

Biological Assessment of

Florida Power and Light St. Lucie Plant

St. Lucie County

NPDES #FL0002208

Sampled 3 December 1990

May 1991

Biology Section
Division of Administrative and Technical Services

Introduction

Toxicological and chemical data were collected on effluent from the Florida Power and Light Nuclear Power Plant, St. Lucie County, Florida, on 3 December, 1990. These data will be used to evaluate the facility's permit criteria.

Florida Power and Light Nuclear Power Plant is located in St. Lucie County on Hutchinson Island 12 miles north of Stuart, Florida. This nuclear powered steam electric plant consists of two 850 MW ("name plate") units, producing a net of 802 million watts/unit . The two units share common once-through cooling water intake and discharge canals, both of which are connected underground to the Atlantic Ocean (see map in Appendix). The plant is also regulated by the Nuclear Regulatory Commission.

Wastewater discharge includes 750 MGD once-through cooling water, 500 GPM steam generator blowdown, 250 GPM radwaste discharge, neutralization basin discharge, 17,000 GPD sewage treatment plant discharge, and non-equipment area stormwater discharge (variable amounts). Effluent limitations are as follows: chlorine at the end of the discharge canal shall be less than 0.1 mg/l, oil and grease shall be less than 15 mg/l, temperature shall not exceed 24° F above ambient, no PCB's shall be present, boron shall be less than 4 mg/l, and TSS shall be less than 30 mg/l as a daily average.

This FPL plant operates 8 circulating pumps with total pumping capacity of 968,000 GPM. The plant uses 58,000 GPM of ocean water to cool auxiliary heat exchange equipment. The once-through cooling water is screened and chlorinated a maximum of two hours per day (per unit) to control fouling organisms. Sewage treatment consists of an activated sludge wastewater treatment system stabilized in an aerobic digester. All hazardous sludges are handled and disposed of in conformance with applicable regulations of the Nuclear Regulatory Commission. Stormwater from roadways, parking lots, and building storm drains either percolates into the ground or is discharged into the cooling water intake canal and/or adjacent Big Mud Creek.

There appears to be no history of any serious problems. A 1984 report indicated no significant disturbance of fish or benthic macroinvertebrate populations. A January, 1989, inspection by EPA indicated that the plant was not experiencing noticeable problems during their inspection. Certain deficiencies were noted in the areas of sampling and laboratory methodologies, however, these were later corrected.

Methods

The focus of this investigation was to determine the quality of the discharger's effluent. An acute screening toxicity bioassay, using *Mysidopsis bahia* as the test organism, was performed on an effluent sample (Peltier and Weber 1985, FDER 1985). The effluent was analyzed for organic constituents (base neutrals, acid extractables, and pesticide extractables). Methods used for all chemical analyses are on file at the Tallahassee DER Chemistry Laboratory.

The following personnel were involved in this investigation: John Petronio (Southeast District), and Lyn Burton, Russel Frydenborg, Kathleen Lurding, and Sandra McClure (Tallahassee Biology Laboratory).

Results and Discussion

The sample of effluent produced 40% mortality to the crustacean, *Mysidopsis bahia*, after 48 hours of exposure. Further definitive toxicity tests appear warranted to determine if this discharge is in violation of toxicity requirements.

Only one effluent organic constituent determined from the sample was above detection limits (Appendix). This compound, tentatively identified as an alkyl isothiocyanate, was found at an estimated concentration of 70 µg/l. It is unknown if the concentration of alkyl isothiocyanate present in the effluent contributed to the observed toxicity.

Several metals were also detected in the discharge, including silver (1.5 µg/l), lead (6.3 µg/l), tin (<100 µg/l), barium (4 µg/l), cadmium (8 µg/l), copper (65 µg/l), iron (54 µg/l), and selenium (33 µg/l). The concentrations of silver, cadmium, copper, and selenium are above ambient water quality standards. Copper is reported to be acutely toxic to saltwater organisms at concentrations of 28 µg/l (flounder) and 181µg/l (mysid shrimp) (EPA Ambient Water Quality Criteria document), and could have contributed to the toxicity of the effluent. Silver is acutely toxic to oysters at 3 µg/l (EPA Ambient Water Quality Criteria document), and also could have contributed to the observed toxicity.

Conclusions

The Florida Power and Light discharge caused 40% mortality to the crustacean, Mysidopsis bahia, in a 48 hour static bioassay. Further definitive testing to determine possible toxicity violations appears warranted. An alkyl isothiocyanate was tentatively identified in the sample. It is unknown if it contributed to the observed toxicity. The metals selenium, silver, cadmium, and copper were detected in the discharge at levels above ambient water quality criteria. The combination of the metals, particularly copper and silver, may have contributed to the mortality of the test organisms.

