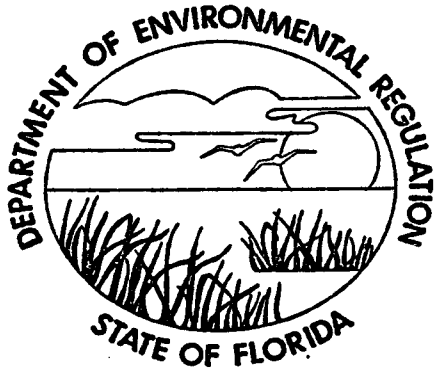


BIOASSAYS OF GROUNDWATER SAMPLES FROM CHLORIDE INC., METALS DIVISION TAMPA, HILLSBOROUGH COUNTY, FLORIDA

SAMPLED 6/17/86

SEPTEMBER 5, 1986

Biology Section
Division of Environmental Programs

BIOASSAYS OF GROUNDWATER SAMPLES FROM CHLORIDE INC., METALS DIVISION. TAMPA, HILLSBOROUGH COUNTY, FLORIDA

Biology Section
Bureau of Laboratories and
Special Programs
September 9, 1986

EXECUTIVE SUMMARY

Chloride Metals, Groundwater Samples, Tampa, on 18 to 20 June, 1986.

Four static acute toxicity bioassays were performed on samples of groundwater collected from two monitoring wells (5-11 and 5-19) near Chloride Metals, a battery recycling operation. Results indicated that neither sample was acutely toxic to the test organisms, Daphnia pulex and Notropis leedsi, during the 48 hour test period. Moderate amounts of ammonia were detected in these samples, up to 1.78 mg/l total and 0.01 mg/l unionized, which were insufficient to have caused any toxicity.

The results of these tests may suggest that the contaminants (various metals and substances causing high pH) previously found to be present in the surface waters around Chloride may not be present in the goundwater, at least to the degree of causing acute toxicity to the test organisms.

