

Bioassays of

Miami Seaquarium Marine Life Habitats and Tanks Flow-Through Seawater Disposal Facility

Dade County

NPDES #FL0169129

Sampled September 26, 2005

November 2005

Biology Section
Bureau of Laboratories
Division of Resource Assessment and Management

Quality Manual No. 870346G
NELAC Certification No. E31780

Miami Seaquarium Marine Life Habitats and Tanks Flow-Through Seawater Disposal Facility, 4400 Rickenbacker Causeway, Miami, Dade County, Florida, NPDES #FL0169129. Effluent samples for this facility were collected on September 26, 2005.

Introduction

Miami Seaquarium Marine Life Habitats and Tanks Flow-Through Seawater Disposal Facility is a Recreational Park (Captive Aquatic Wildlife) and Research Center. The facility has a design flow of 9.388 million gallons per day (MGD). The average annual daily flow (measured semi-annually) from July 2004 through June 2005 was 5.2 MGD. Intake water is supplied to the facility from Biscayne Bay (Class III Marine). Intake water flows continuously through the various habitats and tanks in different sequences before being returned to Biscayne Bay through one of seven outfalls. Outfall D-001, the Lagoon Outfall, has an outfall line 1.83 m (6 ft) long, discharges at a depth of 0.91m (3 ft), and is located approximately at latitude 25º43'52" N, longitude 80º09'50"W. The remaining six outfalls discharge at a depth of 2.13 m (7 ft) and have no measurable outfall line lengths. Outfall D-002, the New York Outfall, is located approximately at latitude 25º43'54" N, longitude 80º10'01"W; Outfall D-003, the Main Outfall, is located approximately at latitude 25º43'55"N, longitude 80º10'02"W; Outfall D-004, the Lost Island Outfall, is located approximately at latitude 25º43'56"N, longitude 80º10'03"W; Outfall D-005, the Training Tank Outfall, is located approximately at latitude 25º44'00"N, longitude 80º10'03"W; Outfall D-006, the Golden Dome Outfall, is located approximately at latitude 25º44'04"N, longitude 80º10'00"W; Outfall D-007, the Shark Channel Outfall, is located approximately at latitude 25º43'53"N, longitude 80º10'00"W.

Treatment of the raw supply water is minimal and is limited to filtration at the intake to improve the purity of the water and chlorination prior to the entrances to most of the tanks to control bacteria and algae growth. There is further conditioning of the supply water (e.g. chilling, aeration and additional filtration, etc.) at various tanks to accommodate the unique habitat environment required of different animals.

The facility has no Administrative or Consent Orders. The facility has a mixing zone for copper which extends outward 30.4 m (100 ft) when copper sulfate based medication must be used to treat fish disease at the reef exhibit. However, copper medication is not currently being used at the facility. This facility's permit does not have toxicity testing requirements (facility information provided by Patrick Pierson of FDEP Southeast District).

Methods

Samples were collected from the EFF-03 NPDES sampling point for Outfall D-003 by Terry Davis (FDEP Southeast District) following DEP-SOP-001/01 FS 2400 Wastewater Sampling. All DEP SOP's are available on the web at: http://www.floridadep.org/labs/qa/sops.htm.

The 48-hour acute screening toxicity tests and algal growth potential test were performed following internal DEP SOP's TA07_03, TA07_04, and TA08_01 through TA08_09. All internal DEP SOP's are available on the web at: http://www.floridadep.org/labs/cgi-bin/sop/biosop.asp. The Department uses the 48-hour acute screening toxicity test to provide reasonable assurance that the facility does not adversely affect waters of the state.

Toxicity Test Results

Tests were performed September 27-29, 2005.

Americamysis bahia 48-hour acute screening bioassay – LC_{50} > 100%, 0% mortality* in 100% sample at 48 hours

Menidia beryllina 48-hour acute screening bioassay – LC_{50} > 100%, 10% mortality* in 100% sample at 48 hours

The bioassay samples were not acutely toxic to the test organisms.

See Appendix 1 for bioassay bench sheets.

*NOTE: In a 48-hr acute screening test of 100% effluent, mortality of <20% provides reasonable assurance that the effluent meets the acute toxicity criterion of Florida's Surface Water Quality Standards (Rule 62-302.500 (1)(a)4, F.A.C.). Mortality between 20-50% mortality indicates low to moderate levels of toxicity, and further action may be required. Mortality of >50% provides reasonable assurance that the effluent fails to meet the minimum requirement to discharge to waters of the state (Rule 62-4.244(3)(a), F.A.C.).

Algal Growth Potential

The effluent Algal Growth Potential (AGP) was 1.34 mg dry wt/L of the salt-water species *Dunaliella tertiolecta,* however, the analyte was detected in both the sample and method blanks. Raschke and Shultz found that AGP values above 10.0 mg dry weight/L represent a "problem" threshold for marine receiving waters, implying nutrient enrichment (personal communication with Ron Raschke USEPA Region 4 1987). The analytical chemistry suggests that the effluent is limited by both nitrogen and phosphorus.

See Table 1 for AGP results.

