

Bioassays of

Charlotte Harbor Reverse Osmosis Water Treatment Plant

Harbour Heights, Charlotte County, Florida

NPDES #FL0035378

Sampled 3/21/00

November 2000

Biology Section

Division of Resource Assessment & Management

Comprehensive Quality Assurance Plan #870346G

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Charlotte Harbor Reverse Osmosis Water Treatment Plant

Harbour Heights, Charlotte County, Florida

NPDES #FL0035378

Biology Section
Bureau of Laboratories
November 2000

Introduction

Charlotte Harbor Reverse Osmosis Water Treatment Plant, 27147 Del Prado Parkway, Harbour Heights, Charlotte County, Florida, NPDES #FL0035378, tests performed from 22 to 24 March 2000.

This reverse osmosis water treatment plant has a design flow of 0.150 MGD. Treatment of the effluent consists of aeration of the brine to increase the dissolved oxygen before discharge. The facility has a mixing zone for gross alpha radiation and combined radium 226 and radium 228. The effluent flows through the outfall pipe into the Class III marine waters of the San Marino Canal near the end of the seawall, where little mixing or flushing occurs. On June 3, 1999, the facility was found in violation of permit limits for chlorine, copper, and fluoride. Between July 31, 1999, and the present, the facility had five permit limit violations for fluoride. The facility's NPDES and FDEP permits have expired. An application was submitted by the facility for a permit on December 1, 1998, but this application is still incomplete. Negotiations are in progress over the consent order, OGC Case Number 99-1906-08-IW, to resolve the issues with the expired permits (facility summary provided by Thomas E. Jackson, FDEP, Ft. Myers).

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 five 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 six ppt and 11 ppt for the *M. beryllina* and *A. bahia* tests, respectively. The salt control was NSW diluted to the initial salinity of the sample (five ppt) and then salted to match the salinity of respective test salinities using Forty Fathoms® artificial sea salts. The purpose for the salt control was to test for possible toxic effects of adding artificial sea salts to the sample. No toxic effects were observed in any of the controls. An aliquot of the sample was adjusted to an apparent salinity of six ppt for the *M. beryllina* test, and another to an apparent salinity 11 ppt for the *A. bahia* test to ensure that the minimum required salinity was due to salt water ions (one ppt for *M. beryllina*, six ppt for *A. bahia*). Test organisms were acclimated over a period of 24 hours from 20 ppt to seven ppt for the *M. beryllina* and *A. bahia*.

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 90 percent mortality in 48 hours (Table 1).

Total residual chlorine was not detected in the sample. Total and unionized ammonia concentrations were 0.662 mg/L and 0.032 mg/L, respectively. Further chemical analyses were performed on the sample, and several metals were identified (Table 2).

The chemistry results confirmed that the ion makeup of the sample was not in seawater proportions and that the apparent five ppt salinity of the sample was due to elevated levels of ground-water 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 demon-strated 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 440 mg/L at five ppt salinity (salinity based on conductivity and temperature). This is approximately 630 percent greater than the normal background concentration for calcium in seawater of this salinity. The magnesium concentration was measured at 302 mg/L at five ppt salinity. This is approximately 65 percent greater than the normal background concentration for magnesium in seawater of this salinity. The elevated calcium and magnesium concentrations are two sources 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 March 21, 2000, did not show toxicity to *M. beryllina*, but did show acute toxicity to *A. bahia.* The cause of toxicity was attributed, at least in part, to the elevated calcium and magnesium concentrations 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 Charlotte Harbor Water Association, Harbour Heights, Charlotte County, Florida, NPDES# FL0035378 performed on 22 to 24 March 2000.

Facility:	**Charlotte Harbor Water Association**	NPDES #	**FL0035378**	Facility Type:	**Reverse**
Location:	27147 Del Prado Parkway, Harbour Heights	Contact/District:	Jackson/ SO-Dist		**Osmosis Plant**
County:	Charlotte County	Test type:	static acute screen		
Sample Collection Date:	3/21/00 Time: 1128	# tests:	2	Receiving Water:	San Marino Canal
Test Beginning Date:	3/22/00 Time: 1515	Chlorination Type:	Not Chlorinated		
Test Ending Date:	3/24/00 Time: 1345				**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:	0.66	0.03

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water (fish):	200	-
100% Sample:	448	-

Salinity[C]	(ppt)
Control Water:	11
100% Sample:	5
Adjusted Sample	11

[C] Salinity based on conductivity and temperature measurements.

