

BIOASSAY OF TECO - BIG BEND POWER PLANT

TAMPA, HILLSBOROUGH COUNTY, FLORIDA

NPDES #FL0000817

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Biological Section
Bureau of Water Analysis
July 14, 1981

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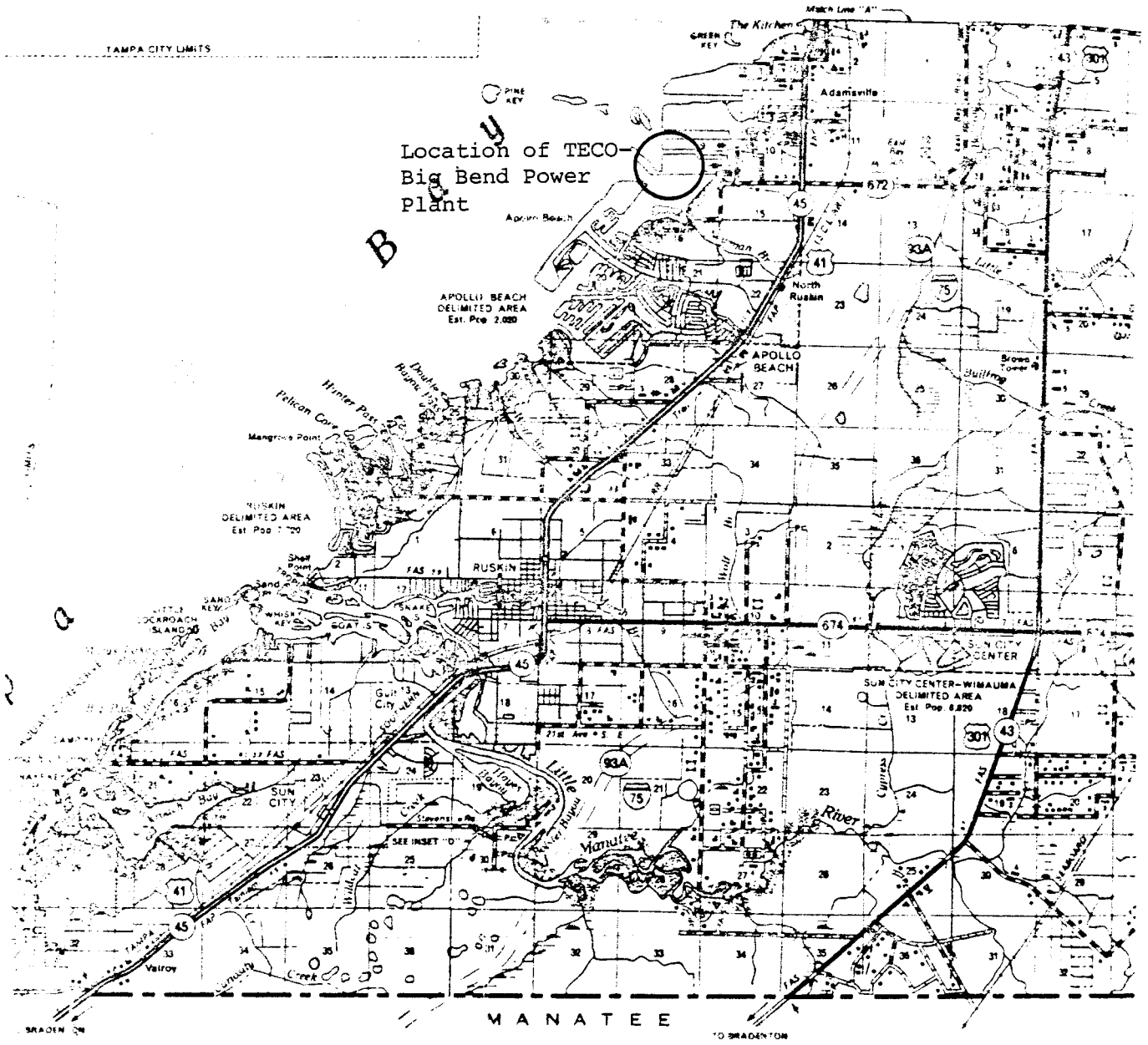
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INTRODUCTION