Chemistry Results

Total residual chlorine and total ammonia were not detected in the bioassay sample in the laboratory. The total ammonia concentration in the sample collected and preserved for chemical analysis was 0.099 mg/L. Based on the pH, salinity, and temperature of the effluent as collected, the calculated unionized ammonia concentration was < 0.02 mg/L.

Copper was detected in the effluent at a level that complies with Class III marine quality criteria. Aluminum and arsenic were detected between the laboratory method detection limits (MDL) and practical quantitation limits (PQL).

See Table 2 for results of analytes detected in the effluent, and corresponding limits.

See Appendix 2 for a complete list of chemical analyses performed.

Conclusion

The effluent sample collected from Outfall D-003 for this facility on September 26, 2005, was not acutely toxic to either test species during the acute screen 48-hour bioassays. The effluent AGP result was less than the "problem" threshold for marine receiving waters.

Table 1. Measured and predicted algal growth potential (AGP; mg dry wt/L) of Duneliella tertiolecta *and ratios of nitrogen to phosphorus for samples collected from Miami Seaquarium Marine Life Habitats and Tanks Flow-Through Seawater Disposal Facility on September 26, 2005.*

Location	AGP (measured)	Inorganic N:P ratio	Total N:P ratio
Effluent Samples	1.34 V	7.25	24.82

V - Analyte was detected in both sample and method blank

Table 2. Effluent limits, Class III Marine Criteria, and chemical data for samples collected from Miami Seaquarium Marine Life Habitats and Tanks Flow-Through Seawater Disposal Facility on September 26, 2005.

Miami Seaquarium NPDES# FL0169129	Class III Marine Stds	Effluent Limits	Effluent Samples
Metals (µg/L unless otherwise noted)			
Aluminum	≤ 1,500	-	17 l
Arsenic	≤ 50	-	19 l
Cadmium	≤ 9.3	-	0.25 U
Calcium (mg/L)	-	-	363
Chromium-III	-	-	4 U
Copper	≤ 3.7	Report	1.03
Iron	≤ 300	-	20 U
Lead	≤ 8.5	-	0.38 U
Magnesium (mg/L)	-	-	1,160
Nickel	≤ 8.3	-	4 U
Selenium	≤ 71	-	6 U
Silver	≤ 2.3	-	0.12 U
Zinc	≤ 86	-	6 U
Nutrients (mg/L)			
Ortho-phosphate	-	-	0.024
Total Phosphorus	-	-	0.028 l
Ammonia	-	-	0.099
Unionized Ammonia	-	-	< 0.02 c
Nitrate+Nitrite	-	-	0.075 f
Total Kjeldahl Nitrogen	-	Report	0.62
Organic Nitrogen	-	-	0.52 c
Total Nitrogen	-	-	0.7 c
General Physical and Chemical Parameters			
pH (S.U.)	6.5-8.5 s	6.5-8.5 s	7.4
Dissolved Oxygen (mg/L)	≥ 4.0 s	-	-
Conductivity (umhos/cm)	-	-	48,850
Temperature (C)	-	-	26.8
BOD (mg/L)	-	Report	0.66 l
TSS (mg/L)	-	Report	8 l
Daily Flow (MGD)	-	3.024	5.2 a
Hardness (mg/L)	-	-	5,683.3 c
Microbiology (# counts/100ml)			
Fecal Coliforms-Membrane Filter	≤ 800 s	Report	-

Value exceeds the Class III Marine Water Quality Criteria (62-302, F.A.C.) and/or Effluent Limits

a - Annual average

c - Calculated value

f - Nitrate+Nitrite was detected in the field blank at a concentration of 0.004 mg/L

s - Single sample

l - The reported value is between the laboratory method detection limit and the laboratory practical quantitation lin

U - Material analyzed for but not detected; value reported is the method detection limit

FDEP Biology Section - Acute Screen Bioassay Bench Sheets

Facility: Miami Seaquarium
Address: 4400 Rickenbacker Causeway
City: Miami County: Dade
Contact/District: Terry Davis / Southeast District
NPDES Permit #: FL 0169129
LIMS Job #: TLH-2005-09-27-31 LIMS Sample #: P060551

Sample Collection: Date: 9-26-05 Time: 1035
Hold Time Start: Date: 9-26-05 Time: 1035

Comments: Control water is Natural Seawater having a salinity of ~ 40ppth (parts per thousand) diluted with deionized water to a salinity of 29.9 ppth. MF 9-27-05

Lims Data Entry: 10-7-05 SB Data Entry Verification: MF 10-7-05
Instructions (for below): Circle appropriate wording. If yes is circled complete blanks.

Test Type: (Screen)
(Static) Static Renewal / Flow-through
Test Duration: (48) 96 Hours.
Light Intensity : 50 - 100 ft. candles.
Photoperiod : 16 hours light 8 hours dark.

