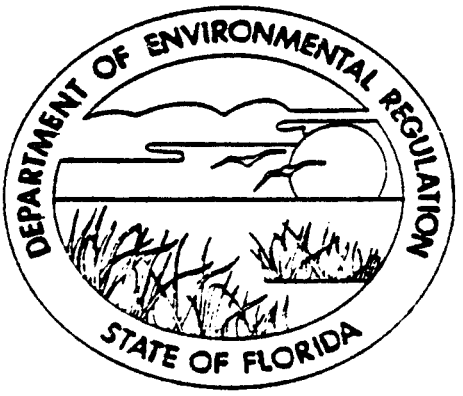


BIOASSAYS OF TRANSCIRCUITS, GROUNDWATER SAMPLES

LAKE PARK, PALM BEACH COUNTY, FLORIDA

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Biology Section
Bureau of Laboratories
September 27, 1984

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EXECUTIVE SUMMARY

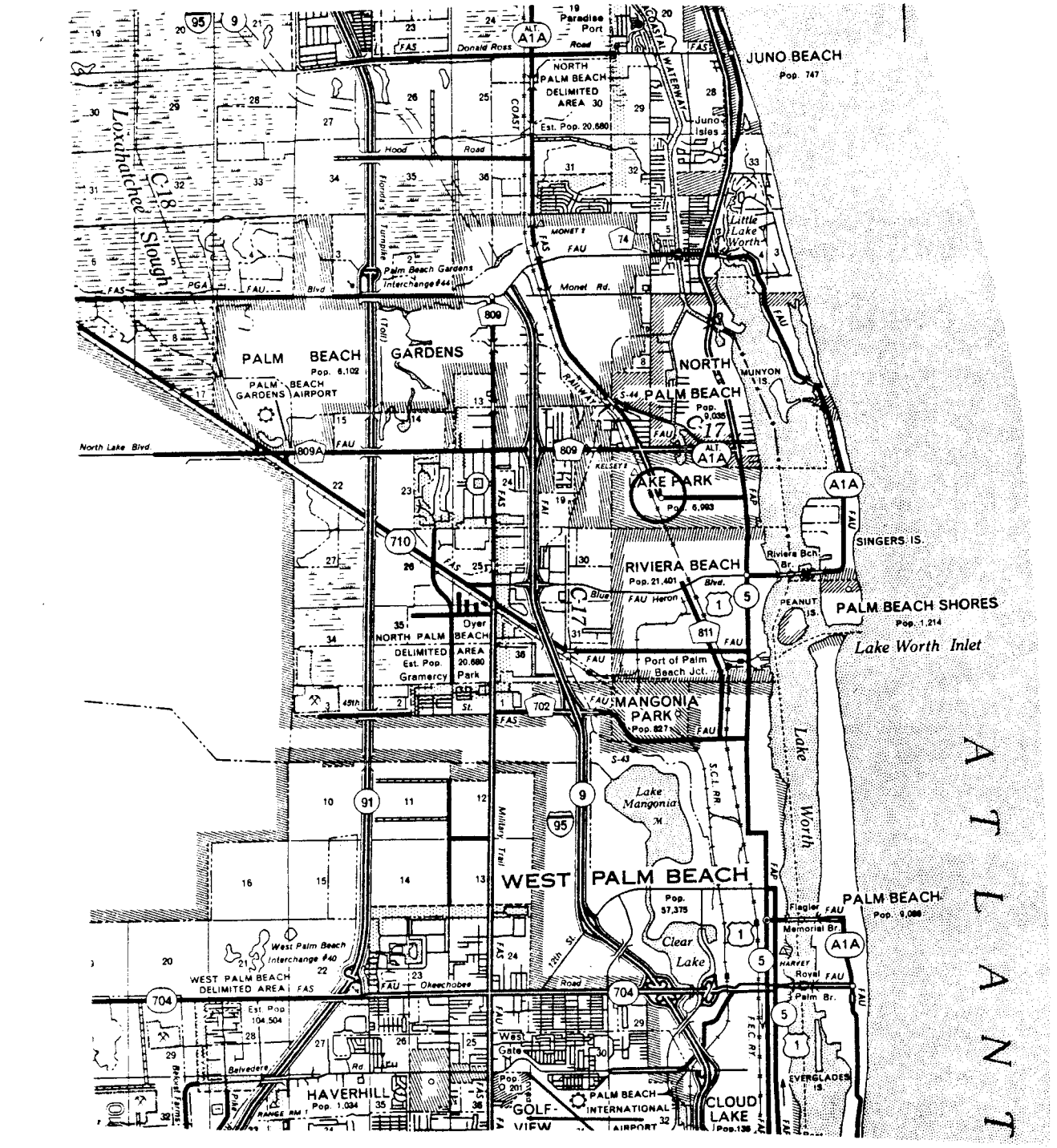
Transcircuits, Groundwater Samples, Lake Park, on 31 July to 2 August, 1984.