Organism: *Americamysis bahia* Life stage: 4-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	0/20	5	5	5	7.7	7.8	8.2	24.4	23.2	25.2	7.6	7.6	6.6	16.6	19.6
Control B	0/20	5	5	5	7.7	7.9	8.2	24.3	23.2	24.7	7.7	7.5	6.5	17.5	19.3
Control C	0/20	5	5	5	7.8	7.9	8.2	24.2	23.3	24.6	7.7	7.3	6.6	17.6	19.5
Control D	0/20	5	5	5	7.8	8.0	8.2	24.1	23.4	24.0	7.8	7.2	6.6	17.7	19.2
Salt Ctrl A	0/20	5	5	5	7.9	8.1	8.2	24.1	23.2	25.0	7.8	7.2	6.5	17.1	20.6
Salt Ctrl B	0/20	5	5	5	7.9	8.2	8.3	24.1	23.1	24.2	7.8	7.3	6.6	16.8	19.1
Salt Ctrl C	0/20	5	5	5	8.0	8.2	8.3	24.1	23.2	23.9	7.8	7.3	6.8	17.6	18.9
Salt Ctrl D	0/20	5	5	5	8.0	8.2	8.3	24.1	23.3	23.7	7.7	7.3	6.9	17.7	19.0
Salt 100% A	20/0	5	4	1	8.2	8.4	8.5	24.2	23.3	24.3	7.9	7.3	6.9	17.4	19.0
Salt 100% B	20/0	5	3	1	8.2	8.4	8.5	24.3	23.4	24.0	7.9	7.4	6.8	17.4	18.5
Salt 100% C	20/0	5	5	0	8.2	8.4	8.5	24.4	23.6	24.3	7.9	7.4	6.8	17.5	18.4
Salt 100% D	20/0	5	3	0	8.2	8.4	8.5	24.4	23.4	24.3	7.8	7.5	6.8	17.3	19.0

[A] Temperatures of room and test incubator were continuously recorded on a strip chart recorder.
Room Temperature range for the test period was 24.5-26.0°C.
Incubator #3 temperature range for the test period was 24.5-26.5°C.

continued

Table1. Data recorded during the 48-hour acute screening bioassays of a sample of effluent from the Charlotte Harbor Water Association,
concluded Harbour Heights, Charlotte County, Florida, NPDES# FL0035378 performed on 22 to 24 March 2000.

Facility:	**Charlotte Harbor Water Association**			**NPDES #**	**FL0035378**	Facility Type:	**Reverse Osmosis Plant**
Location:	27147 Del Prado Parkway, Harbour Heights			Contact/District:	Jackson/ SO-Dist		
County:	Charlotte County			Test type:	static acute screen		
Sample Collection Date:	3/21/00	Time:	1128	# tests:	2	Receiving Water:	San Marino Canal
Test Beginning Date:	3/22/00	Time:	1515	Chlorination Type:	Not Chlorinated		
Test Ending Date:	3/24/00	Time:	1345				**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:	0.66	0.03

Organism: ***Menidia beryllina*** Life stage: 13-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	0/20	5	5	5	8.2	8.4	8.4	24.4	23.4	23.6	8.2	7.9	7.3	9.6	10.6
Control B	0/20	5	5	5	8.1	8.3	8.4	24.3	23.4	23.7	8.0	8.0	7.3	10.1	10.8
Control C	0/20	5	5	5	8.1	8.3	8.3	24.3	23.6	23.8	8.1	7.9	7.3	10.1	10.7
Control D	0/20	5	5	5	8.1	8.3	8.3	24.3	23.5	24.5	8.0	8.0	7.3	10.2	11.3
Salt Ctrl A	0/20	5	5	5	8.3	8.2	8.3	24.3	23.3	24.4	8.0	8.0	7.1	10.0	11.0
Salt Ctrl B	0/20	5	5	5	8.3	8.2	8.3	24.3	23.2	24.6	7.9	8.0	7.3	10.0	10.9
Salt Ctrl C	0/20	5	5	5	8.3	8.2	8.3	24.3	23.3	24.7	7.9	8.2	7.2	9.9	11.2
Salt Ctrl D	0/20	5	5	5	8.3	8.2	8.3	24.2	23.2	24.8	7.9	8.0	7.0	10.1	11.0
Salt 100% A	20/0	5	5	4	8.3	8.4	8.5	24.3	23.3	24.3	8.0	8.0	7.0	10.1	10.7
Salt 100% B	20/0	5	5	5	8.3	8.4	8.5	24.3	23.2	23.8	7.9	7.9	7.0	10.1	10.9
Salt 100% C	20/0	5	5	5	8.3	8.4	8.5	24.4	23.3	23.8	7.8	7.8	7.2	10.0	10.4
Salt 100% D	20/0	5	5	5	8.3	8.4	8.5	24.4	23.3	24.2	7.7	7.9	7.3	9.9	10.8

