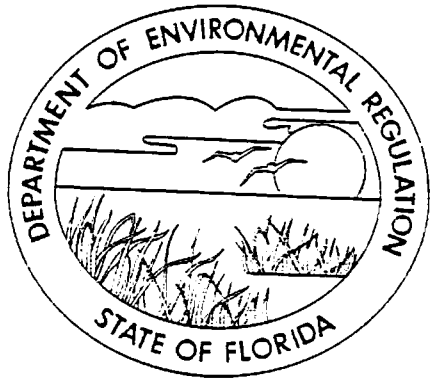


BIOASSAYS OF MODERN PLATING CORPORATION

PINELLAS PARK, PINELLAS COUNTY, FLORIDA

NPDES #FL0001121

Biological Section
Bureau of Water Analysis
February 18, 1981

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INTRODUCTION

Modern Plating Corporation is located at 5271, 102nd Avenue in Pinellas Park (Fig. 1). According to the NPDES permit (#FL0001121, August 1979) this facility is a steel automobile parts nickel and chromium plating operation. Production averages around 8000 square feet per day on an annual basis. In the production process, 0.035 MGD of wastewater is discharged via storm sewer to the Cross Bayou Canal (Fig. 2).

On 13 January 1981, the Biological Section obtained effluent samples from this facility and performed static bioassays to determine the existence and extent of toxicity to the biota of the receiving waters. Potentially toxic substances in this discharge may include nickel and hexavalent and total chromium. The results of these bioassays are reported here.

