

SSOP-8530-0052-ENV Rev 7

February 2009



National Aeronautics and
Space Administration

John C. Stennis Space Center
Stennis Space Center, MS 39529-6000

JOHN C. STENNIS SPACE CENTER

SCIENCE LABORATORY ANNUAL SAMPLE PLAN

Standard Operating Procedure	SSOP-8530-0052-ENV	7
	<i>Number</i>	<i>Rev</i>
	Effective Date: February 18, 2009	
	Review Date: February 18, 2010	
Responsible Office: Science Laboratory Services		
SUBJECT: Science Laboratory Annual Sample Plan		

APPROVAL/CONCURRENCE

<u>T. Butler</u>	<u>2/18/09</u>	<u>Nestor Torres</u>	<u>3/02/09</u>
Originator	Date	Quality	Date
 <u>Al Watkins</u>	 <u>3/3/09</u>	 <u>Sharlene Majors</u>	 <u>2/28/09</u>
Supervisor	Date	Safety	Date
		 <u>Kimberlee Palmer</u>	 <u>3/05/09</u>
		NASA/SSC TechDoc	Date

Status/Change/Revision	Change Date	Originator/Phone	Description
0	01/26/2005	T. Butler/ 8-2065	Initial Release
1	2/2/05	T. Butler/8-2065	Corrected header
2	12/2005	T. Butler	Added new outfall and 2 new Area A wells for baseline. Also added underground storage tank groundwater monitoring. Added monthly pump and treat calibrations section.
3	4/2006	T. Butler	Added the Landfill Wells as a semi-annual sampling event. Added requirement for Field Scientist to look for presence of foam at all NPDES outfalls.
4	2/2007	T. Butler	Table H, EDB-DBCP was changed to Semi-Annual Sampling, other minor spelling etc. revisions.
5	8/2007	T. Butler	Building 2418 changed to 2413
6	4/2008	T. Butler	Added MW-1 & MW-B to Annual monitoring list, reduced discretionary monitoring frequency per NASA direction
7	2/18/2009	T. Butler	Made changes in accordance to Long Term and Operational Monitoring Plan May 2008

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Safety Hazards Involved Yes No

1.0 Scope

The purpose of the plan is to document the planned annual sampling events for the Science Laboratory.

2.0 Applicability

This procedure applies to all laboratory personnel.

3.0 References¹

Mississippi Department of Environmental Quality, State of Mississippi Water Pollution Control Permit, May 3, 2004 – April 30, 2009

Long Term and Operational Monitoring Requirements, May 2008

Groundwater Monitoring System Plan for Solid Waste Management, March 2007

Current Microbiological and Disinfection Byproduct Sample Site Plan

SSP-8730-0001, AGT Safety and Health Plan

¹ *All references are to be the latest version unless otherwise indicated*

4.0 Roles and Responsibilities

It is the responsibility of laboratory management to work closely with NASA Environmental office to maintain and track this document. The sample plan is very dynamic and changes per NASA's requirements. All changes should be tracked and documented in this procedure.

As applicable during the support of this plan, Applied Geo Technologies, Inc. (AGT) Laboratory Sciences personnel shall follow safety and health requirements per SSP-8730-0001, *AGT Safety and Health Plan*.

5.0 Procedure

Sample Plan follows on the following pages:

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Part I: Discretionary Runoff Monitoring Sampling Schedule for FY 2005

Currently, SSC Science Laboratory Services collects and analyzes four (4) points for runoff contamination. Non-point sources (run-off) include agricultural runoff, mine drainage, urban and highway runoff, and runoff from lawns and natural areas. Non-point source pollution accounts for 80 percent of the degradation of waters in the United States. If left unchecked, non-point source pollution can damage the quality of receiving surface and ground waters. The table below lists the collection points, frequency, and analytical parameters of interest.

