7.9	-	-	-	280	275
70%	5	5	5	8.3	8.0	7.8	7.2	7.6	7.7	21.0	19.5	19.6	-	-
70%	5	4	4	8.2	8.0	7.5	7.2	7.6	7.7	-	-	-	305	300
85%	5	5	5	8.2	8.1	7.8	7.0	7.4	7.6	21.0	19.5	19.3	-	-
85%	5	5	5	8.2	8.0	7.8	7.0	7.4	7.5	-	-	-	320	315
100%	5	5	5	8.3	7.8	7.5	6.8	7.2	7.3	21.0	19.5	19.5	-	-
100%	5	5	5	8.3	7.9	7.6	6.8	7.1	7.2	-	-	-	335	335

Table 4. Microtox test results, Naval Coastal Systems WWTP discharge, Bay County, NPDES #FL0002551, on 12 October, 1988.

Microtox Test — Culture Lot # M-606

% Sample	Final Reclaimed Water: Chlorinated 5-min	Chlorinated 15-min	Dechlorinated 5-min	Dechlorinated 15-min
0	24	17	28	22
0	26	18	30	23
0	27	18	30	23
12.38	12	8	34.5	26
12.38	10	8	36	28
12.38	10	9	35.5	28
24.75	0	1	41	30
24.75	0	2	33	25
24.75	0	0	35	29
49.5	0	0	36	24
49.5	0	0	35	24
49.5	0	0	36	26
99	0	0	57	37
99	0	0	34	21
99	0	0	33	20

EC_{50} Chlorinated (15 minute, 15 °C) = 12.03% sample
EC_{50} Dechlorinated (15 minute, 15 °C) = Stimulatory

EC_{50} (15 minute, 15 °C) is calculated using the Data Reduction Computer Program developed by Microbics Corporation for the Sharp Model EL-5100 (Microbics) Systems Operating Manual, 1982.

Table 5. LC50 Data for Bioassay

Organism	Method of Data Analysis	48 Hour LC50 (95% Confidence Intervals)
Chlorinated discharge		
Ceriodaphnia dubia	noncalculated	<100% [a]
Daphnia pulex	noncalculated	<100% [a]
Notropis leedsi	noncalculated	<100% [a]
Dechlorinated discharge		
Ceriodaphnia dubia		no toxicity
Daphnia pulex		no toxicity
Notropis leedsi		no toxicity

[a] The LC50 is < 100% since all the organisms died in the 100% test concentration in these screening tests.

Table 6. Results of chemical analyses on the sample of discharge from the ~~City of Crestview WWTP~~, ~~Crestview, Okaloosa~~ County, Florida.

Organics

Acid Extractables	None Detected
Base Neutral Extractables	None Detected
Pesticide Extractables	Several unidentified components sensitive to ECD and NPD

Metals

Cadmium	0.2 µg/l
Lead	4.2 µg/l
Zinc	79.0 µg/l

Literature Cited

Beckman Instruments, Inc. 1982. Microtox system operating manual.

Florida Department of Environmental Regulation. 1985. Quality assurance manual for performing acute toxicity tests (Second Edition). Biology Section, Tallahassee.

_____. 1988. Bioassays of the Naval Coastal Systems Center Wastewater Treatment Plant, Panama City Beach, Bay County, Florida, NPDES #FL0002551. Biology Section. Tallahassee. 22 p.

Peltier, W. and C. I. Weber. 1985. Methods for measuring the acute toxicity of effluents to aquatic organisms (Third Edition). Environmental Research Laboratory. Athens, Georgia. EPA-600/4-85-012. 217 p.

Discussion of the Toxicity Criteria

The toxicity standards of Chapters 17-3 and 17-4, F.A.C., are complex. Because of this complexity, they will be briefly reviewed here so that these test results may be more readily compared with the standards. For legal purposes, however, the language of the Florida Administrative Code should be consulted directly. Applicable portions of the F.A.C. are: 17-3.021(1), 17-3.021(4), 17-3.051(1)(d), 17-3.061(3)(p), 17-3.402(1), 17-4.244(4), and 17-4.244(6).

The particular restrictions applied to a given discharger depend upon the type of discharge, the type of water body which is impacted, and the type of mixing zone, if any, which has been permitted. The most stringent toxicity limitations which apply to the various combinations of these factors are listed below, specified in terms of the most dilute concentration of effluent which is allowed to kill 50% of the test organisms in 96 hours. Note that any listed concentration greater than 100% is extrapolated from toxicity curves determined from testing various effluent concentrations of 100% or less. Violations of the toxicity standards occur in the following conditions.