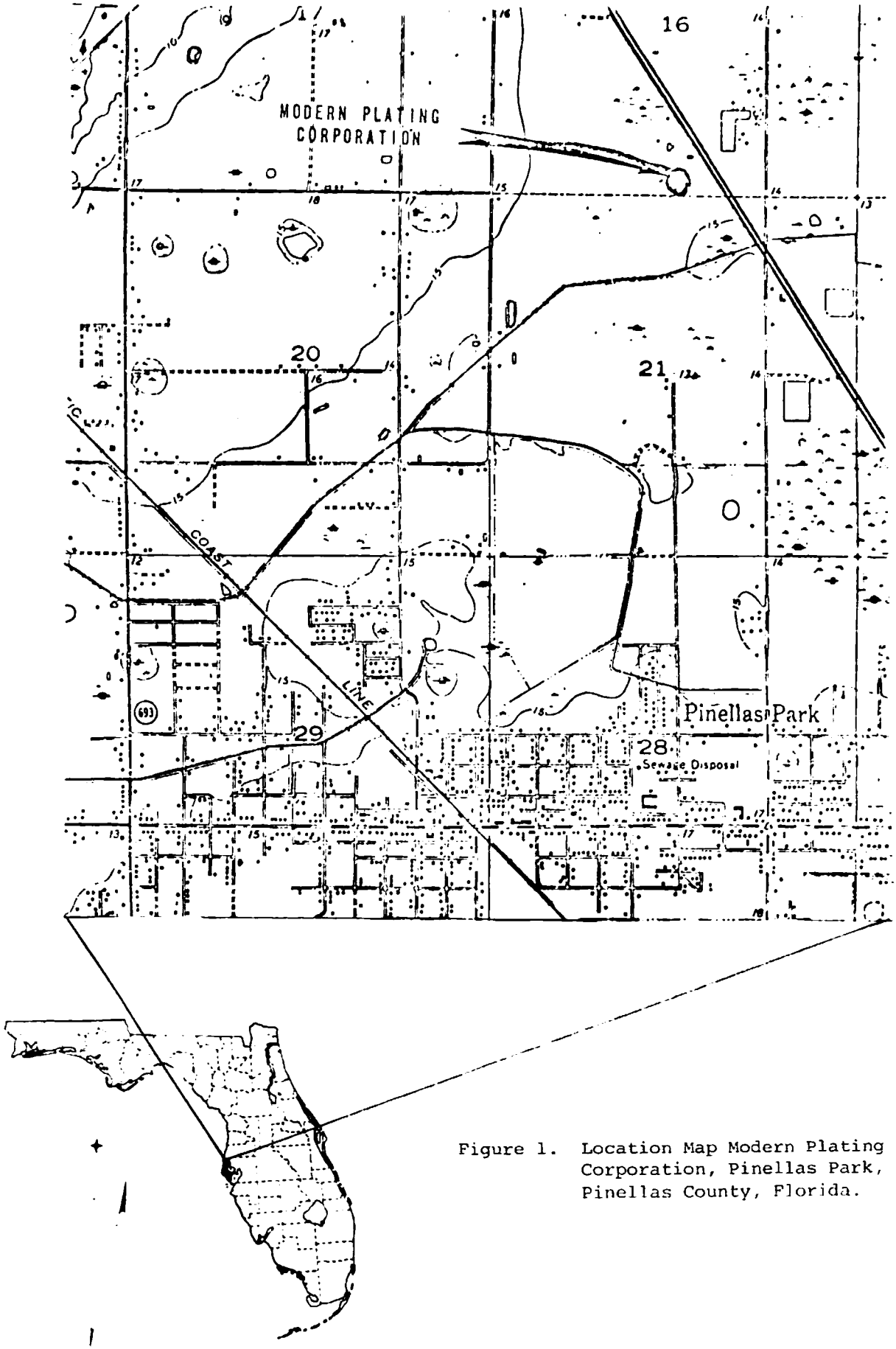


Figure 1. Location Map Modern Plating Corporation, Pinellas Park, Pinellas County, Florida.