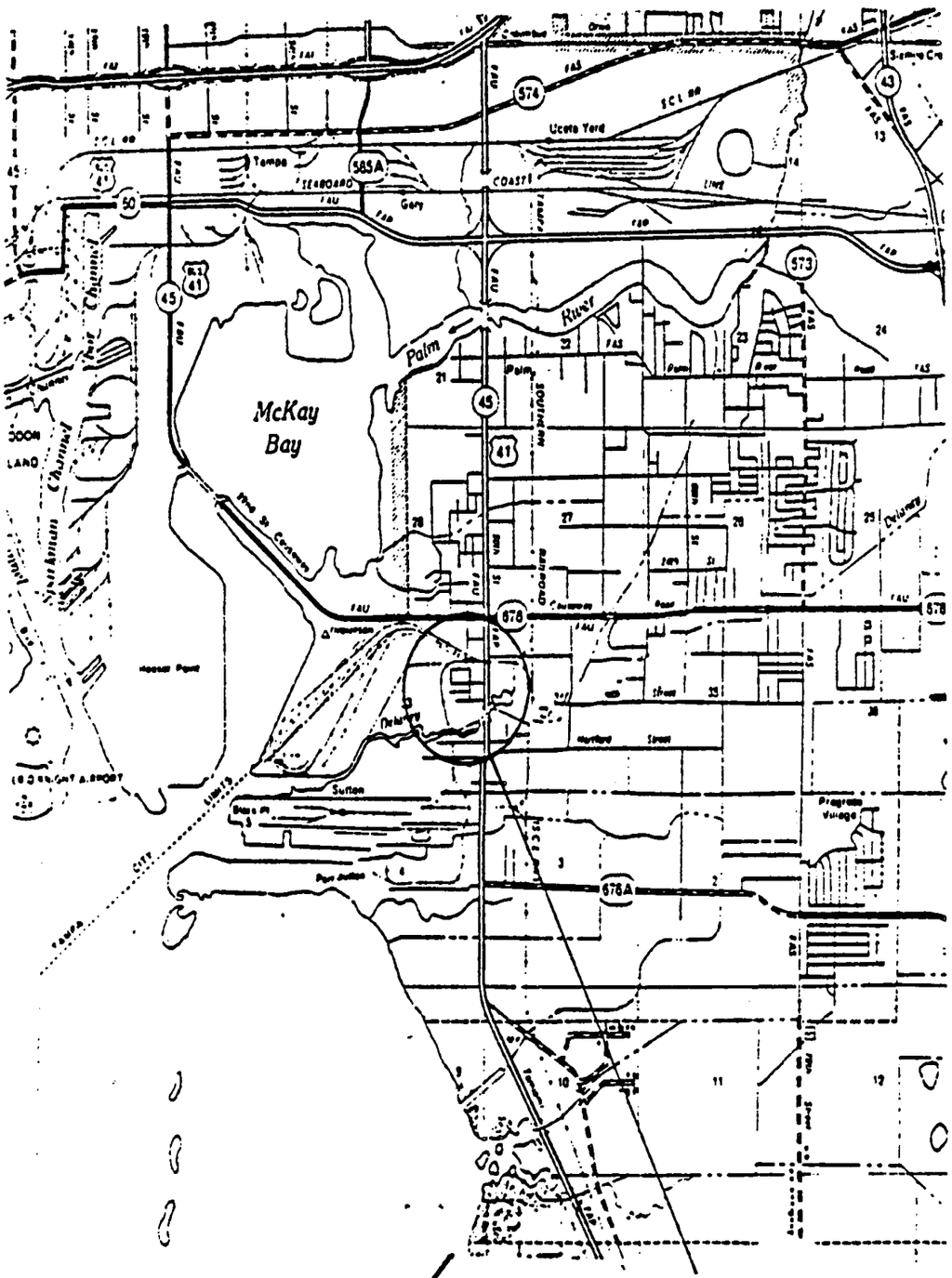
INTRODUCTION

Chloride Metals, Inc. is a secondary lead smelting operation located off U.S. Highway 41, in Tampa, Hillsborough County, Florida (Fig. 1). Lead is recovered from lead-acid storage batteries at a production rate of 48 tons per day.

The wastewater generated at this facility is currently retained on site in a series of percolation/evaporation ponds encompassing an area of 10,000 square feet. Potentially toxic components in the wastewater may include: sulfuric acid, arsenic, cadmium, chromium, copper, nickel, lead, and antimony.

The Biology Section has previously performed toxicity bioassays on samples of wastewater generated at this facility. All tests resulted in acute toxicity to various bioassay test organisms, with LC_{50}'s normally being < 25%. Toxicity was usually attributed to high pH and to significant concentrations of metals in the wastewater (FDER 1981, 1982, and 1984).

Due to the suspected groundwater contamination from Chloride's percolation ponds, DER's Groundwater Section requested that acute toxicity bioassays be performed on several sample from nearby monitoring wells. The selected monitoring wells (5-11 and 5-19) were of particular interest since they are located only 30' from Delaney Creek, a tributary of Tampa Bay. Four static bioassays were performed on these groundwater samples on 18 to 20 June, 1986. The results of these tests are presented in this report. Those involved in performing the tests and in preparation of this report were: R. B. Frydenborg, M. L. Roll, and P. G. Weiland.



Location of Chloride Metals, Inc.

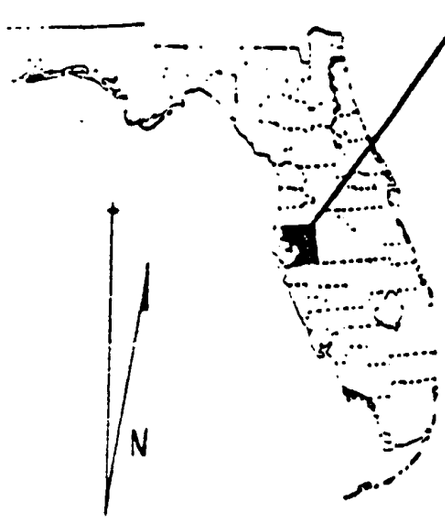


Figure 1. Portions of Hillsborough County including study area.

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), the U.S. EPA (1978), 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.

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 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.

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 30 and 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 Tetra-Min® 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 Tetra Min®. The fish used in this test were approximately three weeks old at the time of the test.

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.

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

Four seprate static acute toxicity screening tests (50% and 100% concentrations) were performed on groundwater samples collected from Chloride Metals' monitoring wells #5-11 and #5-19. The tests were performed from 0930 hours on 18 June to 0930 hours on 20 June, 1986.

The samples were collected by Mr. Michael Clark of DER's Groundwater Section at 1440 hours on 17 June, 1986, using standard wastewater sampling procedures. The samples for the bioassays were unpreserved. 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° $\pm$ 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.

Freshwater Tests

Freshwater for dilution of the groundwater samples was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study is presented in (Table 1).

Two replicates, of two concentrations and a control, were used to test with the water flea, Daphnia pulex. 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 were siphoned into a large culture dish to isolate the proper size and age organisms (neonates). To accomplish this, the water fleas were siphoned through a stainless steel screen. The trapped adults were then discarded. These neonates were then transferred by glass pipette, examined for injury, and were loaded 10 per chamber, resulting in 20 per test concentration. Water fleas were not fed during these tests.

Two replicates, of two concentrations and a control, were used for the Notropis leedsi (bannerfin shiner) bioassays. The fish were transferred individually or by twos, into wide mouth quart jars containing 500 ml each of the appropriate test concentration, and were loaded 5 per chamber, resulting in 10 per concentration. Fish were not fed during these tests.

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. 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 daily 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% test concentrations 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.

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

Daphnia pulex (water flea)

Concentration	Dilution Water	Effluent	Total Volume
Control	200.0 ml	--------	200 ml
50.0%	100.0 ml	100.0 ml	200 ml
100.0%	--------	200.0 ml	200 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Effluent	Total Volume
Control	500 ml	--------	500 ml
50.0%	250 ml	250 ml	500 ml
100.0%	------	500 ml	500 ml

Table 2. Data recorded during 48 hour, Daphnia pulex and Notropis leedsi, static acute toxicity bioassays of Chloride Metals, Groundwater samples, Tampa, on 18 to 20 June, 1986.