Literature Cited

Florida Department of Environmental Regulation. 1985. Quality assurance manual for performing acute toxicity tests. 2nd edition. Fla. Dept. Environmental Regulation, Biology Section, Tallahassee. 53 pp.

Peltier, W. H. and C. I. Weber. 1985. Methods for measuring the acute toxicity of effluents to freshwater and marine organisms. 3rd edition. EPA/600/4-85/013. U. S. EPA, Cincinnati, Ohio. 216 pp.

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: FLA POWER & LIGHT
Address/City: S. HUTCHINSON ISLAND
County: St Lucie
Contact/District: SE District
NPDES Permit #: _____ Outfall #: 001

Sample Collection: Date 12-3-90 Time _____
Test Beginning: Date 12-5-90 Time 0830
Test Ending: Date 12-7-90 Time 0830
Test Organism: MYSIDOPSIS BAHIA
Life Stage/Age: < 5 DAYS

Test Number: 1 of 1 Test Type: Screening | Definitive
Static | Static Renewal | Flow-through

Remarks:

Instrument Calibrations:

	pH	DO	Cond	Temp
0 hr	7@7,9@9	9.3@21°C	1400@22.9	22.9 LKE THERMO
24 hr	7@7, 9@9	8.8@22°	1345 @ 23.1	21.5@22.7
48 hr	7@7, 9@9	8.8@22°	1356@23°	21.8@23.4

Salinity

Conc.	Chamber #	Number Live 0	24	48	DO (mg/l) 0	24	48	pH 0	24	48	Temp. (°C) 0	24	48	Cond. (µmhos/cm) 0	24	48
CONT	18	5	5	5	8.8	7.4	7.5	8.4	~~8.3~~ 8.3	8.1	22.7	20.8	20.6		32000	32300
CONT	—	5	5	5	8.8	7.5	7.7	8.4	8.3	8.1				16.5		
1.0%	39	5	4	3	8.8	10.7	6.7	8.0	~~8.1~~ 8.1	8.1	22.1	20.8	20.8		51000	52100
1.0%	174	5	3	3	8.9	10.6	6.7	8.0	8.1	8.1				36.5		
Measured/Loaded by:		RBF	MF	SMC	RBF	AJ	AJ	RBF	AJ	AJ	RBF	AJ	AJ	RBF	AJ	AJ
Recorded by:		AJ	AJ	SMC	AJ	SMC	SMC	AJ	SMC	SMC	AJ	SMC	SMC	AJ	SMC	SMC

Investigators' Signatures

Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:					
Lab Tot. Resid. Cl2:			0.0	HACH	RBF
Alkalinity:					
Hardness:					
Total Ammonia:					

Ammonia meter slope: _____

FPL ST. LUCIE

Sample Number: 90-DEC-07-10-01 Sample Status: Authorized by MEI FANG
Sample Location: Outfall (discharge canal) Matrix: Effluent
Field ID: 51-4336-B Storet Station Number:
Date/Time Collected: 3-DEC-1990 09:45:35.51
Comments:

Sample Number: 90-DEC-07-10-01 Test status: Authorized by Laura Harrison
Analysis Id: W-BNA Analysis Description: base-neutral-acid water analysis