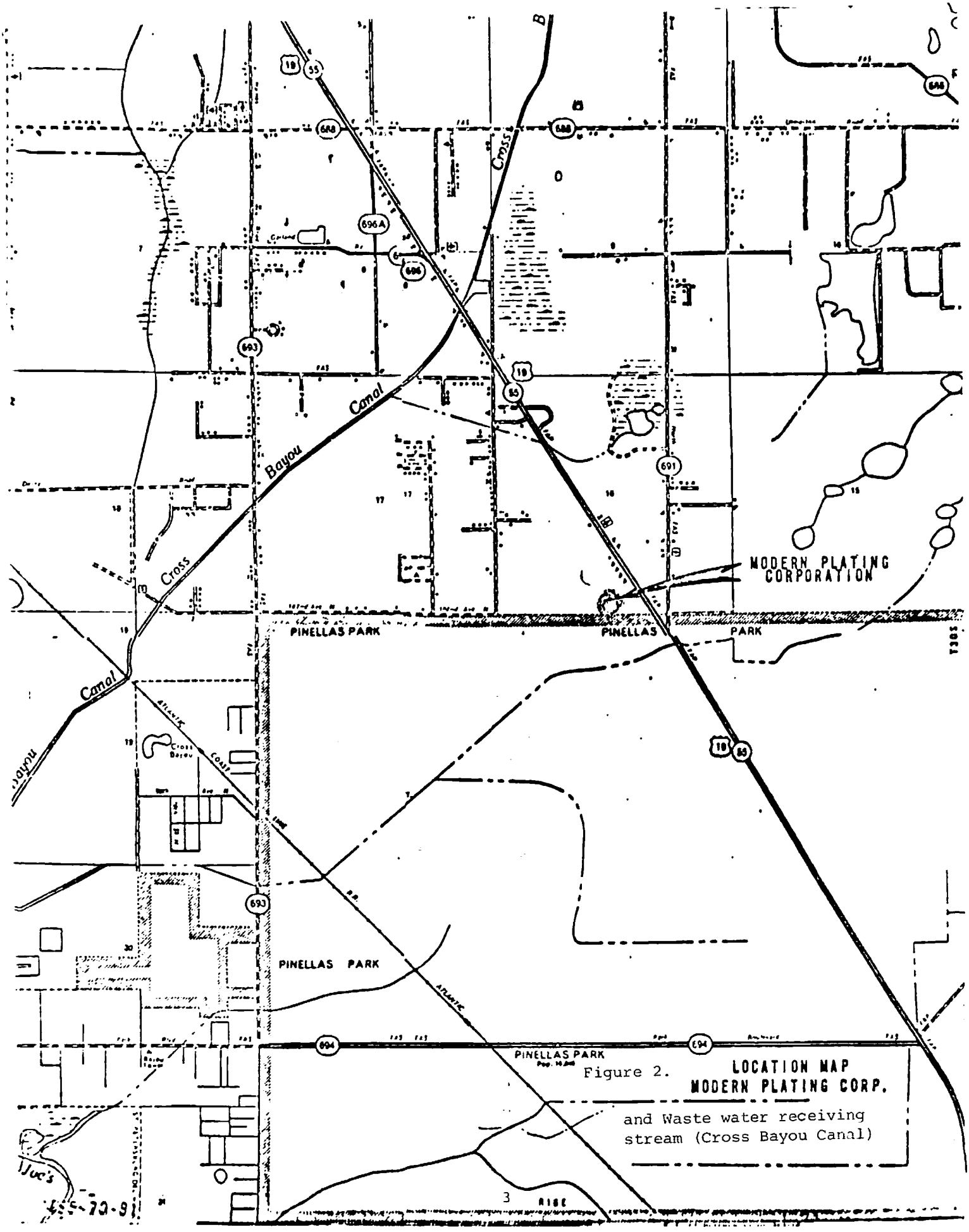


Figure 2. LOCATION MAP
MODERN PLATING CORP.
and Waste water receiving
stream (Cross Bayou Canal)

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organisms selected for this study include species recommended by Peltier (1978) and the U.S. EPA (1978). Additionally, the Biological Section maintains cultures of several species of organisms indigenous to the State of Florida. Life histories of these test organisms and maintenance procedures used to culture them are detailed below.

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 March, 1979. This culture has been maintained since its arrival, in 2½ gallon all glass aquaria filled with unchlorinated DER well water, using a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of $22^{\circ} \pm 1^{\circ}C$. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess daphnids. They are then refilled 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.

Simocephalus serrulatus (water flea) - An indigenous breeding population of S. serrulatus was collected from Lake Jackson, Leon County, Florida, in March, 1980, by personnel from DER's Biological Section. Positive identification of the organism was performed by Mr. Jeff Foran of the Department of Environmental Engineering Sciences, University of Florida in Gainesville. The cultures are maintained in 2½ gallon all glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. The organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of $22^{\circ} \pm 1^{\circ}C$. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess population. They are then refilled with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances.

Heterandria formosa (least killifish) - Approximately 100 adult killifish were obtained from a wild population in the St. Marks Wildlife Refuge (Wakulla County, Florida) during August, 1980. The fish have been maintained in 2½ to 5 gallon all glass aquaria equipped with a flow-through water exchange system. Water for this system is unchlorinated and is pumped from a deep well near the DER laboratory. The fish have been reared at $22^{\circ} \pm 2^{\circ}C$ under a 16:8 hour light-dark cycle and are fed freshly hatched Artemia (brine shrimp) twice daily. New born fish are initially maintained in the adult tanks, but are removed at weekly intervals, thereby segregating fish into even age groups. The fish used in this test were <3 weeks old.

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biological Section conducts monthly Standard Reference Toxicant Bioassays using sodium lauryl sulfate as the reference toxicant.

Test Methods

Three separate 48 hour static bioassays were conducted from 1100 hours on 13 January 1981 to 1100 hours on 15 January 1981, on a grab sample of effluent from outfall, #001. The sample was collected by J. Hager Kroll of DER's Southwest District Office at 1100 hours on 12 January 1981, using standard wastewater sampling procedures. Separate samples were obtained for chemical and biological testing. Samples for metal analysis were preserved with HNO_3. Samples for organic chemical analysis and the bioassays were unpreserved. The samples were iced and transported to the DER Laboratory in Tallahassee within 24 hours of collection.

Freshwater for dilution of the effluent sample was obtained from the same DER well that is used to culture the test organisms. The concentration series selected for this study (Table 1) is that recommended by APHA (1976).

Two replicates, each with six concentrations and a control, were used to test with Daphnia pulex and Simocephalus serrulatus. Flint glass jars of 250 ml capacity were used as test chambers, and 200 ml of the appropriate test concentration was placed in each chamber. Daphnia and Simocephalus were siphoned into large culture dishes through a series of nested stainless steel screens to isolate the proper size and age organisms (neonates). These neonates were then transferred individually by glass pipette examined for injury and loaded 10 per chamber, resulting in 20 per test concentration.

Two replicates, of six concentrations and a control, were used for the Heterandria formosa bioassay. The fish were transferred individually or by twos, by net, examined for injury, and loaded into wide mouth quart jars containing 500 ml each of the appropriate test concentration. Heterandria were loaded 5 per chamber resulting in ten per concentration.