The two groundwater samples collected from on-site monitoring wells from this electronics manufacturing facility were not acutely toxic to the test organisms, Daphnia pulex and Notropis leedsi. Although D. pulex mortalities were noted in almost every test concentration in both bioassays, the mortalities appeared to be random. The two N. leedsi mortalities noted in the groundwater sample from Well #2, however, were both in the 100% concentration, and therefore, may have been due to toxic components in that sample. This mortality, however, was insufficient to calculate an LC_{50}. Since the groundwater samples were not acutely toxic, chemical analyses were not performed.

INTRODUCTION

Transcircuits is an electronics manufacturer located on Newman Road in Lake Park, Palm Beach County, Florida (Figures 1 and 2). Groundwater monitoring data in the vicinity of the facility's percolation pond have indicated elevated levels of cyanide, lead, fluoride and copper. This groundwater contamination is of particular importance since several major bodies of water (C-17 Canal, Lake Worth, and the Intracoastal Waterway) and several municipal drinking water wellfields are all located within approximately one mile of the site.

To evaluate the potential toxicity of this contaminated groundwater to aquatic organisms, the Enforcement Section of DER's Southeast District requested that acute toxicity bioassays be performed. Groundwater samples from two monitoring wells were collected and four static bioassays were performed, on 31 July to 2 August, 1984. The results of these tests are presented in this report. Those involved in performing the tests and in preparation of this report were: C. W. Dye, R. B. Frydenborg, and M. L. Roll.



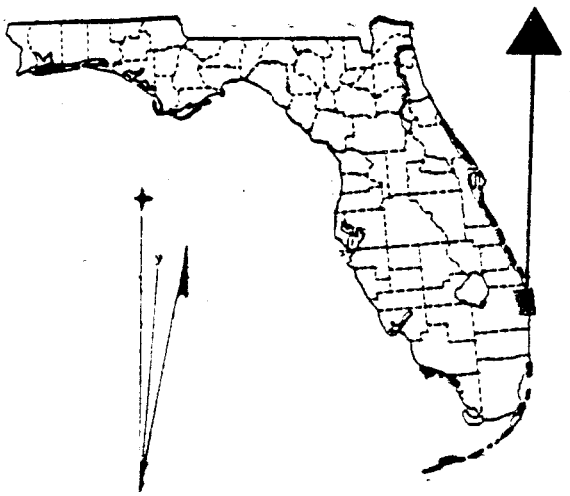


Figure 1. Portions of Eastern Palm Beach County, Florida, including Lake Park and approximate location of Transcircuits.