Table A: Runoff

Runoff Water		Collection Sites					
Method Numbers	Parameters	Army Ditch	Landfill Ditch	Pearl River North	Pearl River South	Total	Analysis
		(parameters and frequency)	(parameters and frequency)	(parameters and frequency)	(parameters and frequency)		
360.1	DO	0	0	2	2	4	
SM2550B	Temperature	4	1	2	2	9	
150.1	PH	4	1	2	2	9	
405.1	BOD	4	1	2	2	9	
160.2	TSS	4	1	2	2	21	
SM 2540C	TDS	4	1	2	2	21	
SM9222D	Fecal Coliform	0	0	2	2	4	
351.3	TKN	4	1	2	2	9	
300	NO3	0	0	2	2	4	
300	SO4	0	0	2	2	4	
300	FI	0	0	2	2	4	
300	CI	0	0	2	2	4	
180.1	Turbidity	0	0	2	2	4	
SM 2510B	Conductivity	0	0	2	2	4	
200.7	Metals I *	4	1	2	2	9	
8260b	VOC	4	1	2	2	9	
415.2	TOC	4	1	2	2	9	

- **Metals I** list consists of the following metals: Silver, Cadmium, Chromium, Copper, Nickel, Total Phosphorus, Lead, and Zinc

Part II: NPDES Schedule of Sampling Events

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. In most cases, the NPDES permit program is administered by authorized states. Since its introduction in 1972, the NPDES permit program is responsible for significant improvements to our

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Nation's water quality. Currently SSC has one NPDES permit, number MS0021610. The current permit became effective May 3, 2004 and will remain until April 9, 2009.

The permit authorized discharge from outfalls **001**, (sanitary Wastewater, Cooling Water, Landfill Leachate, Wash Water and Wastewater from Pump and Treat), **002**, (sanitary Wastewater, Cooling Water, Landfill Leachate, Wash Water and Wastewater from Pump and Treat) **Outfall 008** (Sanitary Wastewater), **010** (Sanitary Wastewater), **011** (Deluge Water from Rocket Test Stands). A copy of the permit is maintained by both the laboratory and NASA environmental office. The table below lists the permitted collection points, frequency, and analytical parameters of interest. Field Scientists have been informed to look for the presence of foam at all Effluent Outfalls. If visible foam is present a notation will be made in the field log and the FOOSC Environmental contractors will be notified via phone or e-mail.

Table B: 001 Permitted Outfall

Analytical Methodology		Outfall 001	Outfall 001	Outfall 001	
EPA Method Numbers		(Lagoon 1)	(Lagoon 1)	(Lagoon 1)	Totals
		Influent	Eff Composite	Effluent	
<i>n/a</i>	Flow Rate	0	0	52	52
<i>150.1</i>	pH	2	0	52	54
<i>SM2550B</i>	Temp	2	0	52	54
<i>405.1</i>	BOD	2	*26	0	54
<i>160.2</i>	TSS	2	*26	0	54
<i>SM9222D</i>	Fecal Coliform	0	0	*26	52
<i>10-204-00-1-X</i>	Total Cyanide	0	0	52	52
<i>200.9</i>	Total Silver	0	0	52	52
<i>SM 2540C</i>	TDS	2	2	0	4
<i>351.3</i>	TKN	2	2	0	4
<i>365.3</i>	TP	2	2	0	4
<i>350.3</i>	NH3	2	0	2	6
<i>200.7</i>	Metals I	2	2	0	4
<i>415.2</i>	TOC	2	2	0	4

* This number of collections is listed as a minimum

* **Metals I** list consists of the following metals, at a minimum: Silver, Cadmium, Chromium, Copper, Nickel, Total Phosphorus, Lead, and Zinc

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Table C: 002 Permitted Outfall

* This number of collections is listed as a minimum

EPA		Outfall 002	Outfall 002	Outfall 002	Totals
Method Numbers		(Lagoon 2) Influent	(Lagoon 2) Eff Composite	(Lagoon 2) Effluent	
n/a	Flow Rate	0	0	*26	52
150.1	pH	2	0	*26	54
SM2550B	Temp	2	0	*26	54
405.1	BOD	2	*26	0	54
160.2	TSS	2	*26	0	54
SM9222D	Fecal Coliform	0	0	*26	52
SM 2540C	TDS	2	2	0	4
351.3	TKN	2	2	0	4
365.3	TP	2	2	0	4
350.3	NH3	2	0	2	6
200.7	Metals I	2	2	0	4
415.2	TOC	2	2	0	4