Test 1 validation: Test 1: SOP TA 03
Control survival ≥90%: (Yes) No
Temperature Range ≤3°C: (Yes) No

Test 2 validation: Test 2: SOP TA 04
Control survival ≥90%: (Yes) No
Temperature Range ≤3°C: (Yes) No

Initial sample handling:
PH adjustment : yes (no) Initial pH: ____ NaOH N HCl N ____ Drops mL Final pH: ____
Aeration : yes (no) Initial DO: ____mg/L Final DO: ____mg/L Duration: ____minutes Rate: ~____bubbles/min
Salinity adjusted (Test 1): yes (no) Initial Salinity: ____ Final Salinity: ____ Salts Hypersaline brine
Salinity adjusted (Test 2): yes (no) Initial Salinity: ____ Final Salinity: ____ Salts Hypersaline brine
Dechlorination: yes (no) ____mL of 0.025N Sodium Thiosulfate per liter of sample Final TRC: ____

Temperature Range °C
Incubator # 3 Range 252-254
Room B246 244-254
Waterbath: n/a

Sample Validation:
Temperature: Shipped ≤6°C (Yes) No Hand Delivered: Cooling (received °C < collected °C) Yes No
Holding Time: ≤36 Hours (Yes) No (Composite-end of collection; grab-when collected; 4 in 24 - time last sample collected)

Investigators' Signatures
Sarah Pritchard
Erin Perry
James Daniels
Marshall Brandt
Mandi Wetherly
REVIEWER

Water Quality Parameters	20% DMW	Moderately Hard Water/ Well Water	Salt Water ASW (NSW) Test 1	Salt Water ASW (NSW) Test 2	Other:	Original Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L)	N/A	N/A	N/A	N/A		not measured	-	SP	
Lab Total Residual Cl2 (mg/L)			<0.03	<0.03		<0.03	HACH	SP	SP
Alkalinity (mg/L as $CaCO_3$)			140	140		144	HACH	SP	SP
Hardness (mg/L as $CaCO_3$)			not measured			not measured	HACH	-	SP
Total Ammonia (mg/L as N)			<0.017	<0.017		<0.060	DENVER	SP	SP
Salinity (ppth)			29.9	29.9		30.2	YSI / Mettler	JD	SP

V 1.4 9/12/05

Appendix 1. Bench Sheets (continued)

FDEP Biology Section - - Bioassay Bench Sheet
Survival

LIMS Sample #: 866551 Test #: 1 Test Started: Date 9-27-05 Time: 1500
Organism: A.bahia Test Ended: Date 9-29-05 Time: 1315
Organism Batch: 23-05 Diluent/ Batch: NSW 29.9‰ 1-05
Organism Age: 3 days Food: YCT *P. subcapitata* *Artemia* SOP: TA_ 07.03
Chamber Size: 1000 mL Batch: - - 351384.25GR
Test Volume: 500 mL Feeding: (Prior to test) - Prior to renewal - (Daily)

Concentration	Replicate	Chamber #	Test Hour 0 hr	24 hr	48 hr BR	48 hr AR	72 hr	96 hr
CTRL	A	C1	5	5	5			
	B	C2	5	5	5			
	C	C3	5	5	5			
	D	C4	5	5	5			
100%	A	C5	5	5	5			
	B	C6	5	5	5			
	C	C7	5	5	5			
	D	C8	5	5	5			
Organisms loaded by: JD		Checked by:	[redacted]	JD	JD			

Loading Verified by: SP

Comments:

m = missing d = dead BR = before renewal AR = after renewal

Test Results:

% mortality in 100% sample Ø

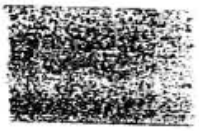
LC_{50}: >100 If Calculated: 95% CI____ Method:____

Screening Tests: Report LC50 as >100%, =100%, or <100%.
Substitue highest test concentration used if other than 100% (example: Ocean outfall tested at 30% concentration).

V 2.0 4/12/05

Page 000027

Appendix 1. Bench Sheets (continued)



FDEP Biology Section - - Bioassay Bench Sheet

Survival

LIMS Sample #: 8616551 Test #: 2 Test Started: Date 9-27-05 Time: 1445

Organism: M.beryllina Test Ended: Date 9.29.05 Time: 1330

Organism Batch: 25-05 Diluent/ Batch: NSW 29.9‰/ 105

Organism Age: 11 days Food: YCT *P. subcapitata* *Artemia* SOP: TA 07.04

Chamber Size: 1000 mL Batch: - - 35138425GR

Test Volume: 500 mL Feeding: Prior to test - Prior to renewal - Daily

Concentration	Replicate	Chamber #	Test Hour 0 hr	24 hr	48 hr BR	48 hr AR	72 hr	96 hr
CTRL	A	C9	5	5	5			
	B	C10	5	4[D]	4			
	C	C11	5	5	5			
	D	C12	5	5	5			
100%	A	C13	5	5	5			
	B	C14	5	4[D]	4			
	C	C15	5	5	5			
	D	C16	5	4[D]	4			
Organisms loaded by: JD		Checked by: [redacted]		JD	JD			
Loading Verified by: BR								

Comments:

m = missing d = dead BR = before renewal AR = after renewal

Test Results:

% mortality in 100% sample 10

LC_{50}: >100 If Calculated: 95% CI _____ Method: _____

Screening Tests: Report LC50 as >100%, =100%, or <100%.

