

Bioassays of

Seminole Electric

North Palatka, Putnam County, Florida

NPDES #FL0036498

Sampled 12/4/00

August 2001

Biology Section

Division of Resource Assessment & Management

Comprehensive Quality Assurance Plan #870346G

Bioassays of

Seminole Electric

North Palatka, Putnam County, Florida

NPDES #FL0036498

Biology Section
Bureau of Laboratories
August 2001

Introduction

Seminole Electric, 890 Highway 70 North, North Palatka, Putnam County, Florida, NPDES #FL0036498, tests performed from 5 to 7 December 2000.

Wastewater from this coal-fueled, electric power plant enters an on-site wastewater treatment plant that has a design flow of 4.634 MGD. The treatment process includes equalization, neutralization, coagulation/flocculation, and sedimentation. The wastewater is disinfected using sodium hypochloride and sodium bromide. The effluent is dechlorinated using sodium bisulfite. The site also has an existing extended-aeration, domestic wastewater treatment plant, and a new wastewater purge stream from the fuel gas desulfurization unit. The treated wastewater continuously flows through outfall D-001 to the class III fresh waters of the St. Johns River. The facility has an interim and final mixing zone for copper, iron, and zinc; and is also authorized to discharge to percolation ponds.

The land application discharge contains effluents from air preheater wash, boiler fireside wash, and boiler blowdown.

This facility is currently required to rehabilitate the wetland area around their landfill site. Seminole Electric is conducting a study of the landfill damage to the wetland area in order to find the best method for retaining the landfill leachate and facilitating the wetland rehabilitation (facility summary provided by Jim Maher, FDEP, Jacksonville).

The toxicity tests discussed in this report were performed in accordance with methods described by Weber, 1993, *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*, 4th Edition, EPA/600/4-90/027F.

Results and Discussion

The FDEP Biology Section performed two 48-hour static acute screening toxicity bioassays on a sample of effluent from this facility. Based on conductivity and temperature, the effluent had a salinity of approximately 4.3 parts per thousand (ppt). The test species used for these bioassays were the inland silverside minnow, *Menidia beryllina*, and the mysid shrimp, *Americamysis bahia*.

The control water was natural seawater (NSW) diluted to 5.3 ppt and 10.3 ppt for the *M. beryllina* and *A. bahia* tests, respectively. An aliquot of the sample was adjusted with artificial sea salts to an apparent salinity of 5.3 ppt for the *M. beryllina* test and 10.3 ppt for *A. bahia* test to ensure that the minimum required seawater ions (one ppt for *M. beryllina*, six ppt for *A. bahia*) were present. The samples apparent salinity was thought to be due to ions other than seawater ions. A salt control was also tested. The salt control was natural seawater diluted to the original salinity (4.3 ppt) of the sample and adjusted to the salinity of the appropriate test with artificial sea salts.

The test results did not indicate toxicity to the *M. beryllina*. However, the test results did indicate that the sample was toxic to *A. bahia* producing 100 percent mortality in 48 hours (Tables 1 & 2).

Total residual chlorine and total ammonia were not detected in the sample. Further chemical analyses were performed on the sample, and several metals were identified (Table 3).

Analytical chemistry results confirmed that the ion concentrations of the sample were not in seawater proportions, and that the apparent 4.3 ppt salinity of the sample was due to elevated levels of groundwater ions. The observed mortality in the *A. bahia* test is likely due to the seawater-ion imbalance of the sample. Previous research conducted by the FDEP Biology Section demonstrated that *A. bahia* is much more sensitive to seawater-ion imbalances than is *M. beryllina* (Wolfe, *et al.* 1995. Protocols for determining Major-Seawater-Ion Toxicity in Membrane-Technology Water-Treatment Concentrate. Florida Department of Environmental Protection, Bureau of Laboratories. 96pp.). The calcium concentration was measured at 555 mg/L at 4.3 ppt salinity (salinity based on conductivity and temperature). This is approximately 11 times greater than the normal background concentration for calcium in seawater of this salinity. The elevated calcium concentration is one source of toxicity in this sample, but other unidentified sources of toxicity cannot be ruled out without performing the major-seawater-ion imbalance toxicity testing protocols cited above.

Conclusion

The sample of effluent collected from this facility on December 4, 2000, did not show toxicity to *M. beryllina*, but did show acute toxicity to *A. bahia* at 48 hours. The cause of toxicity was attributed, at least in part, to the elevated calcium concentration in the sample. The presence of other unidentified toxicants cannot be ruled out without performing the major-seawater-ion imbalance toxicity testing protocols.