Storet Number	Analyte	Result	Units
34205	Acenaphthene	10 U	ug/L
34200	Acenaphthylene	10 U	ug/L
39330	Aldrin	10 U	ug/L
34220	Anthracene	10 U	ug/L
34526	Benzo(a)anthracene	10 U	ug/L
34230	Benzo(b)fluoranthene	10 U	ug/L
34242	Benzo(k)fluoranthene	10 U	ug/L
34247	Benzo(a)pyrene	10 U	ug/L
34521	Benzo(g,h,i)perylene	15 U	ug/L
34292	Benzyl butyl phthalate	10 U	ug/L
	a-BHC	10 U	ug/L
39337	b-BHC	10 U	ug/L
39340	d-BHC	10 U	ug/L
	g-BHC	10 U	ug/L
39120	Benzidine	10 U	ug/L
34273	Bis(2-chloroethyl)ether	10 U	ug/L
34278	Bis(2-chloroethoxy)methane	15 U	ug/L
34283	Bis(2-chloroisopropyl)ether	15 U	ug/L
39100	Bis(2-ethylhexyl)phthalate	10 U	ug/L
34636	4-Bromophenyl phenyl ether	10 U	ug/L
34581	2-Chloronaphthalene	10 U	ug/L
34641	4-Chlorophenyl phenyl ether	10 U	ug/L
34320	Chrysene	10 U	ug/L
39310	4,4'-DDD	10 U	ug/L
39320	4,4'-DDE	10 U	ug/L
39300	4,4'-DDT	10 U	ug/L
34556	Dibenzo(a,h)anthracene	15 U	ug/L
39110	Di-n-butyl phthalate	10 U	ug/L
34536	1,2-Dichlorobenzene	10 U	ug/L
34566	1,3-Dichlorobenzene	10 U	ug/L
34571	1,4-Dichlorobenzene	10 U	ug/L
34631	3,3'-Dichlorobenzidine	10 U	ug/L
39380	Dieldrin	10 U	ug/L
34336	Diethylphthalate	10 U	ug/L
34341	Dimethylphthalate	10 U	ug/L
34611	2,4-Dinitrotoluene	10 U	ug/L
34626	2,6-Dinitrotoluene	10 U	ug/L
34596	Di-n-octyl phthalate	10 U	ug/L
34361	Endosulfan-I	10 U	ug/L

Continued

A - Value reported is the mean of two or more determinations
E - Scientific notation
J - Estimated value
K - Actual value is known to be less than value given
L - Actual value is known to be greater than value given
N - Not analyzed for this compound
T - Value reported is less than the practice quantiation limit
U - Material was analyzed for but not detected; The value reported is the minimum detection limit
N/A - Not applicable NR - Not requested

Sample Number: 90-DEC-07-11-01
Sample Location: Outfall (discharge canal)
Field ID: 51-4336-P
Date/Time Collected: 3-DEC-1990 09:50:17.65
Comments:

Sample Status: Authorized by Liang T. Lin
Matrix: Effluent
Storet Station Number:

Sample Number: 90-DEC-07-11-01
Analysis Id: W-PEST-CL

Test status: Authorized by Liang T. Lin
Analysis Description: Chlorinated pesticide in water

Storet Number	Analyte	Result	Units
39330	Aldrin	0.004 U	ug/L
	Benfluralin	0.004 U	ug/L
39337	Alpha-BHC	0.004 U	ug/L
39338	Beta-BHC	0.006 U	ug/L
34259	Delta-BHC	0.004 U	ug/L
39340	Gamma-BHC	0.004 U	ug/L
39640	Captan	0.01 U	ug/L
	Carbophenothion	0.02 U	ug/L
39350	Chlordane	0.5 U	ug/L
39460	Chlorobenzilate	0.1 U	ug/L
	Chlorothalonil	0.002 U	ug/L
	DDD-o,p'	0.01 U	ug/L
39360	DDD-p,p'	0.01 U	ug/L
	DDE-o,p'	0.006 U	ug/L
39365	DDE-p,p'	0.006 U	ug/L
	DDT-o,p'	0.01 U	ug/L
39370	DDT-p,p'	0.01 U	ug/L
	Dichloran	0.004 U	ug/L
39780	Dicofol	0.01 U	ug/L
39380	Dieldrin	0.006 U	ug/L
	Endosulfan I	0.006 U	ug/L
	Endosulfan II	0.01 U	ug/L
34351	Endosulfan sulfate	0.01 U	ug/L
39390	Endrin	0.01 U	ug/L
34366	Endrin aldehyde	0.01 U	ug/L
39410	Heptachlor	0.004 U	ug/L
39420	Heptachlor epoxide	0.006 U	ug/L
39430	Isodrin	0.006 U	ug/L
39480	Methoxychlor	0.02 U	ug/L
39755	Mirex	0.01 U	ug/L
	PCNB	0.002 U	ug/L
	Pendimethalin	0.01 U	ug/L
	Permethrin	0.2 U	ug/L
39034	Perthane	0.2 U	ug/L
	Strobane	0.5 U	ug/L
39400	Toxaphene	0.5 U	ug/L
81284	Trifluralin	0.01 U	ug/L

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N/A - Not applicable NR - Not requested