[A] Temperatures of room and test incubator were continuously recorded on a strip chart recorder.
Room Temperature range for the test period was 24.5-26.0 °C.
Incubator #3 temperature range for the test period was 24.5-26.5°C.

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water (fish):	200	-
100% Sample:	448	-

Salinity[C]	(ppt)
Control Water:	6
100% Sample:	5
Adjusted Sample	6

[C] Salinity based on conductivity and temperature measurements.

Table 2. Results of chemical analyses on the effluent from the Charlotte Harbor Water Association sampled on April 17, 2000.

Metals

Cadmium	0.043	µg/L [I]
Calcium	440	mg/L
Magnesium	302	mg/L
Nickel	8	µg/L
Silver	0.032	µg/L [I]

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.

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Charlotte Harbor RO
County: Charlotte
Contact / District: Thomas E. Jackson | SO-DIST
NPDES Permit #: FL0035378
LIMS Sample #: 44274 LIMS Job #: TLA2000-03-22-40-01
sample log — 3/17/00

Sample Collection: Date 3/21/00 Time 1129
Test Beginning: Date 3/22/00 Time 1515
Test Ending: Date 3/24/00 Time 1345
Organism Batch #: 10 Diluent Batch #: ASW#13
Organism Age: 13days SRT toxicant — batch #: —

Test Type: ~~Screening~~ | Definitive
Static | Static Renewal | Flow-through
Test Number: 2 of 2

Test organism: M. bahia

Remarks: 3/22/00 DPH Test organism acclimated to from 20ppt to 7ppt over 24 hours
3/22/00 DPH Sample adjusted to 10ppt.

Conc.	Chamber #	Number Live 0 hr	24 h	48 h	pH 0 hr	24 h	48 h	Temperature (°C) 0 hr	24 h	48 h	D.O. (mg/L) 0 hr	24 h	48 h	UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm) 0 hr	24 h	48 h
CTRL A	A9	5	5	5	8.2	8.4	8.4	24.4	23.4	23.6	8.2	7.9	7.5	~~50.6~~	~~17.4~~	10.63
B	A10	5	5	5	8.1	8.3	8.4	24.3	23.4	23.7	8.0	8.6	7.5	~~17.5~~	~~17.4~~	10.79
C	A11	5	5	5	8.1	8.3	8.3	24.3	23.6	23.8	8.1	7.9	7.5	~~17.6~~	~~17.3~~	10.65
D	A12	5	5	5	8.1	8.3	8.3	24.3	23.5	24.5	8.0	8.6	7.3	~~17.7~~	~~17.0~~	11.31
SaltCTRL A	A13	5	5	5	8.3	8.2	8.3	24.3	23.3	24.4	8.0	8.6	7.1	~~17.1~~	~~17.0~~	10.96
B	A14	5	5	5	8.3	8.2	8.3	24.3	23.2	24.6	7.9	8.6	7.3	~~16.8~~	~~17.6~~	10.85
C	A15	5	5	5	8.3	8.2	8.3	24.3	23.3	24.7	7.9	8.2	7.2	~~17.6~~	~~17.7~~	11.19
D	A16	5	5	5	8.3	8.2	8.3	24.2	23.2	24.8	7.9	8.0	7.0	~~17.7~~	~~17.8~~	11.01
100% A	G17	5	5	4 ID	8.3	8.4	8.5	24.3	23.3	24.3	8.0	8.0	7.0	~~17.4~~	~~17.6~~	10.71
B	G18	5	5	5	8.3	8.4	8.5	24.3	23.2	23.8	7.9	7.9	7.0	~~17.4~~	~~17.4~~	10.85
C	G19	5	5	5	8.3	8.4	8.5	24.4	23.3	23.8	7.8	7.8	7.2	~~17.5~~	~~17.3~~	10.43
D	G20	5	5	5	8.3	8.4	8.5	24.4	23.3	24.2	7.7	7.9	7.3	~~17.3~~	~~17.3~~	10.77
												CTRL A		~~9.6~~	9.9	
													B	10.1	10.3	
													C	10.1	10.0	
													D	10.2	10.3	
												SaltCTRL	A	10.0	10.1	
													B	10.0	10.1	
													C	9.9	10.1	
													D	10.1	10.3	
												100%	A	10.1	9.9	
													B	10.1	10.1	
													C	10.0	10.0	
													D	9.9	10.1	
measured by:		SG	SG	SG	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH
recorded by:		VBL	SG	SG	DPH	DPH	SG	DPH	DPH	SG	DPH	DPH	SG	DPH	DPH	SG