Substitue highest test concentration used if other than 100% (example: Ocean outfall tested at 30% concentration).

V 2.0 4/12/05

Page 000028



Bioassay Parameters

LIMS Sample # : 866551 Test # : 1 of 2

TEST SOP: TA07_03 Test Species: *Ceriodaphnia dubia* *Cyprinella leedsi* *Pimephales promelas* (*Americamysis bahia*) *Menidia beryllina* Other:_____

V1.1 2/24/04

Concentration CTRL	0 Hr.	24 Hr.	48 Hr. before renewal	48 Hr. after renewal	72 Hr.	96 Hr.
Replicate	A	B	C			
pH (S.U.)	8.2	8.1	7.9			
Temperature °C	25.1	24.7	25.0			
Dissolved Oxygen mg/L	6.4	5.8	5.6			
Conductivity µmhos (mmhos)	45.8	47.4	48.1			
(initials) Measured by:	[illegible]	[illegible]	[illegible]			
(initials) Recorded by:	[illegible]	[illegible]	[illegible]			

Comments:

Concentration 100%	0 Hr.	24 Hr.	48 Hr. before renewal	48 Hr. after renewal	72 Hr.	96 Hr.
Replicate	A	B	C			
pH (S.U.)	7.9	8.0	8.0			
Temperature °C	25.8	24.7	24.5			
Dissolved Oxygen mg/L	6.7	5.8	6.5			
Conductivity µmhos (mmhos)	46.6	49.3	49.9			
(initials) Measured by:	[illegible]	[illegible]	[illegible]			
(initials) Recorded by:	[illegible]	[illegible]	[illegible]			

Comments:

Concentration	0 Hr.	24 Hr.	48 Hr. before renewal	48 Hr. after renewal	72 Hr.	96 Hr.
Replicate						
pH (S.U.)						
Temperature °C						
Dissolved Oxygen mg/L						
Conductivity µmhos mmhos						
(initials) Measured by:						
(initials) Recorded by:						

Comments:

Concentration	0 Hr.	24 Hr.	48 Hr. before renewal	48 Hr. after renewal	72 Hr.	96 Hr.
Replicate						
pH (S.U.)						
Temperature °C						
Dissolved Oxygen mg/L						
Conductivity µmhos mmhos						
(initials) Measured by:						
(initials) Recorded by:						

Comments:

V 2.0 2/24/04

000029

Page

Bioassay Parameters

LIMS Sample # : 806551 **Test # :** 2 **of** 2

TEST SOP: TA07_ ~~03~~ 04 **Test Species:** *Ceriodaphnia dubia Cyprinella leedsi Pimephales promelas Americamysis bahia* (*Menidia beryllina*) Other:_____

~~V 1.2/24/04~~

Concentration CTRL	0 Hr.	24 Hr.	48 Hr. before renewal	48 Hr. after renewal	72 Hr.	96 Hr.
Replicate	A	B	C			
pH (S.U.)	8.2	8.1	8.0			
Temperature °C	24.9	24.7	25.0			
Dissolved Oxygen mg/L	6.4	5.8	7.0			
Conductivity µmhos (mmhos)	45.9	46.9	50.0			
(initials) Measured by:	[illegible]	[illegible]	JD			
(initials) Recorded by:	[illegible]	[illegible]	JD			

Comments:

Concentration 100%	0 Hr.	24 Hr.	48 Hr. before renewal	48 Hr. after renewal	72 Hr.	96 Hr.
Replicate	A	B	C			
pH (S.U.)	7.9	8.0	8.0			
Temperature °C	25.9	24.7	24.4			
Dissolved Oxygen mg/L	6.7	5.9	7.2			
Conductivity µmhos (mmhos)	46.5	48.5	51.7			
(initials) Measured by:	[illegible]	[illegible]	JD			
(initials) Recorded by:	[illegible]	[illegible]	JD			

Comments:

Concentration	0 Hr.	24 Hr.	48 Hr. before renewal	48 Hr. after renewal	72 Hr.	96 Hr.
Replicate						
pH (S.U.)						
Temperature °C						
Dissolved Oxygen mg/L						
Conductivity µmhos mmhos						
(initials) Measured by:						
(initials) Recorded by:						

Comments:

Concentration	0 Hr.	24 Hr.	48 Hr. before renewal	48 Hr. after renewal	72 Hr.	96 Hr.
Replicate						
pH (S.U.)						
Temperature °C						
Dissolved Oxygen mg/L						
Conductivity µmhos mmhos						
(initials) Measured by:						
(initials) Recorded by:						

Comments:

V 2.0 2/24/04

000030

Page



Appendix 2. Chemical Analyses performed on the effluent from Miami Seaquarium Marine Life Habitats and Tanks Flow-Through Seawater Disposal Facility Outfall D-003, sampled on September 26, 2005.