From previous page for Sample Number: 90-DEC-07-10-01 Analysis_id: W-BNA

34356	Endosulfan-II	10 U	ug/L
34351	Endosulfan-sulfate	10 U	ug/L
39390	Endrin	10 U	ug/L
34366	Endrin-aldehyde	10 U	ug/L
34376	Fluoranthene	10 U	ug/L
34381	Fluorene	10 U	ug/L
39410	Heptachlor	10 U	ug/L
39420	Heptachlor-epoxide	10 U	ug/L
39700	Hexachlorobenzene	15 U	ug/L
34391	Hexachlorobutadiene	10 U	ug/L
34396	Hexachloroethane	60 U	ug/L
34386	Hexachlorocyclypentadiene	10 U	ug/L
34403	Indeno(1,2,3-cd)pyrene	10 U	ug/L
34408	Isophorone	10 U	ug/L
34696	Naphthalene	10 U	ug/L
34447	Nitrobenzene	10 U	ug/L
34438	N-Nitrosodimethylamine	50 U	ug/L
34428	N-Nitrosodi-n-propylamine	10 U	ug/L
34433	N-Nitrosodiphenylamine	15 U	ug/L
34671	PCB-1016	10 U	ug/L
39488	PCB-1221	10 U	ug/L
39492	PCB-1232	10 U	ug/L
39496	PCB-1242	10 U	ug/L
39500	PCB-1248	10 U	ug/L
39504	PCB-1254	10 U	ug/L
39508	PCB-1260	10 U	ug/L
	PCB-1262	10 U	ug/L
34461	Phenanthrene	10 U	ug/L
34469	Pyrene	10 U	ug/L
39400	Toxaphene	10 U	ug/L
34551	1,2,4-Trichlorobenzene	10 U	ug/L
34462	4-Chloro-3-methyl phenol	15 U	ug/L
34586	2-Chlorophenol	15 U	ug/L
34601	2,4-Dichlorophenol	15 U	ug/L
34606	2,4-Dimethylphenol	15 U	ug/L
34616	2,4-Dinitrophenol	30 U	ug/L
34657	2-Methyl-4,6-dinitrophenol	30 U	ug/L
34591	2-Nitrophenol	15 U	ug/L
34646	4-Nitrophenol	50 U	ug/L
39032	Pentachlorophenol	15 U	ug/L
34694	Phenol	15 U	ug/L
34621	2,4,6-Trichlorophenol	15 U	ug/L

Comments (1): Tentative identification of isothiocyanatoethane; est. concentration 70 ug/L.
(2):
(3):
(4):
(5): AKA. ETHYL ISOTHIOCYANATE
(6):

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N/A - Not applicable NR - Not requested

FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
CENTRAL LABORATORY
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

CHEMICAL ANALYSIS REPORT

Job ID: 90-DEC-07-09
Date Received: 4-DEC-1990
Authorized: 15-MAR-1991

Project: OTHER
Customer ID: SE-PSL
By: Yuh-Hsu Pan

Submitted By: DER SE DISTRICT BRANCH OFFICE
2745 S.E. Morningside Blvd.
Port St. Lucie, Florida 34952

For Additional Information, Please Contact
G. William Coppenger, Ph.D.
Yuh-Hsu Pan, Ph.D.
Suncom 277-2571
(904) 487-2571

Preliminary Review Copy Date: 15-MAR-1991

Abbreviations & Storet Codes:

A - Value reported is the mean of two or more determinations
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N - Not analyzed for this compound
T - Value reported is less than the practical quantitation limit
U - Material was analyzed for but not detected;
The value reported is the minimum detection limit
NA - Not applicable
NR - Not requested

Sample ID: 9177/90-DEC-07-09-01 Matrix: W-EFFLUENT
Location: Outfall (discharge canal)
Field ID: 51-4336-M
Collected: 3-DEC-1990 09:55 By: Anderson
Authorized: 7-DEC-1990 By: Tim Fitzpatrick
Type: Grab Sample
Lab Comments:
Field Comments: Unpreserved

Analysis ID: AG-G-W
Silver in water by furnace AA
Analyzed: 23-JAN-1991 By: Jack Merritt
Authorized: 13-FEB-1991 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
01077	Silver	1.5 J	ug/L

Analysis ID: AS-G-W
arsenic by graphite furnace for water samples
Analyzed: 6-FEB-1991 By: Jack Merritt
Authorized: 21-FEB-1991 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
01002	Arsenic	15 U	ug/L

Analysis ID: CD-G-W
Cadmium by graphite furnace for water samples
Analyzed: 27-JAN-1991 By: Jack Merritt
Authorized: 6-FEB-1991 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
01027	Cadmium	N	ug/L

Analysis ID: HG-H-W
Mercury by cold vapor using hydride sys.-water
Analyzed: 14-DEC-1990 By: Laurie Roughton
Authorized: 19-DEC-1990 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
71900	Mercury	0.2 U	ug/L