I. Discharges to Surface Water

   A. With no mixing zone, or with only a dredge and fill mixing zone the discharge may not exhibit an $LC_{50} < 2000\%$ at the point of discharge.

   B. With a non-dredge and fill mixing zone the discharge may not exhibit an $LC_{50} < 100\%$ at the point of discharge and may not exhibit an $LC_{50} < 2000\%$ at the edge of the mixing zone.

   C. With a non-dredge and fill mixing zone, and either discharging to the open ocean through multiport diffusers or meeting the provisions of 17-4.244(4)(b) the LC_{50} at the point of discharge cannot exceed 30% sample concentration.

II. Discharges to ground water may not exceed an LC_{50} of 300% at the point of contact with surface waters

A violation of these provisions occurs if toxicity is found at a more dilute concentration of the sampled discharge than allowed above.

Unit # 013

BIOASSAY DATA FORM

Industry/Toxicant: Naval Coastal Systems Center WWTP
Address: Panama City Bch
Contact/District:
Effluent Serial Number: 001
NPDES Permit Number: FL0002551

Test Number: 1 of 6
Test Type: (Static) Renewal, Screening Conventional
Other: CeCl2

Sample Collection: Date 10-11-88 Time 1315
Test Beginning: Date 10-12-88 Time 1030
Test Ending: Date 10-14-88 Time 1030
Test Organism: Ceriodaphnia dubia
Age/Life Stage: neonate

Conc. or %	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control	1/2	5/5	0/5	0/5			8.6/8.6	—	8.3/8.7			8.4/8.4		8.3/8.4			19.9		20.0							
Control	3/4	5/5	5/5	5/5			8.6/8.6	—	8.7/8.8			8.4/8.4		8.4/8.4								145		255		
10%	5/6	5/5	5/5	5/5			8.4/8.4	—	8.4/8.5			8.4/8.4		8.4/8.4			20.2		20.0							
10%	7/8	5/5	5/5	5/5			8.4/8.4	—	8.4/8.5			8.4/8.4		8.4/8.4								130		270		
30%	9/10	5/5	5/5	5/5			8.5/8.6	—	8.4/8.5			8.2/8.2		8.3/8.3			20.3		20.1							
30%	11/12	5/5	5/5	5/5			8.6/8.6	—	8.4/8.5			8.2/8.2		8.3/8.3								155		290		
50%	13/14	5/5	5/5	5/5			8.2/8.1	—	8.8/8.8			7.9/7.9		8.1/8.1			20.3		20.1							
50%	15/16	5/5	5/5	5/5			8.2/8.3	—	8.6/8.6			7.9/7.9		8.1/8.1								215		310		
70%	17/18	5/6	5/6	5/6			8.2/8.3	—	8.8/8.8			7.7/7.7		7.9/7.9			20.0		20.1							
70%	19/20	5/5	5/5	5/5			8.3/8.3	—	8.4/8.5			7.7/7.7		7.9/7.9								265		350		
85%	21/22	5/5	5/5	5/5			8.2/8.3	—	8.4/8.5			7.4/7.4		7.7/7.7			20.1		20.1							
85%	23/24	5/5	5/5	5/5			8.3/8.3	—	8.8/8.8			7.4/7.4		7.7/7.7								205		340		
100%	25/26	5/5	5/5	5/5			8.3/8.3	—	8.8/8.8			7.0/7.0		7.4/7.4			20.0		20.2							
100%	27/28	5/5	5/5	5/5			8.3/8.3	—	8.8/8.8			7.0/7.0		7.4/7.4								320		361		
Initial of Investigator		SHW	MF	MF			JMF SHW		MF			SHW	JMF	MF			RBF JMF		MF			SHW		MF		

Alkalinity/Hardness (mg/l as $CaCO_3$)
Cond.
Control Water: 128/130
100% Sample: 30/30
well Other: 122/120
Measured by: MF

Ammonia unionized/total (mg/l as NH_3/N)
Hour 0
Cond
Control Water: 0.19
100% Sample: 0.40
Wea Other: 0.00

Hour:
Control Water:
100% Sample:
Other:
Measured by: HW

slope
= 1.4

Signature:
Ingrahall Faircloth
KAllwording
Steven A Lotz
Daniel Lindenberg

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours	7at7, 9at9	8.8 at 22°C	1314 at 1321 (22°C)
24 Hours	7@7, 9@9	9.0 @ 21°C	1310 @ 21.5°C 1313
48 Hours			
72 Hours			
96 Hours			