Table1. Data recorded during the 48-hour acute screening bioassays of a sample of effluent from the Seminole Electric, 890 Highway 70 North, North Palatka, Putnam County, Florida, NPDES# FL0036498 performed on 5 to 7 December 2000.

Facility:	**Seminole Electric**			**NPDES #**	**FL0036498**	Facility Type:	**Industrial**
Location:	890 Highway 70 North			Contact/District:	Pat O'Connor/ Northeast District		**Wastewater**
County:	Putnam County			Test type:	static acute screen		**Treatment**
Sample Collection Date:	12/4/00	Time:	1330	# tests:	2	Receiving Water:	St. Johns River
Test Beginning Date:	12/5/00	Time:	1450	Chlorination Type:	Chlorinated		
Test Ending Date:	12/7/00	Time:	1305		sample collected after dechlorination		**Page 1 of 1**

Total Residual Cl2	mg/L	Method
Field:	-	-
Lab:	<0.03	DR-100

Ammonia	Total (mg/L)	Unionized (mg/L)
Control Water (fish):	< 0.017	<0.017
100% Sample:	<0.017	<0.017

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water (fish):	122	-
100% Sample:	95	-

Salinity[C]	(ppt)
Control Water:	10.3
100% Sample:	4.3
Adjusted Sample	10.3

[C] Salinity based on conductivity and temperature measurements.

Organism: *Americamysis bahia* Life stage: 3 days

	Sample/Diluent	SURVIVAL # Alive			pH			Temperature[A]			Dissolved Oxygen			Conductivity Uncorrected mmhos/cm	
Concentrations	Volume(mL)	0 hr	24 hr	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 A	0/500	5	5	5	7.9	8.1	8.1	24.9	24.5	23.9	7.2	7.2	7.6	17.08	17.72
Control B	0/500	5	5	5	7.9	8.1	8.1	25.0	24.3	23.6	7.4	7.2	7.6	17.31	17.64
Control C	0/500	5	5	5	7.9	8.1	8.1	25.0	24.2	23.4	7.4	7.2	7.7	17.29	17.51
Control D	0/500	5	5	5	7.9	8.1	8.1	25.0	24.1	24.5	7.5	7.2	7.2	17.29	17.57
Salt Control A	0/500	5	5	5	8.3	8.3	8.3	24.9	24.2	24.3	7.4	7.2	7.6	17.18	17.79
Salt Control B	0/500	5	5	5	8.3	8.3	8.3	24.9	23.9	23.7	7.4	7.2	7.6	17.17	17.29
Salt Control C	0/500	5	5	5	8.3	8.3	8.3	24.9	24.0	24.0	7.5	7.3	7.6	17.21	17.51
Salt Control D	0/500	5	5	5	8.3	8.3	8.3	24.9	23.7	24.5	7.5	7.4	7.4	17.23	17.69
Salt 100% A	500/0	5	0	0	8.1	8.0	-	24.8	23.9	-	7.6	6.6	-	17.39	-
Salt 100% B	500/0	5	0	0	8.1	8.0	-	24.8	23.8	-	7.6	6.7	-	17.34	-
Salt 100% C	500/0	5	0	0	8.1	8.0	-	24.8	23.7	-	7.6	6.8	-	17.31	-
Salt 100% D	500/0	5	1	0	8.1	8.0	8.0	24.8	23.8	23.7	7.6	6.6	7.5	17.30	17.53

[A] Temperatures of room and test incubator were continuously recorded on a strip chart recorder.

Room Temperature range for the test period was 24.5-25.5 °C.

Incubator #3 temperature range for the test period was 24.5-25.5°C.

Table2. Data recorded during the 48-hour acute screening bioassays of a sample of effluent from the Seminole Electric, 890 Highway 70 North, North Palatka, Putnam County. Florida, NPDES# FL0036498 performed on 5 to 7 December 2000.

Facility:	**Seminole Electric**			**NPDES #**	**FL0036498**	Facility Type:	**Industrial**
Location:	890 Highway 70 North			Contact/District:	Pat O'Connor/ Northeast District		**Wastewater**
County:	Putnam County			Test type:	static acute screen		**Treatment**
Sample Collection Date:	12/4/00	Time:	1330	# tests:	2	Receiving Water:	St. Johns River
Test Beginning Date:	12/5/00	Time:	1450	Chlorination Type:	Chlorinated		
Test Ending Date:	12/7/00	Time:	1305		sample collected after dechlorination		**Page 1 of 1**

Total Residual Cl2	mg/L	Method
Field:	-	-
Lab:	<0.03	DR-100

Ammonia	Total (mg/L)	Unionized (mg/L)
Control Water (fish):	< 0.017	<0.017
100% Sample:	<0.017	<0.017

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water (fish):	122	-
100% Sample:	95	-

Salinity[C]	(ppt)
Control Water:	5.3
100% Sample:	4.3
Adjusted Sample	5.3

[C] Salinity based on conductivity and temperature measurements.