Table D: 008 Permitted Outfall

EPA		Outfall 008	Outfall 008	Totals
Method Numbers		(South Gate) Effluent	Composite	
n/a	Flow Rate	2		2
150.1	pH	2		2
SM2550B	Temp	2		2
405.1	BOD		2	2
160.2	TSS		2	2
SM9222D	Fecal Coliform	2		2
SM 2540C	TDS		2	2
351.3	TKN		2	2
365.3	TP		2	2
350.3	NH3	2		2
200.7	Metals I		2	2
415.2	TOC		2	2

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Table E: 010 Permitted Outfall

EPA		Outfall 010 Effluent	Outfall 010 Composite	Totals
Method		(South Gate)		
Numbers				
<i>n/a</i>	Flow Rate	2		2
<i>150.1</i>	pH	2		2
<i>SM2550B</i>	Temp	2		2
<i>405.1</i>	BOD		2	2
<i>160.2</i>	TSS		2	2
<i>SM9222D</i>	Fecal Coliform	2		2
<i>SM 2540C</i>	TDS		2	2
<i>351.3</i>	TKN		2	2
<i>365.3</i>	TP		2	2
<i>350.3</i>	NH3	2		2
<i>200.7</i>	Metals I		2	2
<i>415.2</i>	TOC		2	2

- **Aluminum and Iron** are required per the compliance Schedule Section of the permit. After 12 collections at a suggested frequency of once a month (SSC lab collects twice a month) Section V part B should be resubmitted to include monitoring results. (June 2005). **This was completed and submitted to FOSC environmental in July 2005. Per conversation with Jenette Gordon – the aluminum and Iron collections will continue for the duration of the permit. Tbutler 2/2007**
- **Aluminum and Iron** were disregarded as discretionary monitoring - permit requirements were met back in 2005, and results did not indicate a potential problem with these metals. 4/2008 tbutler

Table F: 011/Spillway Permitted Outfall *

Analytical Methodology		Outfall 011*	Outfall 011 Composite	Total Samples
EPA				
Method				
Numbers				
<i>n/a</i>	Flow Rate	**estimation		0
<i>150.1</i>	pH	24		24
<i>SM2550B</i>	Temp	24		24
<i>160.2</i>	TSS	24		24
<i>1664</i>	Oil and Grease	24		24

- **011 outfall** is collected twice a month in the canal near the spillway. Outfall 011 replaces the discretionary sample formerly referred to as the monthly spillway sample.
- **Flow data** is received from the water plant twice a month and entered into the report as an estimation.

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Table G: Discretionary Locks Sampling

Analytical Methodology

<i>EPA Method Numbers</i>		Locks	Total Samples
<i>150.1</i>	pH	4	4
<i>160.2</i>	TSS	4	4
<i>SM2550B</i>	Temp	4	4
<i>1664</i>	Oil and Grease	4	4

Part III: Drinking Water Sampling Schedule

Currently NASA monitors site drinking water monthly for a variety of primary and secondary analytes. The Mississippi State Department of Health submits sample containers for required collections of volatiles, Haloacetic acids, and Trihalomethanes on a quarterly basis. All such samplings are analyzed in-house resulting in a split sample.

Upon receipt of the report from the state, the results are compared for accuracy and reproducibility. Every three years, lead and copper samplings are required to be sent to the state office for analysis. The State provides the written instructions and the sample containers which must be sent back to the state for analysis. NASA has a Lead and Copper Plan, and the plan is available on file with the NASA Environmental Office. An unofficial copy of the plan is available on file in the laboratory.