 Continued on Page 3

9177/90-DEC-07-09-01 Continued from Page 2

Analysis ID: PB-G-W
Lead by furnace AA in water
Analyzed: 25-JAN-1991 By: Jack Merritt
Authorized: 6-FEB-1991 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
01051	Lead	6.3	ug/L

Analysis ID: SE-G-W
Selenium in water by furnace AA
Analyzed: 8-FEB-1991 By: Jack Merritt
Authorized: 21-FEB-1991 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
01147	Selenium	N	ug/L

Analysis ID: SN-G-W
Tin in water by furnace AA
Analyzed: 27-FEB-1991 By: Jack Merritt
Authorized: 11-MAR-1991 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
01102	Tin	100 K	ug/L

Analysis ID: W-ICP-23
ICP multielement analysis for water samples
Analyzed: 27-DEC-1990 By: Kate Brackett
Authorized: By: ----------

Storet#	Analyte	Value	Units
01106	Aluminum	NR	ug/L
01002	Arsenic	20 U	ug/L
01097	Antimony	NR	ug/L
01007	Barium	4	ug/L
01012	Beryllium	NR	ug/L
01027	Cadmium	8 T 5 ug limit	ug/L
00916	Calcium	NR	mg/L
01034	Chromium	10 U	ug/L
01037	Cobalt	NR	ug/L

9177/90-DEC-07-09-01/W-ICP-23 Continued on Page 4

9177/90-DEC-07-09-01/W-ICP-23 Continued from Page 3

Storet#	Analyte	Value	Units
01042	Copper	65 15 ug/L	ug/L
01045	Iron	54	ug/L
01051	Lead	15 U	ug/L
00927	Magnesium	NR	mg/L
01055	Manganese	1 U	ug/L
01067	Nickel	5 U	ug/L
00937	Potassium	NR	mg/L
01147	Selenium	33 T 25 ug/L	ug/L
01077	Silver	NR	ug/L
00929	Sodium	NR	mg/L
01082	Strontium	NR	ug/L
01059	Thallium	NR	ug/L
01087	Vanadium	NR	ug/L
01092	Zinc	NR	ug/L
Comment	NONE		

Sample ID: 9178/90-DEC-07-09-02 Matrix: W-TRIP-BLK
Location: Trip Blank
Field ID: 51-4337-M
Collected: 3-DEC-1990 08:30 By: Anderson
Authorized: 7-DEC-1990 By: Tim Fitzpatrick
Type: Grab Sample
Lab Comments:
Field Comments:

Analysis ID: AG-G-W
Silver in water by furnace AA
Analyzed: 12-JAN-1991 By: Jack Merritt
Authorized: 17-JAN-1991 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
01077	Silver	2 U	ug/L

Analysis ID: AS-G-W
arsenic by graphite furnace for water samples
Analyzed: 6-FEB-1991 By: Jack Merritt
Authorized: 21-FEB-1991 By: Tim Fitzpatrick

Storet#	Analyte	Value	Units
01002	Arsenic	3 U	ug/L

 Continued on Page 5

Department of Environmental Regulation
Results of Fifth Year Inspections

Discharger: **Florida Power and Light St. Lucie Plant**
County: **St. Lucie**
NPDES Number: **FL0002208**
State Permit Expiration Date:

Toxics Sampling Inspection (XSI)

Date Sampled: 3 December 1990

Results: Silver (1.5 µg/l), lead (6.3 µg/l), tin (<100 µg/l), barium (4 µg/l), cadmium (8 µg/l), copper (65 µg/l), iron (54 µg/l), and selenium (33 µg/l). The concentrations of silver, cadmium, copper, and selenium are above ambient water quality standards. The combination of the metals, particularly copper and silver, may have contributed to the mortality of the test organisms. An organic compound, tentatively identified as an alkyl isothiocyanate, was found at an estimated concentration of 70 µg/l.

Compliance Biomonitoring Inspection (CBI)

Date Sampled: 3 December 1990

Results: Full strength effluent caused 40% mortality to *Mysidopsis bahia*. Further definitive toxicity tests appear warranted.

Impact Bioassessment Inspection (IBI)

Date Sampled:

Results:

Water Quality Inspection (WQI)

Date Sampled:

Results :

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

Transaction Code	NPDES NUMBER	YR/MO/DA	Insp Type	Inspector	Fac Type
1 N 2 5	3 F L 0 0 0 2 2 0 8 11	12 9 0 / 1 2 0 3 17	18 B X	19	20

Remarks

21 66

These fifth year inspections provide the necessary information to evaluate the facility's impact on its receiving waters and to provide specific recommendations for renewal.