Organism: *Menidia beryllina* Life stage: 11 days

	Sample/Diluent	SURVIVAL # Alive			pH			Temperature[A]			Dissolved Oxygen			Conductivity Uncorrected mmhos/cm	
Concentrations	Volume(mL)	0 hr	24 hr	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 A	0/500	5	5	5	7.9	8.2	8.1	24.5	24.5	24.1	7.6	7.4	8.3	9.24	9.35
Control B	0/500	5	5	5	7.9	8.2	8.2	25.0	24.2	24.3	7.6	7.5	8.2	9.26	9.70
Control C	0/500	5	5	5	7.9	8.2	8.2	25.0	23.8	24.2	7.6	7.5	8.2	9.26	9.45
Control D	0/500	5	5	5	7.9	8.2	8.2	25.0	23.8	24.0	7.6	7.6	8.2	9.22	9.39
Salt Control A	0/500	5	5	5	8.0	8.2	8.2	24.8	23.9	24.5	7.6	7.5	8.1	9.47	9.74
Salt Control B	0/500	5	5	5	8.0	8.2	8.2	24.7	23.6	24.4	7.6	7.6	8.1	9.33	10.20
Salt Control C	0/500	5	5	5	8.0	8.2	8.2	24.7	23.5	24.7	7.6	7.6	8.1	9.31	9.75
Salt Control D	0/500	5	5	5	8.0	8.2	8.2	24.7	23.5	24.5	7.6	7.7	8.2	9.34	9.85
Salt 100% A	500/0	5	5	5	7.9	7.9	7.8	24.7	23.7	24.2	7.7	7.2	8.2	9.10	9.56
Salt 100% B	500/0	5	5	5	7.9	7.9	7.8	24.6	24.0	24.1	7.8	7.2	7.9	3.09	9.42
Salt 100% C	500/0	5	5	5	7.9	7.9	7.8	24.6	23.8	24.7	7.7	7.1	7.8	9.19	9.81
Salt 100% D	500/0	5	5	5	7.9	7.9	7.8	24.6	23.8	24.2	7.7	7.2	7.7	9.18	9.49

[A] Temperatures of room and test incubator were continuously recorded on a strip chart recorder.
Room Temperature range for the test period was 24.5-25.5 °C.
Incubator #3 temperature range for the test period was 24.5-25.5°C.

Table 3. Results of chemical analyses on the effluent from Seminole Electric sampled on December 4, 2000.

Metals

Aluminum	1060	µg/L	
Arsenic	4.4	µg/L	I
Calcium	555	mg/L	
Chromium	3.5	µg/L	
Copper	6.9	µg/L	
Iron	564	µg/L	
Magnesium	160	mg/L	
Nickel	17.5	µg/L	
Selenium	1.6	µg/L	I
Zinc	11	µg/L	J

Pesticides and Herbicides

none detected

Base, Neutral, & Acid Extractable Organics

none detected

[I] Value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit.
[J] Estimated value.

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Seminole Electric
County: Putnam
Contact / District: Pat O'Connor / Northeast
NPDES Permit #: FL0036498
LIMS Sample #: 498210 LIMS Job #: TLH-2000-12-05-19
sample log 12-18-00 mf
Test Type: ~~Screening~~ | Definitive
~~Static~~ | Static Renewal | Flow-through
Test Number: 1 of 2

Remarks:

Sample Collection: Date 12/4/00 Time 1330
Test Beginning: Date 12/5/00 Time 14:50
Test Ending: Date 12/7/00 Time 13:25
Organism Batch #: 337 Diluent Batch #: NSW
Organism Age: 3days SRT toxicant batch #: NA
Test organism: A. bahia