In addition to the required state split samplings, Science laboratory Services collects monthly drinking water samples from 18 locations. The following table contains building numbers collected monthly, frequency of sampling, and parameters analyzed from each collection point. The sample locations are spread out throughout the month instead of collected all at once. The Total Coliform rule is driving the weekly collections rather than one sampling event due to population of Stennis. The Microbiological sample plan and a letter was submitted and approved by the state detailing the schedule of drinking water collections, a copy of the letter is on file with Laboratory management.

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Table H: Drinking Water

EPA	Parameters	Location	Location	Location	Location	Location	Location
Method Numbers		B4400	B1100	B3312	B7001	B3101	B2425
		Reservoir	Kitchen	Main Well #1	North Gate	South Gate	Rouchon
<i>SM2550B</i>	Temperature	12	12	12	12	12	12
<i>SM9222B</i>	Total Coliform	12	12	12	12	12	12
<i>SM4500-Cl G</i>	Residual Cl	12	12	12	12	12	12
<i>150.1</i>	pH	12	12	12	12	12	12
<i>405.1</i>	BOD	2	2	2	2	2	2
<i>160.2</i>	TSS	2	2	2	2	2	2
<i>SM 2540C</i>	TDS	2	2	2	2	2	2
<i>351.3</i>	TKN	2	2	2	2	2	2
<i>365.3</i>	TP	2	2	2	2	2	2
<i>300</i>	NO3	2	2	2	2	2	2
<i>300</i>	SO4	2	2	2	2	2	2
<i>300</i>	FI	2	2	2	2	2	2
<i>300</i>	Cl	2	2	2	2	2	2
<i>180.1</i>	Turbidity	2	2	2	2	2	2
<i>200.7 / 200.9</i>	Metals	2	2	2	2	2	2
<i>525.2</i>	SEMIS	2	2	2	2	2	2
<i>524.2</i>	THM	4	4	4	4	4	4
<i>524.2</i>	VOC	12	12	12	12	12	12
<i>415.2</i>	TOC	2	2	2	2	2	2
<i>4500CLO2d</i>	Chlorine Dioxide*	12	12	12	12	12	12
	Chloramine	12	12	12	12	12	12
<i>552.1</i>	Haloacetic Acids	4	4	4	4	4	4
<i>300</i>	Bromide	2	2	2	2	2	2
<i>300</i>	Nitrite	2	2	2	2	2	2
<i>300</i>	Phosphate	2	2	2	2	2	2
<i>300.1</i>	Chlorate	2	2	2	2	2	2
<i>300.1</i>	Chlorite	12	12	12	12	12	12
<i>300.1</i>	Bromate	12	12	12	12	12	12
<i>504.1</i>	EDB/DBCP	2	2	2	2	2	2

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Table H: Drinking Water Cont'd

EPA	Parameters	Location	Location	Location	Location	Location	Location
Method		B2411	B1009	B3202	B4120	B4220	B1002
Numbers		Cypress House	NRL Area	Boeing SSME	A-1 Stand	B-1 Stand	Navo
<i>SM2550B</i>	Temperature	12	12	12	12	12	12
<i>SM9222B</i>	Total Coliform	12	12	12	12	12	12
<i>SM4500-Cl G</i>	Residual Cl	12	12	12	12	12	12
<i>150.1</i>	pH	12	12	12	12	12	12
<i>405.1</i>	BOD	2	2	2	2	2	2
<i>160.2</i>	TSS	2	2	2	2	2	2
<i>SM 2540C</i>	TDS	2	2	2	2	2	2
<i>351.3</i>	TKN	2	2	2	2	2	2
<i>365.3</i>	TP	2	2	2	2	2	2
<i>300</i>	NO3	2	2	2	2	2	2
<i>300</i>	SO4	2	2	2	2	2	2
<i>300</i>	FI	2	2	2	2	2	2
<i>300</i>	Cl	2	2	2	2	2	2
<i>180.1</i>	Turbidity	2	2	2	2	2	2
<i>200.7 / 200.9</i>	Metals	2	2	2	2	2	2
<i>525.2</i>	SEMIS	2	2	2	2	2	2
<i>524.2</i>	THM	4	4	4	4	4	4
<i>524.2</i>	VOC	12	12	12	12	12	12
<i>415.2</i>	TOC	2	2	2	2	2	2
<i>4500CLO2d</i>	Chlorine Dioxide*	12	12	12	12	12	12
	Chloramine	12	12	12	12	12	12
<i>552.1</i>	Haloacetic Acids	4	4	4	4	4	4
<i>300</i>	Bromide	2	2	2	2	2	2
<i>300</i>	Nitrite	2	2	2	2	2	2
<i>300</i>	Phosphate	2	2	2	2	2	2
<i>300.1</i>	Chlorate	2	2	2	2	2	2
<i>300.1</i>	Chlorite	12	12	12	12	12	12
<i>300.1</i>	Bromate	12	12	12	12	12	12
<i>504.1</i>	EDB/DBCP	2	2	2	2	2	2