The TECO - Big Bend Power Plant is located on Big Bend Road in south Hillsborough County, Florida (Fig. 1). It uses three generating units to produce approximately 1108 MW of electricity for residents of Hillsborough County. The plant discharges almost 8 million gallons per hour of once-through cooling water, as well as various amounts for boiler and ash blowdown. Water is discharged from various ponds through at least 13 outfalls into a canal adjacent to the plant. The canal then empties into Tampa Bay (NPDES Outfall #001). Water from Tampa Bay is also circulated through the canal to minimize thermal effects from the plant. Components of the discharge may include various heavy metals from the boiler and ash blowdown and from the ash and sludge ponds. In fact, TECO is currently seeking a variance from state water quality standards for several metals. Chlorination is also used to prevent biological fouling of the various intake and discharge pipes.

To evaluate the effects of this discharge to the biota of the receiving waters, the Biological Section performed a static acute toxicity bioassay on a sample from Outfall #001, on 7 to 9 July, 1981. The results of this test are presented in this report.



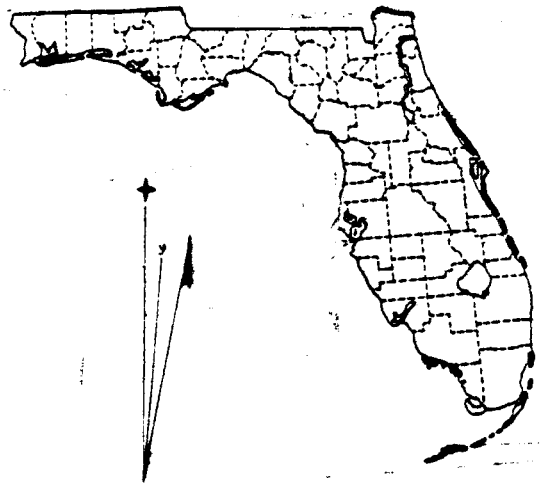


Figure 1. Portions of Hillsborough County, Florida, including site of TECO-Big Bend Power Plant.

METHODS AND MATERIALS

Test methods used to conduct this static bioassay are extensively described by Peltier (1978). The organism selected for this study is among those recommended by Peltier (1978) and the U.S.EPA (1978). The life history and maintenance procedures used to culture them are detailed below.

History and Maintenance of Bioassay Organisms

Mysidopsis bahia (mysid shrimp) - In September, 1978, approximately 300 adult mysid shrimp were obtained from the Gulf Breeze EPA Laboratory in Pensacola, Florida. The mysids have been cultured under continuous lighting in 10 and 15 gallon all glass aquaria equipped with undergravel filtration and aeration. The mysid shrimp are cultured over a wide range of salinities (10-30 ppt) to minimize acclimation periods to low or high salinity effluents. Sea water is obtained from the FSU Marine Laboratory located at Turkey Point, Florida (salinity range 17-31 ppt) and partial water changes are performed weekly. Fresh water, for dilutuion of the sea water as necessary, is obtained from a deep well near the DER laboratory. The mysids are fed twice daily with freshly hatched Artemia (brine shrimp) and are kept at a constant temperature of $22^{o} \pm 1^{o}C$. Immediately prior to the bioassay, a suitable number of mysids were transferred by net to a culture dish for observation and selection of individuals for the test. Fifteen day old (three-quarter adult size) mysids were used in this test. Organisms selected for testing were transferred individually by glass tube and randomly placed in the test chambers.

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

A 48 hour static bioassay was conducted from 0830 hours on 7 July, 1981 to 0830 hours on 9 July, 1981. The grab sample of effluent (Outfall #001) was obtained by Ms. Janice Hager of DER's Southwest District at 0930 hours on 6 July, 1981, using standard wastewater sampling procedures. The sample was iced and transported to the DER laboratory in Tallahassee within 24 hours of collection.

Saltwater for dilution of the effluent sample was obtained from the FSU Marine Laboratory at Turkey Point (salinity = 31.0 ppt). This saltwater diluent was then adjusted to the salinity of the sample and of the receiving body of water (Tampa Bay, approximately 24 ppt) by adding an appropriate amount of DER well water. For test concentrations of 56% and below, this adjusted diluent was mixed directly with the effluent, achieving a range of final salinities (23 ppt to 25 ppt). A control, consisting of adjusted Turkey Point seawater

(salinity = 23 ppt) was then used to ensure that no toxic properties were associated with the diluent.