	Conc.	Chamber #	Number Live 0 hr	Number Live 24 h	Number Live 48 h	pH 0 hr	pH 24 h	pH 48 h	Temperature (°C) 0 hr	Temperature (°C) 24 h	Temperature (°C) 48 h	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 h	D.O. (mg/L) 48 h	UNCORRECTED Cond. (mmhos/cm) / Cond. (µmhos/cm) 0 hr	24 h	48 h
Diluted to 10.3ppt	CNTL A	C1	5	5	5	7.9	8.1	8.1	24.9	24.5	23.9	7.2	7.2	7.6	17.08	17.45	17.72
	B	C2	5	5	5	7.9	8.1	8.1	25.0	24.3	23.6	7.4	7.2	7.6	17.31	17.40	17.64
	C	C3	5	5	5	7.9	8.1	8.1	25.0	24.2	23.4	7.4	7.2	7.7	17.24	17.15	17.51
	D	C4	5	5	5	7.9	8.1	8.1	25.0	24.1	24.5	7.5	7.2	7.2	17.24	17.38	17.57
Salt adjusted to 10.3ppt	Salt A	C5	5	5	5	8.3	8.3	8.3	24.9	24.2	24.3	7.4	7.2	7.6	17.13	17.20	17.49
	CNTL B	C6	5	5	5	8.3	8.3	8.3	24.9	23.9	23.7	7.4	7.2	7.6	17.17	17.03	17.29
	C	C7	5	5	5	8.3	8.3	8.3	24.9	24.0	24.0	7.5	7.3	7.6	17.21	17.26	17.51
	D	C8	5	5	5	8.3	8.3	8.3	24.9	23.7	24.5	7.5	7.4	7.4	17.23	17.36	17.69
Salt adjusted to 10.3ppt	100% A	C9	5	0SD	—	8.1	8.0	—	24.8	23.9	—	7.6	6.6	—	17.39	17.30	—
	B	C10	5	0SD	—	8.1	8.0	—	24.8	23.8	—	7.6	6.7	—	17.34	17.34	—
	C	C11	5	0SD	—	8.1	8.0	—	24.8	23.7	—	7.6	6.8	—	17.31	17.30	—
	D	C12	5	1D	0ID	8.1	8.0	8.0	24.8	23.8	23.7	7.6	6.6	7.5	17.30	17.47	17.53
measured by:			MF	SG	SG	[illegible]	SG	SG	SG	SG	SG	SG	SG	SG	[illegible]	SG	SG
recorded by:			DPH	SG	SG	[illegible]	SG	[illegible]	[illegible]	SG	[illegible]	[illegible]	SG	[illegible]	[illegible]	SG	[illegible]

Investigators' Signatures

Shannon Gerard
Della Parker Flack
Marshall Faircloth
[illegible]
[illegible]
A H Wolfe
reviewer

form updated 3/3/99

Temperature Range °C
Incubator # 3 24.5 - 25.5°C
Room B246 24.5 - 25.5°C

Additional * Information
Diluted NSW CNTL. Alk. 129
Salt Sample 128
Ammonia <0.017 <0.017

Water Quality Parameters	Salt Water Well Water	20% Min Water	Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L):	[redacted]		Not measured			MF
Lab Total Residual Cl2 (mg/L):	<0.03		<0.03	DR10C	DPH	SG
Alkalinity (mg/L as $CaCO_3$):	122 *		95 *	Hach	SG	SG
Hardness (mg/L as $CaCO_3$):	NA		NA	Hach	SG	SG
Total ammonia (mg/L as N):	<0.051 *		<0.017 *	Denver	DPH	SG
Salinity:	10.3		4.3	Ysi	MF	SG

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Seminole Electric
County: Putnam
Contact / District: PAT O'CONNER / Northeast
NPDES Permit #: FL00 36498
LIMS Sample #: 498210 LIMS Job #: TLH-2000-12-05-19
sample log 12-13-00 MF
Test Type: (Screening) | Definitive
(Static) | Static Renewal | Flow-through
Test Number: 2 of 2

Sample Collection: Date 12/4/00 Time 1330
Test Beginning: Date 12/5/00 Time 1445
Test Ending: Date 12/7/00 Time 1305
Organism Batch #: 47 Diluent Batch #: NSW
Organism Age: 11 days SRT toxicant batch #: NH4
Test organism: M. beryllina

Remarks:

Conc.	Chamber #	Number Live 0 hr	Number Live 24 h	Number Live 48 h	pH 0 hr	pH 24 h	pH 48 h	Temperature (°C) 0 hr	Temperature (°C) 24 h	Temperature (°C) 48 h	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 h	D.O. (mg/L) 48 h	UNCORRECTED Cond. (mmhos/cm) 0 hr	UNCORRECTED Cond. (mmhos/cm) 24 h	UNCORRECTED Cond. (mmhos/cm) 48 h
CNTL A	C13	5	5	5	7.9	8.2	8.1	24.1	24.1	24.1	7.6	7.4	8.3	9.24	9.15	9.35
B	C14	5	5	5	7.9	8.2	8.2	23.6	24.2	24.3	7.6	7.5	8.2	9.26	9.35	9.70
C	C15	5	5	5	7.9	8.2	8.2	23.6	23.5	24.2	7.6	7.5	8.2	9.26	9.15	9.45
D	C16	5	5	5	7.9	8.2	8.2	23.6	23.5	24.0	7.6	7.6	8.2	9.22	9.14	9.39
SAL A	C17	5	5	5	8.1	8.2	8.2	23.6	23.6	24.5	7.6	7.6	8.1	9.47	9.50	9.74
B	C18	5	5	5	8.0	8.2	8.2	23.6	23.6	24.4	7.6	7.6	8.1	9.33	9.35	10.20
C	C19	5	5	5	8.0	8.2	8.2	23.6	23.5	24.7	7.6	7.6	8.1	9.31	9.38	9.75
D	C20	5	5	5	8.0	8.2	8.2	23.6	23.5	24.5	7.6	7.7	8.2	9.34	9.35	9.85
H A	C21	5	5	5	7.9	7.9	7.8	23.6	23.7	24.2	7.7	7.2	8.2	9.16	9.23	9.56
B	C22	5	5	5	7.9	7.9	7.8	23.6	24.0	24.1	7.8	7.2	7.9	9.09	9.25	9.42
C	C23	5	5	5	7.9	7.9	7.8	24.6	23.8	24.7	7.7	7.3	7.8	9.19	9.35	9.81
D	C24	5	5	5	7.9	7.9	7.8	24.6	23.8	24.2	7.7	7.3	7.7	9.18	9.30	9.49
measured by:		MF	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG
recorded by:		DPH	SG	SG	DPH	TS	Jmk	DPH	JO	Jmk	DPH	SA	Jmk	DPH	Sa	Jmk

Investigators' Signatures
Shannon Edwards
Marshall Faircloth
AH Wolfe
reviewer

form updated 3/3/99

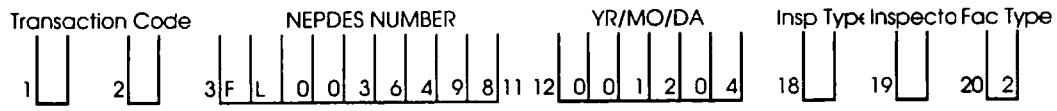
Temperature Range °C
Incubator # 3 24.5-25.5°C
Room 3246 24.5°-25.5°C

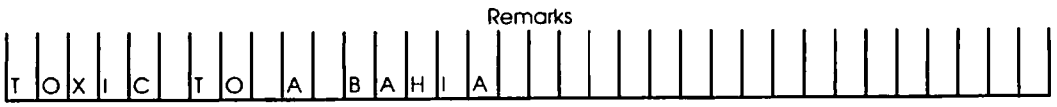
Additional Information *
Salt Water
Diluted NSW Salt CNTL 168 Salt Sample 128
Alk 129
Ammonia <0.017 <0.017

Water Quality Parameters	Well Water	20% Min Water	Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L):			Not measured			MF
Lab Total Residual Cl2 (mg/L):	<0.03		<0.03	DR100	DPH	SG
Alkalinity (mg/L as $CaCO_3$):	122*		95*	Hach	SG	SG
Hardness (mg/L as $CaCO_3$):	NA		NA	Hach	SG	SG
Total ammonia (mg/L as N):	<0.051+		<0.017+	Denver	DPH	SG
Salinity:	53 ppt		4.3	Ysi	MF	SG

The Bioassay of the Seminole Electric WWTP effluent sampled on December 4, 2000, NPDES #FL0036498

Fill Out This Section For All Surface Water Discharger Inspections(CEI, CSI, CBI, PAI, XSI-RI Optional)

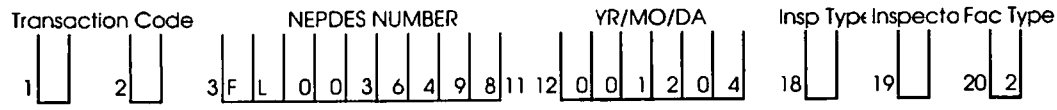


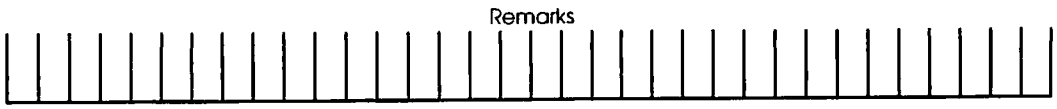


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The Priority Pollutants Analysis for Bioassay of the Seminole Electric WWTP effluent sampled on December 4, 2000, NPDES #FL0036498

Fill Out This Section For All Surface Water Discharger Inspections(CEI, CSI, CBI, PAI, XSI-RI Optional)





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