0) DO Temp 7.8 at 21.8°C
24) " " 20.9 at 20.1
48) " " 21.0 at 21.8°C

Total Residual Chlorine:
Cal data: 1.6 Method: HACH DR 100
Lab: 1.2 Method: HACH
Lab: 1.5 Method: IODO
(Chlorinated) Non-chlorinated by: RBF

Reviewed by:
Date: 3/13/57

NCSC WWTP

10-11-88 1315
10-12-88 1030
10-14-88 1030

Test Number: 2.6
Test Type: (Effl.) Renewal, Static, Recirculation
Others: de Cl2

Daphnia pulex neonate

		Initial Conc. (mg/l)	Number Dead			Dissolved Oxygen (mg/l)					pH					Temperature (°C)					Conductivity				
			24	48	72	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Control	29	5	5	5		8.1		8.7			8.3		8.2			20.0		20.2							
"	30	5	5	5		8.0		8.7			8.3		8.2												
"	31	4	4	4		8.1		8.7			8.3		8.2												
"	32	5	5	5		8.2		8.7			8.3		8.2								200		260		
100%	33	5	5	5		8.2		8.1			7.0		7.5			20.0		20.2							
"	34	5	5	5		8.1		8.7			7.0		7.5												
"	35	5	5	5		8.2		8.7			7.0		7.5												
"	36	5	5	4		8.3		8.7			7.0		7.5								320		378		
Initial of Investigator			KML	MF	MF			RBF	MF				JME	AHF	MF			RBF	MF				SHW	MF	

Control Water: 128/130
100% Sample: 30/90
Other: well (0 hr) 122/120
Measured by: MF

Ammonia unionized/total (mg/l as NH3/N)
Hour 0

Control Water:
100% Sample:
Other:

Hour ____

Control Water:
100% Sample:
Other:
Measured by: ____

Signatures:
Marshall Faircloth
K M Lurding
Steven H Wolfe
Russell Frydenborg

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Remarks:

Total Residual Chlorine:

Field data: ____ Method: ____
Lab: ____ Method: ____
Lab: ____ Method: ____

De-chlorinated:
Measurements by: ____

Reviewed by: [signature]

Date: 3/13/89

Industry/Toxicant NCSC WWTP
Address
Contact/District
Effluent Serial Number
NPDES Permit Number

BIOASSAY DATA FORM

Test Number: 3 of 6
Test Type: Static Renewal, Screening Conventional
Other: de Cl2

Sample Collection: Date 10-11-88 Time 1315
Test Beginning: Date 10-12-88 Time 1020
Test Ending: Date 10-14-88 Time 1030
Test Organism Notropis lucas
Age/Life Stage 8 days

Conc. or %	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control	86	5	5	5			8.2	8.4	8.0			7.8	8.1	8.3			21.0	19.8	19.8							
Control	21	5	5	5			8.3	8.4	8.0			7.8	8.1	8.1								220		225		
10%	20	5	5	5			8.3	8.3	8.0			7.6	8.0	8.2			21.0	19.8	19.5							
10%	120	5	5	5			8.3	8.3	8.0			7.6	8.0	8.2								235		235		
30%	70	5	5	5			8.3	8.3	7.9			7.5	7.9	8.0			21.0	19.7	19.4							
30%	34	5	5	5			8.3	8.3	7.9			7.5	7.9	8.0								255		255		
50%	47	5	5	5			8.2	8.0	7.7			7.4	7.8	7.9			21.0	19.6	19.4							
50%	228	5	5	5			8.2	8.0	7.7			7.4	7.8	7.9								260		275		
70%	72	5	5	5			8.3	8.0	7.8			7.2	7.6	7.7			21.0	19.5	19.3							
70%	49	5	4	4			8.2	8.0	7.5			7.2	7.6	[illegible]								305		300		
85%	18	5	5	5			8.2	8.1	7.8			7.0	7.4	7.6			21.0	19.5	19.3							
85%	38	5	5	5			8.2	8.0	7.8			7.0	7.4	7.5								320		315		
100%	4	5	5	5			8.3	7.8	7.5			6.8	7.2	7.3			21.0	19.5	19.5							
100%	99	5	5	5			8.3	7.9	7.6			6.8	7.1	7.2								335		335		
Initial of Investigator		RBF	MF	MF			RBF	SMF	MF			JMF	JMF	MF			RBF	SMF	MF			SHW		MF		

Alkalinity/Hardness (mg/l as $CaCO_3$)
Control Water: 122/120
100% Sample: 30/90
Other:
Measured by: MF