Date Sampled	Field ID	Analysis	Component	Result	Units	Remark	MDL	PQL
9/26/2005 10:35	Outfall D-003	Bio-AGP/LimNut	Algal Growth Potential	1.34	mg DryWt/L	V	0.3	0.9
9/26/2005 10:35	Outfall D-003	Bio-BOD	Biochemical Oxygen Demand-5 Day	0.66	mg/L	I	0.2	2.0
9/26/2005 10:35	Outfall D-003	Bio-Chl-a	Chlorophyll-A, Monochromatic, Water	0.85	ug/L	U	0.85	2.6
9/26/2005 10:35	Outfall D-003	Bio-Chl-a	Phaeophytin-A, Monochromatic, Water	0.85	ug/L	U	0.85	2.6
9/26/2005 10:35	Outfall D-003	Bio-Toxicology	Bioassay-Acute-Screen-SW-Fish, LC50	100	LC50	L		
9/26/2005 10:35	Outfall D-003	Bio-Toxicology	Bioassay-Acute-Screen-SW-Mysid, LC50	100	LC50	L		
9/26/2005 10:35	Outfall D-003	BNA-Water	1,2,4-Trichlorobenzene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	1,2-Dichlorobenzene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	1,3-Dichlorobenzene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	1,4-Dichlorobenzene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	2,4,6-Trichlorophenol	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	2,4-Dichlorophenol	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	2,4-Dimethylphenol	49	ug/L	U	49	190
9/26/2005 10:35	Outfall D-003	BNA-Water	2,4-Dinitrophenol	15	ug/L	U	15	58
9/26/2005 10:35	Outfall D-003	BNA-Water	2,4-Dinitrotoluene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	2,6-Dinitrotoluene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	2-Chloronaphthalene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	2-Chlorophenol	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	2-Methyl-4,6-dinitrophenol	2.9	ug/L	U	2.9	12
9/26/2005 10:35	Outfall D-003	BNA-Water	2-Nitrophenol	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	3,3'-Dichlorobenzidine	39	ug/L	U	39	160
9/26/2005 10:35	Outfall D-003	BNA-Water	4,4'-DDD	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	4,4'-DDE	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	4,4'-DDT	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	4-Bromophenyl phenyl ether	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	4-Chloro-3-methylphenol	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	4-Chlorophenyl phenyl ether	1.9	ug/L	U	1.9	7.8
9/26/2005 10:35	Outfall D-003	BNA-Water	4-Nitrophenol	15	ug/L	U	15	58
9/26/2005 10:35	Outfall D-003	BNA-Water	Acenaphthene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Acenaphthylene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Aldrin	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	alpha-BHC	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Anthracene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Benzidine	97	ug/L	U	97	390
9/26/2005 10:35	Outfall D-003	BNA-Water	Benzo(a)anthracene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Benzo(a)pyrene	0.97	ug/L	U	0.97	3.9

Appendix 2. Chemical Analyses (continued)

Date Sampled	Field ID	Analysis	Component	Result	Units	Remark	MDL	PQL
9/26/2005 10:35	Outfall D-003	BNA-Water	Benzo(b)fluoranthene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Benzo(g,h,i)perylene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Benzo(k)fluoranthene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	beta-BHC	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Bis(2-chloroethoxy)methane	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Bis(2-chloroethyl)ether	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Bis(2-chloroisopropyl)ether	2.9	ug/L	U	2.9	12
9/26/2005 10:35	Outfall D-003	BNA-Water	Bis(2-ethylhexyl)phthalate	15	ug/L	U	15	58
9/26/2005 10:35	Outfall D-003	BNA-Water	Butyl benzyl phthalate	4.9	ug/L	U	4.9	19
9/26/2005 10:35	Outfall D-003	BNA-Water	Chrysene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	delta-BHC	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Dibenzo(a,h)anthracene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Dieldrin	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Diethyl phthalate	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Dimethyl phthalate	49	ug/L	U	49	190
9/26/2005 10:35	Outfall D-003	BNA-Water	Di-n-butyl phthalate	4.9	ug/L	U	4.9	19
9/26/2005 10:35	Outfall D-003	BNA-Water	Di-n-octyl phthalate	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Endosulfan I	3.9	ug/L	U	3.9	16
9/26/2005 10:35	Outfall D-003	BNA-Water	Endosulfan II	3.9	ug/L	U	3.9	16
9/26/2005 10:35	Outfall D-003	BNA-Water	Endosulfan sulfate	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Endrin	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Endrin aldehyde	3.9	ug/L	U	3.9	16
9/26/2005 10:35	Outfall D-003	BNA-Water	Fluoranthene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Fluorene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	gamma-BHC	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Heptachlor	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Heptachlor epoxide	1.5	ug/L	U	1.5	5.8
9/26/2005 10:35	Outfall D-003	BNA-Water	Hexachlorobenzene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Hexachlorobutadiene	2.9	ug/L	U	2.9	12
9/26/2005 10:35	Outfall D-003	BNA-Water	Hexachlorocyclopentadiene	2.9	ug/L	U	2.9	12
9/26/2005 10:35	Outfall D-003	BNA-Water	Hexachloroethane	2.9	ug/L	U	2.9	12
9/26/2005 10:35	Outfall D-003	BNA-Water	Indeno(1,2,3-cd)pyrene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Isophorone	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Naphthalene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Nitrobenzene	1.9	ug/L	U	1.9	7.8
9/26/2005 10:35	Outfall D-003	BNA-Water	N-Nitrosodimethylamine	1.9	ug/L	U	1.9	7.8
9/26/2005 10:35	Outfall D-003	BNA-Water	N-Nitrosodi-n-propylamine	1.9	ug/L	U	1.9	7.8