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EPA	Parameters	Location	Location	Location	Location	Location	Location
Method Numbers		B3407	B2437	B2201	B8201	B5005	B5100
		CRYO	Magnetics	Fire Dept.	Horn Bldg	ASRM	LMTO
<i>SM2550B</i>	Temperature	12	12	12	12	12	12
<i>SM9222B</i>	Total Coliform	12	12	12	12	12	12
<i>SM4500-C1 G</i>	Residual Cl	12	12	12	12	12	12
<i>150.1</i>	pH	12	12	12	12	12	12
<i>405.1</i>	BOD	2	2	2	2	2	2
<i>160.2</i>	TSS	2	2	2	2	2	2
<i>SM 2540C</i>	TDS	2	2	2	2	2	2
<i>351.3</i>	TKN	2	2	2	2	2	2
<i>365.3</i>	TP	2	2	2	2	2	2
<i>300</i>	NO3	2	2	2	2	2	2
<i>300</i>	SO4	2	2	2	2	2	2
<i>300</i>	Fl	2	2	2	2	2	2
<i>300</i>	Cl	2	2	2	2	2	2
<i>180.1</i>	Turbidity	2	2	2	2	2	2
<i>200.7 / 200.9</i>	Metals	2	2	2	2	2	2
<i>525.2</i>	SEMIS	2	2	2	2	2	2
<i>524.2</i>	THM	4	4	4	4	4	4
<i>524.2</i>	VOC	12	12	12	12	12	12
<i>415.2</i>	TOC	2	2	2	2	2	2
<i>4500CLO2d</i>	Chlorine Dioxide*	12	12	12	12	12	12
	Chloramine	12	12	12	12	12	12
<i>552.1</i>	Haloacetic Acids	4	4	4	4	4	4
<i>300</i>	Bromide	2	2	2	2	2	2
<i>300</i>	Nitrite	2	2	2	2	2	2
<i>300</i>	Phosphate	2	2	2	2	2	2
<i>300.1</i>	Chlorate	2	2	2	2	2	2
<i>300.1</i>	Chlorite	12	12	12	12	12	12
<i>300.1</i>	Bromate	12	12	12	12	12	12
<i>504.1</i>	EDB/DBCP	2	2	2	2	2	2

Part IV: Landfill monitoring

NASA has tasked the laboratory with monitoring of the SSC Landfill per the SSC document, Groundwater Monitoring System Plan for Solid Waste Management. The laboratory follows the guidelines established in this document. Currently, monitoring consists of 15 shallow wells. The sampling frequency has been reduced to a semi-annual collection.

Table I lists the analytical parameters and well identifications associated with the landfill monitoring activities.

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Table I: Semi-annual Landfill Monitoring * Full list of parameters listed in the Groundwater Monitoring System Plan for Solid Waste Management

EPA Method Numbers	Parameters	location	location	location	location	location	location	location	location
		**02-01MW	02-03MW	02-04MW	02-05MW	02-13MW	02-20MW	02-21MW	02-22MW
150.1	pH	2	2	2	2	2	2	2	2
SM 2510B	Conductivity	2	2	2	2	2	2	2	2
SM2550B	Temperature	2	2	2	2	2	2	2	2
200.7, 200.9	Metals*	2	2	2	2	2	2	2	2
8260b	VOCs*	2	2	2	2	2	2	2	2
8150A	Herbicides*	2	2	2	2	2	2	2	2
8081/80 82	Pesticides*	2	2	2	2	2	2	2	2
	Water Level	2	2	2	2	2	2	2	2