Ammonia unionized/total (mg/l as NH_3/N)
Hour 0
Control Water:
100% Sample:
Other:
Hour
Control Water:
100% Sample:
Other:
Measured by:

Signatures:
Marshall Faulk
KM Harding
Steven H Wolfe
Russel Lyndenberg

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours	7.0 7.4	9.0 6 21°C	
48 Hours			
72 Hours			
96 Hours			
Recorder:		13/13 21.7	
		13-89	

Total Residual Chlorine:
Field data: Method:
Lab: Method:
Lab: Method:
Reviewed by:
Re-chlorinated:
Measurements by:
Date: 3/13/89

NCSC WWTP

4 6

Cl2

10-11-88 1315
10-12-88 1030
10-13-88 1030

C. dubia neonate

Conductivity

Control	37	5	5			7.9	8.5			8.2	8.2			20.0	20.1	10					
"	38	5	5			8.0	8.5			8.2	8.3										
"	39	5	5			8.2	8.7			8.2	8.3										
"	40	5	5			8.2	8.6			8.2	8.3							220	225		
100%	41	5	0			8.0	8.9			6.8	7.7			19.8	20.0						
"	42	5	0			8.0	8.9			6.8	7.7										
"	43	5	0			8.1	8.9			6.8	7.6										
"	44	5	0			8.2	8.9			6.8	7.6							305	340		
Initial of Investigator		Kat SHW	MT			RBF	JMF			JMF	JMF			RBF	JMF			SHW	JMF		

Control Water: 128/130
100% Sample: 90/90
Other:
Hardness (mg/l as CaCO3): MT

Ammonia unionized/total (mg/l as N)/(%)
Hour 0

Control Water:
100% Sample:
Other:

Hour ____

Control Water:
100% Sample:
Other:
Measured by: ____

Signatures:
Mark Handbill
K M Lurding
Steve H Wolfe
Russel Frydenborg

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Remarks:

Total Residual Chlorine:

Field data: ____ Method: ____
Lab: ____ Method: ____
Lab: ____ Method: ____

Re-chlorinated:
Measurements by: ____

Reviewed by: ____

Date: 3/13/89

Industry/Toxicant NCSC WWTP
Address
Contact/District
Effluent Serial Number
NPDES Permit Number

BIOASSAY DATA FORM

Test Number: 5 of 6
Test Type: (Static) Renewal, (Screening) Conventional
Other: Cl_2

Sample Collection: Date 10-11-88 Time 1315
Test Beginning: Date 10-12-88 Time 1030
Test Ending: Date 10-13-88 Time 1030
Test Organism D. pulex
Age/Life Stage neonate

Conc. or %	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control	45	5	5				7.8	8.7				8.2	8.2				20.0	20.0								
"	46	5	5				8.0	8.7				8.2	8.2													
"	47	5	5				8.0	8.7				8.2	8.2													
"	48	5	5				8.2	8.7				8.2	8.2													
100%	49	0	0				8.2	8.9				6.8	7.6				19.5	20.0				220	250			
"	50	0	0				8.1	8.9				6.8	7.5													
"	51	0	0				8.2	8.9				6.8	7.5													
"	52	0	0				8.3	8.9				6.8	7.5									305	340			
Initial of Investigator		KWL	MH				SHW	JMF				JMF	JMF				RGF	JHF				SHW	JMF			

Alkalinity/Hardness (mg/l as $CaCO_3$)
Control Water: 128/13
100% Sample: 30/90
Other:
Measured by: MK

Ammonia unionized/total (mg/l as NH_3/N)
Hour 0
Control Water:
100% Sample:
Other:
Hour
Control Water:
100% Sample:
Other:
Measured by:

Signatures:
Marshall Faucett
Kathleen Winchester
Steven L. Wolfe
Russell Frydenborg

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Total Residual Chlorine:
Field data: Method:
Lab: Method:
Lab: Method:

Dechlorinated:
Measurements by:

Reviewed by:
Date: 3/13/89

NCSL WWTP

10-11-88 1315
10-12-88 1030
10-13-88 1030

6 6
Cl_2

N. Inlet
18 days

Conductivity

~~Control~~	~~50~~	~~5~~	~~0~~			~~8.3~~	~~8.7~~			~~7.6~~	~~8.0~~			~~210~~	~~195~~				
~~Control~~	~~130~~	~~5~~	~~0~~			~~8.3~~	~~8.8~~			~~7.6~~	~~8.0~~							~~220~~	~~220~~
100%	5	5	0			8.4	8.9			6.8	7.2			19.8	19.5				
100%	113	5	0			8.4	8.9			6.8	7.2							315	325
Inicial of Investigator		RHF	AL			SHW	JMF			JMF	JMF			SHW	JMF	JMF		SHW	JMF