Appendix 2. Chemical Analyses (continued)

Date Sampled	Field ID	Analysis	Component	Result	Units	Remark	MDL	PQL
9/26/2005 10:35	Outfall D-003	BNA-Water	N-Nitrosodiphenylamine	2.9	ug/L	UJ	2.9	12
9/26/2005 10:35	Outfall D-003	BNA-Water	Pentachlorophenol	2.9	ug/L	U	2.9	12
9/26/2005 10:35	Outfall D-003	BNA-Water	Phenanthrene	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Phenol	0.97	ug/L	U	0.97	3.9
9/26/2005 10:35	Outfall D-003	BNA-Water	Pyrene	0.97	ug/L	U	0.97	3.9
9/26/2005 11:00	Field Blank	BNA-Water	1,2,4-Trichlorobenzene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	1,2-Dichlorobenzene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	1,3-Dichlorobenzene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	1,4-Dichlorobenzene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	2,4,6-Trichlorophenol	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	2,4-Dichlorophenol	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	2,4-Dimethylphenol	48	ug/L	U	48	190
9/26/2005 11:00	Field Blank	BNA-Water	2,4-Dinitrophenol	14	ug/L	U	14	58
9/26/2005 11:00	Field Blank	BNA-Water	2,4-Dinitrotoluene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	2,6-Dinitrotoluene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	2-Chloronaphthalene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	2-Chlorophenol	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	2-Methyl-4,6-dinitrophenol	2.9	ug/L	U	2.9	12
9/26/2005 11:00	Field Blank	BNA-Water	2-Nitrophenol	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	3,3'-Dichlorobenzidine	38	ug/L	U	38	150
9/26/2005 11:00	Field Blank	BNA-Water	4,4'-DDD	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	4,4'-DDE	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	4,4'-DDT	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	4-Bromophenyl phenyl ether	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	4-Chloro-3-methylphenol	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	4-Chlorophenyl phenyl ether	1.9	ug/L	U	1.9	7.7
9/26/2005 11:00	Field Blank	BNA-Water	4-Nitrophenol	14	ug/L	U	14	58
9/26/2005 11:00	Field Blank	BNA-Water	Acenaphthene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Acenaphthylene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Aldrin	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	alpha-BHC	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Anthracene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Benzidine	96	ug/L	U	96	380
9/26/2005 11:00	Field Blank	BNA-Water	Benzo(a)anthracene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Benzo(a)pyrene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Benzo(b)fluoranthene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Benzo(g,h,i)perylene	0.96	ug/L	U	0.96	3.8

Appendix 2. Chemical Analyses (continued)

Date Sampled	Field ID	Analysis	Component	Result	Units	Remark	MDL	PQL
9/26/2005 11:00	Field Blank	BNA-Water	Benzo(k)fluoranthene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	beta-BHC	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Bis(2-chloroethoxy)methane	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Bis(2-chloroethyl)ether	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Bis(2-chloroisopropyl)ether	2.9	ug/L	U	2.9	12
9/26/2005 11:00	Field Blank	BNA-Water	Bis(2-ethylhexyl)phthalate	14	ug/L	U	14	58
9/26/2005 11:00	Field Blank	BNA-Water	Butyl benzyl phthalate	4.8	ug/L	U	4.8	19
9/26/2005 11:00	Field Blank	BNA-Water	Chrysene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	delta-BHC	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Dibenzo(a,h)anthracene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Dieldrin	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Diethyl phthalate	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Dimethyl phthalate	48	ug/L	U	48	190
9/26/2005 11:00	Field Blank	BNA-Water	Di-n-butyl phthalate	4.8	ug/L	U	4.8	19
9/26/2005 11:00	Field Blank	BNA-Water	Di-n-octyl phthalate	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Endosulfan I	3.8	ug/L	U	3.8	15
9/26/2005 11:00	Field Blank	BNA-Water	Endosulfan II	3.8	ug/L	U	3.8	15
9/26/2005 11:00	Field Blank	BNA-Water	Endosulfan sulfate	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Endrin	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Endrin aldehyde	3.8	ug/L	U	3.8	15
9/26/2005 11:00	Field Blank	BNA-Water	Fluoranthene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Fluorene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	gamma-BHC	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Heptachlor	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Heptachlor epoxide	1.4	ug/L	U	1.4	5.8
9/26/2005 11:00	Field Blank	BNA-Water	Hexachlorobenzene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Hexachlorobutadiene	2.9	ug/L	U	2.9	12
9/26/2005 11:00	Field Blank	BNA-Water	Hexachlorocyclopentadiene	2.9	ug/L	U	2.9	12
9/26/2005 11:00	Field Blank	BNA-Water	Hexachloroethane	2.9	ug/L	U	2.9	12
9/26/2005 11:00	Field Blank	BNA-Water	Indeno(1,2,3-cd)pyrene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Isophorone	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Naphthalene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Nitrobenzene	1.9	ug/L	U	1.9	7.7
9/26/2005 11:00	Field Blank	BNA-Water	N-Nitrosodimethylamine	1.9	ug/L	U	1.9	7.7
9/26/2005 11:00	Field Blank	BNA-Water	N-Nitrosodi-n-propylamine	1.9	ug/L	U	1.9	7.7
9/26/2005 11:00	Field Blank	BNA-Water	N-Nitrosodiphenylamine	2.9	ug/L	UJ	2.9	12
9/26/2005 11:00	Field Blank	BNA-Water	Pentachlorophenol	2.9	ug/L	U	2.9	12