Well #5-11

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48
Daphnia pulex														
Control	10	10	10	8.3	8.2	7.4	8.1	8.0	7.8	20.8	20.0	22.1		
Control	10	10	10	8.5	8.2	7.4	8.1	8.0	7.8				210	220
50.0%	10	10	10	8.6	8.2	7.4	7.3	7.8	7.8	21.5	20.0	22.0		
50.0%	10	10	10	8.6	8.2	7.5	7.3	7.8	7.8				850	880
100.0%	10	10	10	8.1	7.0	7.6	7.0	7.7	7.8	22.2	20.0	22.0		
100.0%	10	10	10	8.1	7.0	7.6	7.0	7.7	7.8				1430	1480
Notropis leedsi														
Control	5	5	5	8.3	7.8	7.9	7.6	7.8	7.9	21.6	19.7	21.9		
Control	5	5	5	8.4	7.8	7.9	7.6	7.8	7.9				205	210
50.0%	5	5	5	8.4	7.6	7.1	7.2	7.7	7.7	22.1	19.7	21.7		
50.0%	5	5	5	8.4	7.6	7.1	7.2	7.7	7.7				900	870
100.0%	5	5	5	8.0	5.8	7.2	7.0	7.4	7.7	22.5	19.7	21.6		
100.0%	6[a]	6	6	8.0	5.8	7.2	7.0	7.4	7.7				1500	1460

Control Water

NH_3(as NH_3)(mg/l): 0

Total Alkalinity (mg/l $CaCO_3$):

Total ammonia (as N)(mg/l): 0

Total Hardness (mg/l $CaCO_3$):

100% Effluent

NH_3(as NH_3)(mg/l): .01

Total Alkalinity (mg/l $CaCO_3$):

Total ammonia (as N)(mg/l): 1.78

Total Hardness (mg/l $CaCO_3$):

[a] Extra organism loaded by mistake, allowed to remain.

Table 3. Data recorded during 48 hour, Daphnia pulex and Notropis leedsi, static acute toxicity bioassays of Chloride Metals, Groundwater Samples, Tampa, on 18 to 20 June, 1986.

Well #5-19

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48
Daphnia pulex														
Control	10	10	10	8.5	8.0	7.7	8.1	8.0	7.9	21.2	20.0	22.0		
Control	10	10	10	8.4	8.0	7.7	8.1	8.0	7.9				212	232
50.0%	10	10	10	8.6	8.0	7.8	7.0	7.8	7.9	21.0	20.0	22.0		
50.0%	10	10	10	8.6	8.0	7.8	7.0	7.8	7.9				900	950
100.0%	10	10	10	8.6	7.8	7.8	6.7	7.7	8.0	21.1	20.2	21.9		
100.0%	10	10	10	8.6	7.8	7.8	6.7	7.7	8.0				1510	1510
Notropis leedsi														
Control	5	5	5	8.4	7.8	7.2	7.6	7.8	7.8	21.8	19.8	21.6		
Control	5	5	5	8.4	7.8	7.2	7.6	7.8	7.8				205	210
50.0%	5	5	5	8.5	7.9	7.5	7.0	7.6	7.8	21.3	19.8	21.6		
50.0%	5	5	5	8.5	7.9	7.5	7.0	7.6	7.8				950	920
100.0%	5	5	5	8.3	7.8	7.4	6.7	7.4	7.8	21.2	19.8	21.5		
100.0%	5	5	5	8.3	7.8	7.4	6.7	7.4	7.8				1580	1550

Control Water

NH_3(as NH_3)(mg/l): 0

Total Alkalinity (mg/l $CaCO_3$):

Total ammonia (as N)(mg/l): 0

Total Hardness (mg/l $CaCO_3$):

100% Effluent

NH_3(as NH_3)(mg/l): .003

Total Alkalinity (mg/l $CaCO_3$):

Total ammonia (as N)(mg/l): 1.04

Total Hardness (mg/l $CaCO_3$):

RESULTS AND DISCUSSION

The groundwater samples from Chloride Metals' monitoring wells #5-11 and #5-19 were not acutely toxic to the test organisms, Daphnia pulex and Notropis leedsi. There was no mortality noted during the 48 hour bioassays (Tables 2 and 3). Therefore, it is believed that these tests satisfy the FAC 96 hour toxicity test requirement. The ammonia measured in these samples, up to 1.79 mg/l total and 0.01 unionized, was apparently insufficient to have caused any toxicity.

These results suggest that the contaminants (various metals and substances causing high pH) previously found in surface waters around Chloride Metals and causing acute toxicity, may not be present in these groundwater samples tested, at least not in acutely toxic concentrations. Because of the surface water contaminants, however, it is recommended that both groundwater and surface water biomonitoring continue at this facility.

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