** April 2006, it was discovered that MW 02-01 was destroyed during storm clean-up efforts

EPA Method Numbers	Parameters	location	location	location	location	location	location	location
		02-23MW	**02-24MW	02-25MW	02-26MW	02-27MW	02-28MW	02-29MW
150.1	pH	2	2	2	2	2	2	2
SM 2510B	Conductivity	2	2	2	2	2	2	2
SM2550B	Temperature	2	2	2	2	2	2	2
200.7, 200.9	Metals*	2	2	2	2	2	2	2
8260b	VOCs*	2	2	2	2	2	2	2
8150A	Herbicides	2	2	2	2	2	2	2
8081/80 82	Pesticides	2	2	2	2	2	2	2
	Water Level	2	2	2	2	2	2	2

** Monitoring Well 02-24 destroyed sometime between April 2008 collection and the October 2008 collection it is believed to be due to logging activity

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Part V: Waste characterization

Nearly everything we do leaves behind some kind of waste. Industrial and manufacturing processes create solid and hazardous waste. The Office of Solid Waste (OSW) regulates all this waste under the Resource Conservation and Recovery Act (RCRA).

RCRA's goals are to:

1. Protect humans from the hazards of waste disposal
2. Conserve energy and natural resources by recycling and recovery
3. Reduce or eliminate waste, and
4. Clean up waste, which may have spilled, leaked, or been improperly disposed.

Hazardous waste comes in many shapes and forms. RCRA tightly regulates all hazardous waste from "cradle to grave." RCRA also controls garbage and industrial waste. Common garbage is municipal waste, which consists mainly of paper, yard trimmings, glass, and other materials. Industrial waste is process waste that comes from a broad range of operations. Some wastes are managed by other federal agencies or state laws. Examples of such wastes are animal waste, radioactive waste, and medical waste.

Stennis Space Center is responsible for proper management of waste generated by NASA operations and all contractors. Process knowledge is used for managing some waste streams; however, analysis is necessary when the process knowledge is not sufficient for waste characterization. Leachate testing is performed on a variety of wastes. Such wastes streams consists of, but are not limited to, soils, waters, waste oils, used antifreeze, and spent carbon filters. The purpose for testing is to estimate the leaching potential of constituents of concern to water sources. It is important to estimate leaching potential in order to accurately estimate the quantity of chemicals that could potentially reach groundwater or surface water resources. (Drinking water supply wells, waters used for recreation) Each year, the laboratory analyzes a wide variety of unknown wastes for characterization and disposal purposes. NASA places thirty (30) TCLP analyses in our sample plan automatically every year to cover such characterizations. **The Table below lists the TCLP regulatory analytes and the limits:**

Table J: TCLP REGULATORY LIMITS

<i>Mettals</i>	<i>Reg. Limit</i>	<i>Volatiles</i>	<i>Reg. Limit</i>	<i>Semivolatiles</i>	<i>Reg. Limit</i>
Arsenic	5.0 mg/L	Benzene	0.50 mg/L	o-Cresol	200 mg/L
Barium	100 mg/L	Carbon Tetrachloride	0.50 mg/L	m-Cresol	200 mg/L
Cadmium	1.0 mg/L	Chlorobenzene	100 mg/L	p-Cresol	200 mg/L
Chromium	5.0 mg/L	Chloroform	6.0 mg/L	1,4 Dichlorobenzene	7.5 mg/L
Lead	5.0 mg/L	1,4 Dichlorobenzene	7.5 mg/L	2,4 Dichlorobenzene	0.13 mg/L
Mercury	0.2 mg/L	1,2 Dichlorobenzene	0.50 mg/L	Hexachlorobenzene	0.13 mg/L

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Selenium 1.0 mg/L 2 Butanone, MEK Hexachloroethane 3.0 mg/L
200 mg/L