Appendix 2. Chemical Analyses (continued)

Date Sampled	Field ID	Analysis	Component	Result	Units	Remark	MDL	PQL
9/26/2005 11:00	Field Blank	BNA-Water	Phenanthrene	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Phenol	0.96	ug/L	U	0.96	3.8
9/26/2005 11:00	Field Blank	BNA-Water	Pyrene	0.96	ug/L	U	0.96	3.8
9/26/2005 10:35	Outfall D-003	GC-Water	Alachlor	0.58	ug/L	U	0.58	2.3
9/26/2005 10:35	Outfall D-003	GC-Water	Ametryn	0.048	ug/L	U	0.048	0.19
9/26/2005 10:35	Outfall D-003	GC-Water	Atrazine	0.048	ug/L	U	0.048	0.19
9/26/2005 10:35	Outfall D-003	GC-Water	Azinphos Methyl	0.19	ug/L	U	0.19	0.76
9/26/2005 10:35	Outfall D-003	GC-Water	Bromacil	0.19	ug/L	U	0.19	0.76
9/26/2005 10:35	Outfall D-003	GC-Water	Butylate	0.19	ug/L	U	0.19	0.76
9/26/2005 10:35	Outfall D-003	GC-Water	Chlorpyrifos Ethyl	0.048	ug/L	U	0.048	0.19
9/26/2005 10:35	Outfall D-003	GC-Water	Chlorpyrifos Methyl	0.096	ug/L	U	0.096	0.38
9/26/2005 10:35	Outfall D-003	GC-Water	Diazinon	0.048	ug/L	U	0.048	0.19
9/26/2005 10:35	Outfall D-003	GC-Water	Ethion	0.048	ug/L	U	0.048	0.19
9/26/2005 10:35	Outfall D-003	GC-Water	Ethoprop	0.096	ug/L	U	0.096	0.38
9/26/2005 10:35	Outfall D-003	GC-Water	Fenamiphos	0.19	ug/L	U	0.19	0.76
9/26/2005 10:35	Outfall D-003	GC-Water	Fonofos	0.096	ug/L	U	0.096	0.38
9/26/2005 10:35	Outfall D-003	GC-Water	Hexazinone	0.096	ug/L	U	0.096	0.38
9/26/2005 10:35	Outfall D-003	GC-Water	Malathion	0.14	ug/L	UJ	0.14	0.56
9/26/2005 10:35	Outfall D-003	GC-Water	Metalaxyl	0.24	ug/L	U	0.24	0.96
9/26/2005 10:35	Outfall D-003	GC-Water	Metolachlor	0.48	ug/L	U	0.48	1.9
9/26/2005 10:35	Outfall D-003	GC-Water	Metribuzin	0.096	ug/L	U	0.096	0.38
9/26/2005 10:35	Outfall D-003	GC-Water	Mevinphos	0.19	ug/L	U	0.19	0.76
9/26/2005 10:35	Outfall D-003	GC-Water	Naled	0.77	ug/L	UJ	0.77	3.1
9/26/2005 10:35	Outfall D-003	GC-Water	Norflurazon	0.14	ug/L	U	0.14	0.56
9/26/2005 10:35	Outfall D-003	GC-Water	Parathion Ethyl	0.14	ug/L	U	0.14	0.56
9/26/2005 10:35	Outfall D-003	GC-Water	Parathion Methyl	0.096	ug/L	U	0.096	0.38
9/26/2005 10:35	Outfall D-003	GC-Water	Phorate	0.048	ug/L	U	0.048	0.19
9/26/2005 10:35	Outfall D-003	GC-Water	Prometryn	0.14	ug/L	U	0.14	0.56
9/26/2005 10:35	Outfall D-003	GC-Water	Simazine	0.048	ug/L	U	0.048	0.19
9/26/2005 10:35	Outfall D-003	Metals-Water	Aluminum	17	ug/L	I	10	40
9/26/2005 10:35	Outfall D-003	Metals-Water	Arsenic	19	ug/L	I	8	32
9/26/2005 10:35	Outfall D-003	Metals-Water	Cadmium	0.25	ug/L	U	0.25	1
9/26/2005 10:35	Outfall D-003	Metals-Water	Calcium	363	mg/L		0.1	0.4
9/26/2005 10:35	Outfall D-003	Metals-Water	Chromium	4	ug/L	U	4	16
9/26/2005 10:35	Outfall D-003	Metals-Water	Copper	1.03	ug/L		0.25	1
9/26/2005 10:35	Outfall D-003	Metals-Water	Iron	20	ug/L	U	20	80
9/26/2005 10:35	Outfall D-003	Metals-Water	Lead	0.38	ug/L	U	0.38	1.5