Dissolved oxygen, temperature, pH, and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours, and 48 hours. Total alkalinity, total hardness, and conductivity were recorded at the beginning of the test for the controls and the 100% effluent concentration. These values were recorded on the bioassay data forms and are presented in Tables 2, 3 and 4. Organisms were not fed during these tests.

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

Water fleas (Daphnia pulex and Simocephalus serrulatus)

Concentration	Dilution Water	Effluent	Total Vol.
Control	200 ml	---	200 ml
5.6%	188.8 ml	11.2 ml	200 ml
10.0%	180 ml	20 ml	200 ml
18.0%	164 ml	36 ml	200 ml
32.0%	136 ml	64 ml	200 ml
56.0%	88 ml	112 ml	200 ml
100%	----	200 ml	200 ml

Least Killifish (Heterandria formosa)

Concentration	Dilution Water	Effluent	Total Vol.
Control	500 ml	---	500 ml
5.6%	472 ml	28 ml	500 ml
10.0%	450 ml	50 ml	500 ml
18.0%	410 ml	90 ml	500 ml
32.0%	340 ml	160 ml	500 ml
56.0%	220 ml	280 ml	500 ml
100%	---	500 ml	500 ml

Table 2. Data recorded during 48 hour, Simocephalus serrulatus, static acute toxicity bioassay of Modern Plating Corporation, Pinellas Park, Pinellas Co., Florida. NPDES # FL0001121, during 13 to 15 January 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (μmhos)
	0	24	48[e]	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0
Control	10	10	6	8.6	9.0	9.1	7.6	7.5	7.7	112		118		20.5	19.7	20.0			215
Control	10	9	7	8.6	9.1	9.1	7.6	7.5	7.7										
5.6	10	9	7	8.5	9.1	9.1	7.6	7.6	7.6					20.4	19.6	19.9			
5.6	11[a]	11	8	8.5	9.1	9.1	7.6	7.7	7.6										
10.0	10	9	7	8.5	9.2	9.1	7.5	7.7	7.6					20.4	19.5	19.9			
10.0	10	9	9	8.5	9.2	9.1	7.6	7.8[c]	7.6										
18.0	10	10	0[d]	8.6	9.2	9.1	7.6	7.5	7.6					20.2	19.5	19.9			
18.0	10	10	10	8.6	9.2	9.1	7.6	7.5	7.6										
32.0	10	9	7	8.6	9.1	9.2	7.5	7.5	7.7					20.2	19.6	19.9			
32.0	10	10	8	8.6	9.1	9.1	7.6	7.5	7.7										
56.0	10	8[b]	2	8.6	9.2	9.1	7.5	7.5	7.7					19.6	19.7	19.9			
56.0	10	8[b]	5	8.6	9.1	9.1	7.5	7.5	7.8										
100	10	8[b]	0	8.6	9.1	9.1	7.5	7.6	7.8	232		400		19.5	19.7	20.1			950
100	10	7[b]	0	8.6	9.1	9.1	7.5	7.6	7.9										

Remarks:
a. Extra test organism was not removed to avoid disturbing the test concentration.
b. Organisms stressed (unable to swim).
c. pH probe broke, new probe used in remaining test concentrations.
d. Broken pH probe resulted in potassium chloride solution leaking into the test chamber and may have caused observed mortality.
e. Test invalidated at 48 hours due to excessive control mortality (>20%).

Table 1. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of Modern Plating Corporation, Pinellas Park, Pinellas Co., Florida. NPDES # FL0001121 during 13 to 15 January 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (µmhos)
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0
Control	10	1[a]	1[a]	8.7	9.1	9.1	7.5	6.8	7.1	112		118		20.5	20.0	20.0			215
Control	10	10	10	8.6	9.0	9.1	7.6	7.5	7.4										
5.6	10	10	10	8.6	9.1	9.1	7.6	7.6	7.4					20.5	19.7	19.8			
5.6	10	10	9	8.6	9.1	9.1	7.6	7.6	7.5										
10.0	10	10	10	8.4	9.1	9.1	7.5	7.7	7.5					20.0	19.6	19.9			
10.0	10	10	9	8.5	9.1	9.1	7.5	7.7	7.5										
18.0	10	10	10	8.6	9.1	9.1	7.5	7.7	7.6					20.0	19.6	19.9			
18.0	10	10	9[b]	8.6	9.1	9.1	7.5	7.7	7.7										
32.0	10	10	9	8.6	9.1	9.1	7.5	7.7	7.7					19.5	19.6	19.9			
32.0	10	10	10	8.6	9.1	9.1	7.5	7.7	7.7										
56.0	10	10	9	8.6	9.1	9.1	7.5	7.7	7.7					19.5	19.7	19.9			
56.0	10	10	10	8.6	9.1	9.1	7.5	7.7	7.8										
100	10	10	7	8.7	9.1	9.1	7.5	7.6	7.8	232		400		19.5	19.7	20.0			950
100	10	9	6	8.7	9.1	9.1	7.5	7.7	7.9										