Two replicates of each test concentration and the control were used in this static test. Immediately prior to the bioassay , a suitable number of mysids were transferred by net from the 25 ppt salinity aquarium to a culture dish for observation and selection of individuals for the test. Individual mysid shrimp were siphoned via glass tube, carefully examined for injury and transferred to wide mouth quart jars, each containing 500 ml of the appropriate concentration. For each concentration the mysid shrimp were pre-acclimated to within 2 ppt salinity. The concentration series selected for this study (Table 1) are those recommended by the APHA (1976).

Five organisms were loaded per test chamber, giving ten per concentration. Temperature, pH, dissolved oxygen, and the number of live organisms were recorded at 0, 24, and 48 hours for each test chamber (Table 2). Additionally, ammonia concentrations, including total (expressed in mg/l as N) and unionized (calculated from the total ammonia, pH, temperature and salinity, and is expressed in mg/l as NH_3) fractions, were determined for a control and a 100% test concentration, with an Orion model 95-10 specific ion probe, at the beginning of the bioassay. According to EPA (1978), "Although it is generally undesirable to feed most fish and macroinvertebrates during static toxicity tests, an exception is necessary for M. bahia". Therefore, the mysids were fed brine shrimp (Artemia) nauplii at the rate of approximately 10 to 20 per mysid shrimp to minimize cannibalism.

Table 1. Concentration Series and Volumes Used for This Static Bioassay

Mysidopsis bahia (mysid shrimp)

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, Mysidopsis bahia, static acute toxicity bioassay of TECO-Big Bend Power Plant, Tampa, Hillsborough County, Florida, NPDES #FL0000817, Outfall #001 on 7 to 9 July, 1981.

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Salinity (o/oo)
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	0
Seawater Control	5	5	5	7.1	5.4	5.9	7.8	7.5	7.6	20.8	20.6	20.8	.01/.42	—	23.0
Seawater Control	5	5	5	7.1	5.6	6.0	7.8	7.5	7.7						
5.6%	5	5	5	7.1	5.8	6.1	7.9	7.6	7.7	20.8	20.4	20.7			23.0
5.6%	5	5	5	7.1	6.0	6.1	7.9	7.6	7.7						
10%	5	5	5	7.0	5.7	6.0	7.9	7.6	7.7	20.6	20.4	20.5			23.5
10%	5	5	5	7.0	5.8	6.1	7.9	7.6	7.7						
18%	5	5	5	6.9	5.7	6.1	8.0	7.7	7.7	20.4	20.4	20.3			24.0
18%	5	5	5	6.9	5.7	6.2	8.0	7.7	7.7						
32%	5	5	5	6.8	5.8	6.1	8.0	7.7	7.7	20.4	20.4	20.2			24.0
32%	5	5	5	6.8	5.8	6.1	8.0	7.7	7.7						
56%	5	5	5	6.6	6.5	6.2	8.2	7.8	7.8	20.3	20.5	20.0		—	24.5
56%	5	5	5	6.6	6.5	6.2	8.2	7.8	7.8						
100%	5	5	5	6.1	6.5	6.6	8.4	7.9	7.9	20.0	20.6	20.0	.03/.43	—	25.0
100%	5	5	5	6.1	6.5	6.7	8.4	8.0	7.9						

Remarks:

RESULTS AND DISCUSSION

The sample collected from the discharge canal of the TECO Big Bend Power Plant was not acutely toxic to Mysidopsis bahia. In fact, not a single organism died during this bioassay.

LITERATURE CITED

American Public Health Association. 1976. Standard Methods for the Examination of Water and Wastewater. 14th ed. 1193pp.

Peltier, William. 1978. Methods for measuring the acute toxicity of effluents to aquatic organisms. Environmental Research Laboratory. Athens, Georgia. EPA-600/4-78-012 (Revised July 1978). 51pp.

U.S. Environmental Protection Agency. 1978. Bioassay procedures for the Ocean Disposal Permit Program. Environmental Research Laboratory. Gulf Breeze, Florida. EPA-600/9-78-010.