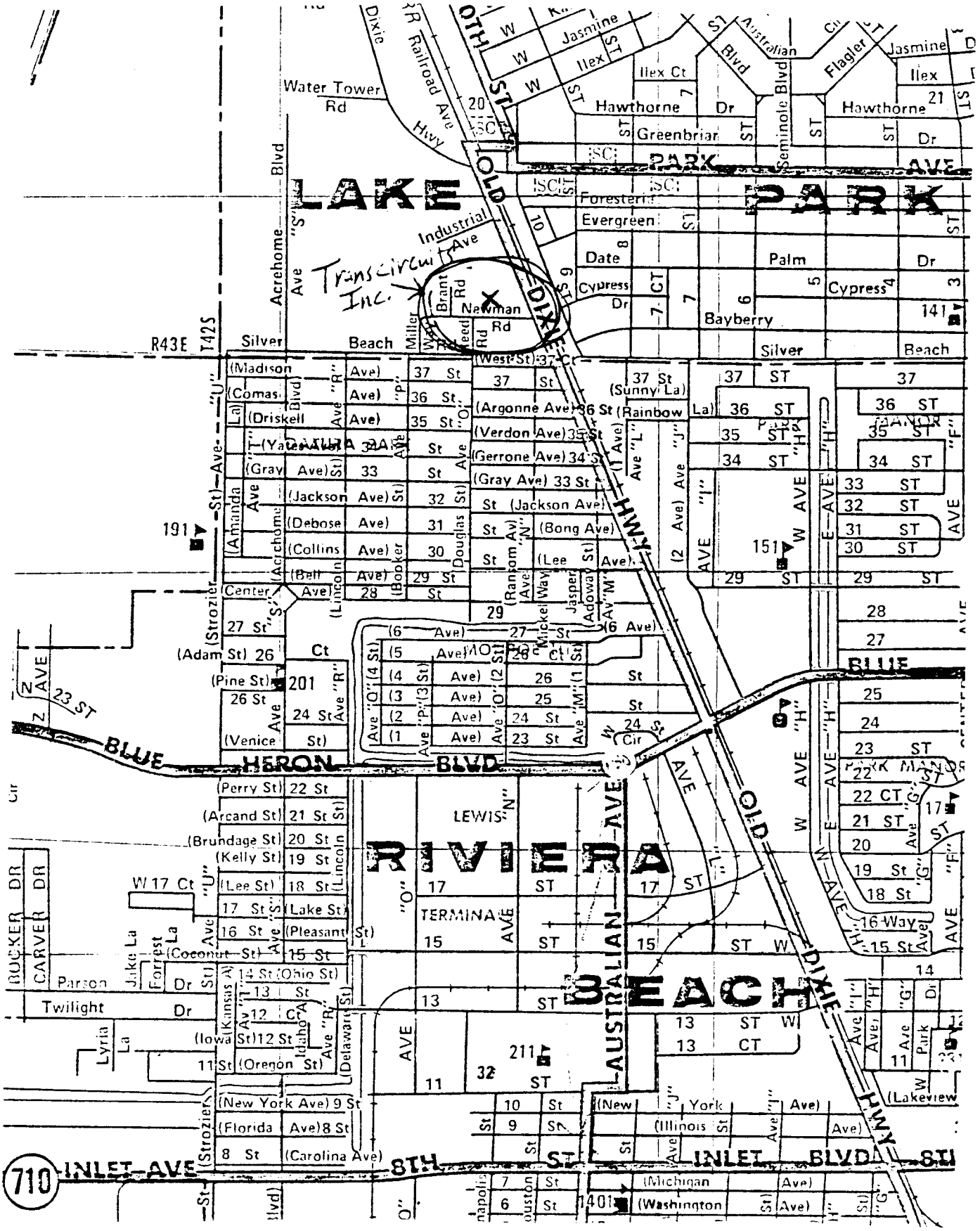


FIGURE 2. Location of Transcircuits in Lake Park, Florida

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978) and the FDER Biology Section (1983). The organisms selected for this study include a species recommended by Peltier (1978), the U.S. EPA (1978), and the FDER Biology Section (1983). 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° plus or minus 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° plus or minus 2°C under a 16:8 hour light 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 19 to 22 days 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

Four separate 48 hour static acute toxicity bioassays were performed on two groundwater samples collected from on-site monitoring wells from Transcircuits. The tests were performed from 1025 hours on 31 July to 1050 hours on 2 August, 1984. The samples were collected by Mr. Brad Rieck of DER's Southeast District from 1045 hours to 1145 hours on 30 July, 1984, using standard wastewater sampling procedures. Separate samples were obtained for chemical and biological testing. Samples for metal analyses were preserved with HNO_3. Samples for organic chemical analyses and for the bioassays were unpreserved. The samples were iced and transported to the DER laboratory in Tallahassee for analyses within 24 hours of collection.

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 (Table 1) is that recommended by APHA (1980).

Two replicates, each with five 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 five 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.

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% concentrations. 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. These values were recorded on the bioassay data forms and are presented in Tables 2 through 5.