3/17 3100 DPH Received 10 ppt

Investigators' Signatures
Shannon Gerard
Della Barker Jefferson
Marshall Faircloth

Temperature Range °C
Incubator # 3 24.5°-26.5°C
Room B246 24.5°-26.0°C

Salt Water / Well Water / 20% Min Water

Water Quality Parameters	Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L):	—	—	—	—
Lab Total Residual Cl2 (mg/L):	<0.03	DR100	DPH	SG
Alkalinity (mg/L as $CaCO_3$):	448	Hach	DPH	SG
Hardness (mg/L as $CaCO_3$):	—	Hach	DPH	SG
Total ammonia (mg/L as N):	0.662	Denver	MF	SG
Salinity:	~5	Ysi	DPH	SG

S H Wolfe
reviewer

form updated 3/3/99

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Charlotte Harbor Ro
County: Charlotte
Contact / District: Thomas E. Jackson / SO- DIST
NPDES Permit #: FL00 35378
LIMS Sample #: 442714 **LIMS Job #:** TH2000-03-22-40-01

Sample Collection: Date 3/21/00 Time 1128
Test Beginning: Date 3/22/00 Time 1515
Test Ending: Date 3/24/00 Time 1345
Organism Batch #: 78 **Diluent Batch #:** ASW #13
Organism Age: 4 days **SRT toxicant batch #:** —

sample log
Test Type: Screening I Definitive (Screening struck through, "sample log")
Static I Static Renewal I Flow-through (Static circled)
Test Number: 1 of 2

Test organism: A. bahia

Remarks: 3/22/00 DPH ~~An aliquot of the sample~~ Organisms were acclimated from 20ppt to 7 over 24 hours
3/22/00 DPH Sample adjusted to 11 ppt.

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	Cond. 24 h	Cond. 48 h
CTRL A	A1	5	5	5	7.7	7.8	8.2	24.4	23.2	25.2	7.6	7.6	6.6	~~9.57~~	17.4	19.60
B	A2	5	5	5	7.7	7.9	8.2	24.3	23.2	24.7	7.7	7.5	6.5	~~10.1~~	17.9	19.27
C	A3	5	5	5	7.8	7.9	8.2	24.2	23.3	24.6	7.7	7.3	6.6	~~10.1~~	17.3	19.45
D	A4	5	5	5	7.8	8.0	8.2	24.1	23.4	24.0	7.8	7.2	6.6	~~10.2~~	18.0	19.20
SALT CTRL A	A5	5	5	5	7.9	8.1	8.2	24.1	23.2	25.0	7.8	7.2	6.5	~~10.0~~	18.0	20.6
B	A6	5	5	5	7.9	8.2	8.3	24.1	23.1	24.2	7.8	7.3	6.6	~~10.0~~	17.6	19.1
C	A7	5	5	5	8.0	8.2	8.3	24.1	23.2	23.9	7.8	7.3	6.8	~~9.9~~	17.7	~~20~~ * 18.9 F.O. (SG)
D	A8	5	5	5	8.0	8.2	8.3	24.1	23.3	23.7	7.7	7.3	6.9	~~10.1~~	17.8	19.0
100% A	G9	5	4 1D	1 3D	8.2	8.4	8.5	24.2	23.3	24.3	7.9	7.3	6.9	~~10.1~~	17.6	19.0
B	G10	5	3 2D	1 2D	8.2	8.4	8.5	24.3	23.4	24.0	7.9	7.4	6.8	~~10.1~~	17.4	18.5
C	G11	5	3 2D	0 5D	8.2	8.4	8.5	24.4	23.6	24.3	7.9	7.4	6.8	~~10.0~~	17.3	18.4
D	G12	5	5 *	0 3D	8.2	8.4	8.5	24.4	23.4	24.3	7.8	7.5	6.8	~~9.9~~	17.3	19.0
													CTRL A	* 16.6		
													B	17.5		
													C	17.4		
													D	17.7		
												SALT CTRL	A	17.1		
													B	16.8		
													C	17.6		
													D	17.7		
												100%	A	17.4		
													B	~~17.5~~ 17.4		
													C	~~17.9~~ 17.5		
													D	17.3		
measured by:		SG	SG	SG	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH	DPH
recorded by:		KBL	SG	SG	DPH	DPH	SG	DPH	DPH	SG	DPH	DPH	SG	DPH	DPH	SG