Appendix 2. Chemical Analyses (continued)

Date Sampled	Field ID	Analysis	Component	Result	Units	Remark	MDL	PQL
9/26/2005 10:35	Outfall D-003	Metals-Water	Magnesium	1.16E+03	mg/L		0.2	0.8
9/26/2005 10:35	Outfall D-003	Metals-Water	Nickel	4	ug/L	U	4	16
9/26/2005 10:35	Outfall D-003	Metals-Water	Selenium	6	ug/L	U	6	24
9/26/2005 10:35	Outfall D-003	Metals-Water	Silver	0.12	ug/L	U	0.12	0.5
9/26/2005 10:35	Outfall D-003	Metals-Water	Zinc	6	ug/L	U	6	24
9/26/2005 11:00	Field Blank	Metals-Water	Aluminum	5	ug/L	U	5	20
9/26/2005 11:00	Field Blank	Metals-Water	Arsenic	4	ug/L	U	4	16
9/26/2005 11:00	Field Blank	Metals-Water	Cadmium	0.05	ug/L	U	0.05	0.2
9/26/2005 11:00	Field Blank	Metals-Water	Calcium	0.05	mg/L	U	0.05	0.2
9/26/2005 11:00	Field Blank	Metals-Water	Chromium	2	ug/L	U	2	8
9/26/2005 11:00	Field Blank	Metals-Water	Copper	0.25	ug/L	U	0.25	1
9/26/2005 11:00	Field Blank	Metals-Water	Iron	10	ug/L	U	10	40
9/26/2005 11:00	Field Blank	Metals-Water	Lead	0.45	ug/L	U	0.45	1.8
9/26/2005 11:00	Field Blank	Metals-Water	Magnesium	0.01	mg/L	U	0.01	0.04
9/26/2005 11:00	Field Blank	Metals-Water	Nickel	2	ug/L	U	2	8
9/26/2005 11:00	Field Blank	Metals-Water	Selenium	0.5	ug/L	U	0.5	2
9/26/2005 11:00	Field Blank	Metals-Water	Silver	0.025	ug/L	U	0.025	0.1
9/26/2005 11:00	Field Blank	Metals-Water	Zinc	3	ug/L	U	3	12
9/26/2005 10:35	Outfall D-003	Nutrients-Liquid	Ammonia-N	0.099	mg N/L		0.02	0.04
9/26/2005 10:35	Outfall D-003	Nutrients-Liquid	Kjeldahl Nitrogen	0.62	mg N/L		0.12	0.4
9/26/2005 10:35	Outfall D-003	Nutrients-Liquid	NO2NO3-N	0.075	mg N/L		0.004	0.01
9/26/2005 10:35	Outfall D-003	Nutrients-Liquid	O-Phosphate-P	0.024	mg P/L		0.004	0.01
9/26/2005 10:35	Outfall D-003	Nutrients-Liquid	Total-P	0.028	mg P/L	I	0.02	0.06
9/26/2005 10:35	Outfall D-003	Nutrients-Liquid	TSS	8	mg/L	I	4	16
9/26/2005 11:00	Field Blank	Nutrients-Liquid	Ammonia-N	0.01	mg N/L	U	0.01	0.02
9/26/2005 11:00	Field Blank	Nutrients-Liquid	Kjeldahl Nitrogen	0.06	mg N/L	U	0.06	0.2
9/26/2005 11:00	Field Blank	Nutrients-Liquid	NO2NO3-N	0.004	mg N/L	I	0.004	0.01
9/26/2005 11:00	Field Blank	Nutrients-Liquid	O-Phosphate-P	0.004	mg P/L	U	0.004	0.01
9/26/2005 11:00	Field Blank	Nutrients-Liquid	Total-P	0.02	mg P/L	U	0.02	0.06

The Bioassay of Miami Seaquarium Marine Life Tanks and Flow-Through Seawater Disposal Facility effluent sampled on September 26, 2005. NPDES #FL0169129.

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 1 6 9 1 2 9 11	12 0 5 0 9 2 6	18 **B**	19 **S**	20 2

Remarks

66

The Priority Pollutants Analysis of Miami Seaquarium Marine Life Tanks and Flow-Through Seawater Disposal Facility effluent sampled on September 26, 2005. NPDES #FL0169129.

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 1 6 9 1 2 9 11	12 0 5 0 9 2 6	18 **X**	19 **S**	20 2

Remarks

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Biological Analyses of Miami Seaquarium Marine Life Tanks and Flow-Through Seawater Disposal Facility effluent sampled on September 26, 2005. NPDES #FL0169129.

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 1 6 9 1 2 9 11	12 0 5 0 9 2 6	18 **S**	19 **S**	20 2

Remarks

66