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

Daphnia pulex (water flea)

Concentration	Dilution Water	Groundwater	Total Volume
Control	200.0 ml	--------	200 ml
10.0%	180.0 ml	20.0 ml	200 ml
18.0%	164.0 ml	36.0 ml	200 ml
32.0%	136.0 ml	64.0 ml	200 ml
56.0%	88.0 ml	112.0 ml	200 ml
100.0%	--------	200.0 ml	200 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Groundwater	Total Volume
Control	500 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
100.0%	------	500 ml	500 ml

Table 2. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of Transcircuits, Lake Park, Palm Beach County, Florida, on 31 July to 2 August, 1984

Monitoring Well #1 Groundwater Sample

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)		NH_3/N (mg/l)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	0	48
Control	10	10	8	8.3	8.6	7.9	7.6	7.9	8.0	21.8	21.5	22.0				
Control	10	10	8	8.3	8.6	7.9	7.6	7.9	8.0				207	211		
10%	10	9	6	8.1	8.7	7.8	7.5	7.9	8.1	21.7	21.3	21.7				
10%	10	10	5	8.1	8.7	7.8	7.5	7.9	8.1				200	193		
18%	10	10	9	8.0	8.7	7.5	7.5	7.9	8.1	21.8	21.2	21.5				
18%	10	10	6	8.0	8.7	7.5	7.5	7.9	8.1				178	191		
32%	10	10	8	7.8	8.6	7.6	7.4	7.9	8.0	21.6	21.2	21.5				
32%	10	10	8	7.8	8.6	7.6	7.4	7.9	8.0				189	188		
56%	10	10	8	7.4	8.6	7.5	7.3	7.9	8.0	21.4	21.2	21.5				
56%	10	9	8	7.4	8.6	7.6	7.3	7.9	8.0				177	175		
100%	10	10	9	6.7	8.5	7.8	7.0	7.9	7.9	21.1	21.2	21.5				
100%	10	10	9	6.7	8.5	7.8	7.0	7.9	7.9				153	157		

Control Water

Total Alkalinity 82 (mg/l $CaCO_3$)

Total Hardness 116 (mg/l $CaCO_3$)

100% Sample

Total Alkalinity 65 (mg/l $CaCO_3$)

Total Hardness 83 (mg/l $CaCO_3$)

Remarks:

Table 3. Data recorded during 48 hour, Notropis leedsi, static acute toxicity bioassay of Transcircuits, Lake Park, Palm Beach County, Florida, on 31 July to 2 August, 1984

Monitoring Well #1 Groundwater Sample

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)		NH_3/N (mg/l)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	0	48
Control	5	5	5	8.1	7.8	7.2	7.6	7.8	7.9	21.8	21.5	21.8				
Control	5	5	5	8.1	7.8	7.2	7.6	7.8	7.9				207	208		
10%	5	5	5	8.1	7.7	7.1	7.5	7.8	78.9	21.7	21.2	21.4				
10%	5	5	5	8.1	7.7	7.1	7.5	7.8	7.9				202	201		
18%	5	5	5	8.0	7.7	7.0	7.4	7.8	7.8	21.5	21.0	21.3				
18%	5	4	4	8.0	7.7	7.0	7.4	7.8	7.8				199	197		
32%	5	5	5	7.9	7.7	7.0	7.3	7.7	7.8	21.4	21.0	21.2				
32%	5	5	5	7.9	7.7	7.1	7.3	7.7	7.8				192	190		
56%	5	5	5	7.5	7.7	7.2	7.2	7.7	7.8	21.2	21.0	21.2				
56%	5	5	5	7.5	7.7	7.2	7.2	7.7	7.8				180	180		
100%	5	5	5	6.4	7.5	6.9	7.0	7.7	7.7	21.1	21.0	21.3				
100%	5	5	5	6.4	7.2	6.9	7.0	7.7	7.7				158	160		

Control Water

Total Alkalinity 82 (mg/l $CaCO_3$)

Total Hardness 116 (mg/l $CaCO_3$)

100% Sample

Total Alkalinity 65 (mg/l $CaCO_3$)

Total Hardness 83 (mg/l $CaCO_3$)

Remarks:

Table 4. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of Transcircuits, Lake Park, Palm Beach County, Florida, on 31 July to 2 August, 1984.