(Margin note: * DPH 3/23/00 Recorded wrong value)

Arrow note at G11/G12 24 h: switched values.

Investigators' Signatures
Shannon Garard
Della Parker Hanson
Marshall Faircloth

* W.P. (SG)
Temperature Range °C
Incubator # 3 24.5°-26.5°C
Room B246 24.5°-26.0°C

Water Quality Parameters

	Salt Water / Well Water	20% Min Water	Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L):	[redacted]		—	—	—	—
Lab Total Residual Cl2 (mg/L):	<0.03		<0.03	DR100	DPH	SG
Alkalinity (mg/L as $CaCO_3$):	200		448	Hach	DPH	SG
Hardness (mg/L as $CaCO_3$):	—		—	Hach	DPH	SG
Total ammonia (mg/L as N):	0.44		0.662	Denver	MF	SG
Salinity:	11		1.5	YSI	DPH	SG

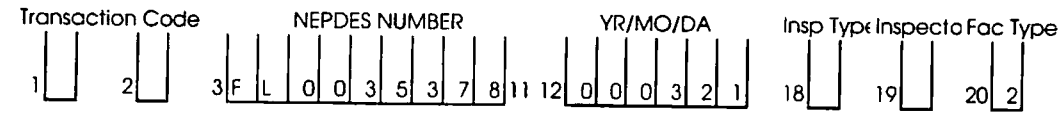
(Salt Water circled)

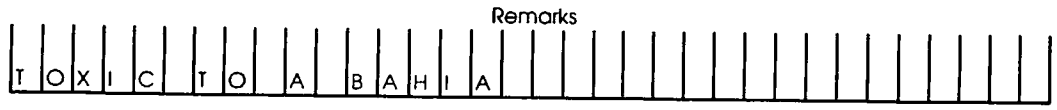
A. J. Wolfe
reviewer

form updated 3/3/99

The Bioassay of the Charlotte Harbor Water Association effluent sampled on March 21, 2000, NPDES #FL0035378

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

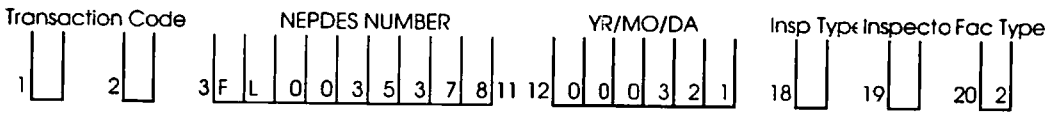


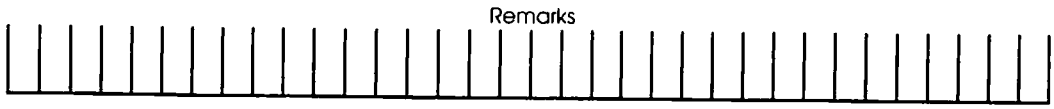


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The Priority Pollutants Analysis for Bioassay of Charlotte Harbor Water Association effluent sampled on March 21 2000, NPDES #FL0035378

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





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