Control Water: 122/120
100% Sample: 30/90
Other:
Measured by: RF

Ammonia unionized/total mg/l as NH_3/N)
Hour 0

Control Water:
100% Sample:
Other:
Measured by:

Hour ____

Control Water:
100% Sample:
Other:
Measured by: ____

Signatures:
Marshall Fondell
H Hillerdink
Steven H Wolfe
Russel Frydenborg

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Total Residual Chlorine:

Field data: ____ Method: ____
Lab: ____ Method: ____
Lab: ____ Method: ____

De-chlorinated:
Measurements by: ____

Reviewed by: [signature]

Date: 3/13/89

Remarks:
* INSUFFICENT FISH FOR CONTROL & NONE LOADED, USE CONTROL FROM DECHLORINATED. ALL ENTRIES IN # GIVE ARE IN ERROR.

MICROTOX™ Data Reduction Sheet

SOURCE: Naval Coastal Systems WWTP

GRAPH CALC EC 50 (15 MIN, 15 °C) = Stimulation % SAMPLE mg/L

SAMPLE DATA:

SAMPLE TYPE (EFFLUENT, LEACHATE, ETC.): effluent de-cl

DATE ASSAYED: 10 12-88 TIME: 11000

VISUAL COLOR: Slightly tannic CORRECTION REQUIRED: YES (NO)

VISUAL TURBIDITY: none SEPARATION REQUIRED: YES (NO)

INITIAL pH: pH ADJUSTED TO: WITH:

OSMOTICALLY ADJUSTED WITH: MOAS (DRY NaCl) OTHER

PRIMARY DILUTION OF SAMPLE:

OPERATOR: Joseph M. Faircloth REAGENT VIAL LOT NO. M-606

REMARKS:

MICROTOX™ 99% TEST

SAMPLE CUVETTE	% SAMPLE	READINGS 5 MIN	READINGS 15 MIN	Γ5	Γ15	NOTES
A1	0	28 mf	22	X	X	
B1		~~25~~ 30	23			
C1		30	23			
A2	12.38	34.5 mf	26	-.162	~~-.171~~	
B2		36.0 mf	28	~~-.173~~ mf	-.171	
C2		35.5 mf	28			
A3	24.75	41	30	~~-.190~~	-.190	
B3		33	25	~~-.179~~	~~-.179~~	
C3		35	29	-.193		
A4	49.5	36	24	-.179	~~-.161~~ mf	
B4		35	24	~~-.179~~	-.081	
C4		36	26			
A5	99	57	37	-.290	-.128	
B5		34	21			
C5		33	20			
EC_{50} (MIN, °C)						

REVIEWED BY:

DATE: 3/13/89

MICROTOX™ Data Reduction Sheet

SOURCE: Naval Coastal Systems WWTP

GRAPH CALC EC 50 (15 MIN, 15 °C) = 12,025 %SAMPLE mg/L

SAMPLE DATA:

SAMPLE TYPE (EFFLUENT, LEACHATE, ETC.): effluent chlorinated

DATE ASSAYED: 10-12-88 TIME: 1030

VISUAL COLOR: Bright tannic CORRECTION REQUIRED: YES (NO)

VISUAL TURBIDITY: None SEPARATION REQUIRED: YES (NO)

INITIAL pH: pH ADJUSTED TO: WITH:

OSMOTICALLY ADJUSTED WITH: MOAS (DRY NaCl) OTHER

PRIMARY DILUTION OF SAMPLE:

OPERATOR: Joseph McCandlish REAGENT VIAL LOT NO. M- 606

REMARKS: Cl > 1 ppm

MICROTOX™ 99% TEST

SAMPLE CUVETTE	% SAMPLE	READINGS 5 MIN	READINGS 15 MIN	Γ5	Γ15	NOTES
A1	0	24	17	X	X	
B1		26	18			
C1		27	18			
A2	12.38	12	8	1,406	1,120	
B2		10	8			
C2		10	9			
A3	24.75	0	1	0	16,667	
B3		0	2			
C3		0	0			
A4	49.5	0	0	0	0	
B4		0	0			
C4		0	0			
A5	99	0	0	0	0	
B5		0	0			
C5		0	0			
EC_{50} (MIN, °C)				<12,389	12,025	

REVIEWED BY:

DATE: 3/13/89