Monitoring Well #2 Groundwater Sample

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)		NH_3/N (mg/l)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	0	48
Control	10	10	9	8.1	8.6	7.8	7.6	7.9	8.0	21.8	21.2	21.5				
Control	10	10	8	8.1	8.6	7.8	7.6	7.9	8.0				208	208		
10%	10	10	10	8.0	8.6	7.5	7.6	8.0	8.1	21.7	21.1	21.4				
10%	10	10	8	8.0	8.6	7.5	7.5	8.0	8.1				200	210		
18%	10	10	10	8.0	8.6	7.7	7.7	8.0	8.1	21.7	21.1	21.5				
18%	10	8	8	8.0	8.6	7.7	7.7	8.0	8.1				193	198		
32%	10	8	6	7.9	8.6	7.8	7.7	8.0	8.0	21.6	21.1	21.5				
32%	10	9	8	7.9	8.6	7.8	7.7	8.0	8.0				182	184		
56%	10	10	10	7.8	8.6	7.7	7.7	8.0	8.0	21.2	21.2	21.5				
56%	10	10	10	7.8	8.6	7.7	7.7	8.0	8.0				162	167		
100%	10	9	8	7.4	8.5	7.7	7.6	8.0	7.9	20.9	21.2	21.7				
100%	10	10	10	7.4	8.5	7.7	7.6	8.0	7.9				128	132		

Control Water

Total Alkalinity 82 (mg/l $CaCO_3$)

Total Hardness 116 (mg/l $CaCO_3$)

100% Sample

Total Alkalinity 54 (mg/l $CaCO_3$)

Total Hardness 67 (mg/l $CaCO_3$)

Remarks:

Table 5. Data recorded during 48 hour, Notropis leedsi, static acute toxicity bioassay of Transcircuits, Lake Park, Palm Beach County, Florida, on 31 July to 2 August, 1984.

Monitoring Well #2 Groundwater Sample

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)		NH_3/N (mg/l)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	0	48
10%	5	5	5	8.1	7.5	7.0	7.6	7.8	7.8	21.6	21.1	21.3				
10%	5	5	5	8.1	7.5	7.0	7.6	7.8	7.8				200	202		
18%	4[a]	4	4	8.1	7.8	7.3	7.6	7.8	7.9	21.4	21.0	21.3				
18%	4	4	4	8.1	7.8	7.3	7.6	7.8	7.9				193	195		
32%	4	4	4	8.0	8.0	7.3	7.7	7.8	7.9	21.2	21.0	21.2				
32%	4	4	4	8.0	8.0	7.3	7.7	7.8	7.9				181	183		
56%	4	4	4	7.9	8.0	7.3	7.7	7.8	7.8	20.9	21.0	21.2				
56%	4	4	4	7.9	8.0	7.3	7.7	7.8	7.8				161	167		
100%	4	3	3	7.4	7.2	6.8	7.7	7.8	7.7	20.5	21.1	21.4				
100%	4	3	3	7.4	7.5	6.8	7.7	7.8	7.7				128	132		

Control Water

Total Alkalinity 82 (mg/l $CaCO_3$)

Total Hardness 116 (mg/l $CaCO_3$)

100% Sample

Total Alkalinity 54 (mg/l $CaCO_3$)

Total Hardness 67 (mg/l $CaCO_3$)

Remarks: [a] Due to a shortage of fish, only four were loaded into each of these chambers.

RESULTS AND DISCUSSION

The groundwater sample from Transcircuits' Monitoring Well #1 was not acutely toxic to the test organisms, Daphnia pulex and Notropis leedsi (Tables 2 and 3). Although D. pulex mortalities were noted in every test concentration, similar mortality was also noted in the controls, and the mortalities appeared to be random. Only one N. leedsi died during the 48 hour test, in the 18% concentration.

A similar D. pulex response was noted in the bioassay of Transcircuits' groundwater from Monitoring Well #2 (Table 4). Random mortalities were noted in almost every test concentration. However, in the N. leedsi test of this sample (Table 5), the two fish mortalities were both in the 100% concentration. This mortality does not suggest randomness but may be due to toxic components in the sample. This suggestion of toxicity may warrant continued biological and chemical monitoring of Transcircuits' groundwater. Since these samples were not acutely toxic, the additional samples collected for chemical analyses were not analyzed.

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