Remarks: a. Test invalid at 24 and 48 hours due to excessive control mortality (>20%).
b. Two organisms severely stressed (unable to swim).

Table 4. Data recorded during 48 hour, Heterandria formosa, static acute toxicity bioassay of Modern Plating Corporation, Pinellas Park, Pinellas Co., Florida. NPDES # FL0001121, during 13 to 15 January 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (µmhos)
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0
Control	5	5	5	8.7	8.8	8.7	7.7	6.9	7.7	112		118		20.5	19.6	19.8			210
Control	5	5	5	8.7	8.8	8.7	7.7	6.9	7.8										
5.6	5	5	5	8.7	8.7	8.7	7.6	6.9	7.7					20.4	19.5	19.7			
5.6	5	5	5	8.7	8.7	8.7	7.6	7.0	7.8										
10.0	5	5	5	8.7	8.8	8.7	7.6	7.1	7.7					20.4	19.5	19.7			
10.0	5	5	5	8.7	8.8	8.7	7.6	7.1	7.7										
18.0	5	5	5	8.7	8.7	8.7	7.6	7.2	7.8					20.3	19.5	19.7			
18.0	5	5	5	8.7	8.7	8.7	7.6	7.2	7.8										
32.0	5	5	5	8.6	8.6	8.8	7.5	7.3	7.8					20.2	19.5	19.7			
32.0	5	5	5	8.6	8.6	8.7	7.6	7.4	7.8										
56.0	5	5	5	8.6	8.6	8.5	7.5	7.4	7.8					20.0	19.6	19.8			
56.0	5	5	5	8.6	8.5	8.5	7.5	7.4	7.8										
100	5	5	5	8.6	8.4	8.4	7.5	7.4	7.9	232		400		19.5	19.8	20.0			950
100	5	5	5	8.6	8.4	8.4	7.6	7.5	7.9										

Remarks: a. Average weight of the 7 to 27 day old fish used in this test was 0.012g/individual.

RESULTS AND DISCUSSION

This particular grab sample from Modern Plating Corporation was not toxic to the two freshwater invertebrates and the freshwater fish species used as test organisms. Although some mortality was noted at 24 hours in the Simocephalus serrulatus bioassay (Table 2), the LC_{50} proved to be greater than 100%. However, at 48 hours the test was invalidated due to excessive control mortality (>20%, Table 2). Excessive control mortality was also responsible for invalidating the Daphnia pulex bioassay (Table 3). The Biological Section is currently conducting tests to determine the causes of this control mortality. None of the Heterandria formosa died during the course of these tests (Table 4).

This sample of effluent from the Modern Plating Corporation was chemically characterized by DER's Chemistry Section in Tallahassee. These results are presented in Table 5. The mortality produced by this effluent sample may be attributed to the high concentrations of nickel (U.S. EPA, 1977). Chromium was also found in the effluent in sufficient concentrations to have stressed the organisms (U.S.EPA, 1977).

Table 5. Chemical Characterization of Effluent from Modern Plating Corporation. NPDES #FL0001121

Parameter	Values (ug/l)
Metals	
Antimony	200 k
Arsenic	50 k
Beryllium	10 k
Cadmium	10 k
Chromium	146
Copper	50 k
Lead	50 k
Mercury	0.3
Nickel	7876
Selenium	40 k
Silver	10 k
Thallium	100 k
Zinc	25 k
Organics	
Pesticides	N.D.
Base/Neutrals	N.D.
Acid Extractables	N.D.

Note: k = Actual value is known to be less than value given.
N.D. = Not Detected

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