Table J: TCLP REGULATORY LIMITS Cont'd

<i>Metals</i>	<i>Reg. Limit</i>	<i>Volatiles</i>	<i>Reg. Limit</i>	<i>Semivolatiles</i>	<i>Reg. Limit</i>
Silver	5.0 mg/L	Tetrachloroethylene	0.70 mg/L	Nitrobenzene	2.0 mg/L
		Trichloroethylene	0.50 mg/L	Pentachlorophenol	100 mg/L
		Vinyl Chloride	0.20	Pyridine	5.0 mg/L
				2,4,5, Trichlorophenol	400 mg/L
				2,4,6, Trichlorophenol	2.0 mg/L

Other Hazardous Waste Characterizations performed in the laboratory include:

Method 9010B, Reactive Cyanide, Method 9215, Reactive Sulfide, Method 1010 Flashpoint/Ignitability, Method 150.1 Corrosivity

UNDERGROUND STORAGE TANK GROUNDWATER MONITORING:

Currently, our laboratory is tasked with an annual collection of three monitoring wells near underground storage tanks. There are four wells near the gas pumps at building 2201: G-1, G-2, G3 and G4, and one well at building 2501, B-1. These five wells are collected and analyzed for volatiles and TOC on an annual basis, usually during the month of November and reported in the December NPDES deliverable, EN03. In addition, instructions were given in March of 2008 to begin collecting and analyzing two other wells for volatiles: MW-1 and MW-B located at the NEXCOM station, formerly APG. These will be collected annually during the first quarter of the calendar year.

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Part VI: Area A – Air Force Disposal Site and Pesticide Operations

Groundwater remediation for Area A includes using a RCRA Cap/Barrier Wall and Passive Treatment Wall. Remedial duration for Area A began May 2002 and will end August 2008.

Sampling during the remedial duration which was conducted under previous LTOMPs was conducted quarterly for the first year and annually thereafter. Samples were analyzed for VOCs and water quality parameters. Samples were also analyzed for SVOCs and perchlorates on a quarterly basis for one year, April 2003-April 2004). Groundwater samples from select wells were also analyzed for dioxins.

When present, groundwater seep, sediment, and surface water samples were collected and analyzed during the remediation period to monitor the discharge of contaminants to Mike's River and the associated ecological risks. The surface water and sediment samples were taken from the same area.

During post-remediation, which is set to begin August 2009, the following wells in WBZ-1 will be sampled: 07-107MW and 07-139MW will monitor up gradient and down gradient of Plume A, respectively; and 07-04MW and 07-136MW will monitor up gradient and down gradient of Plume B, respectively. For WBZ-2, monitor wells 07-113MW and 07-135MW will be used to monitor up gradient of Plume C, and well 07-133MW will be used to monitor down gradient of Plume C. Wells 07-121MW (WBZ-1) and 07-122MW (WBZ-2) will be used to monitor background data.

Table K: Area A Monitoring Wells – Post Remediation

<i>EPA Method Numbers</i>	<i>Water Bearing Zone 1 Method Description</i>	<i>Well ID 07-04</i>	<i>Well ID 07-107</i>	<i>Well ID 07-121</i>	<i>Well ID 07-136</i>	<i>Well ID 07-139</i>
	Dioxin Analysis*	1	1	1	1	1
8260b	VOC	1	1	1	1	1
150.1	pH	1	1	1	1	1
SM2550.B	Temperature	1	1	1	1	1
SM 2510B	Conductivity	1	1	1	1	1
SM2580.B	REDOX	1	1	1	1	1
SM 20TH ED 2320B	Alkalinity	1	1	1	1	1
360.1	Dissolved Oxygen	1	1	1	1	1
180.1	Turbidity	1	1	1	1	1
SM 2540C	Total Dissolved Solids	1	1	1	1	1
160.2	Total Suspended Solids	1	1	1	1	1
300	Chloride	1	1	1	1	1
200.7	Total Phosphorus	1	1	1	1	1
300	Ortho-Phosphate	1	1	1	1	1
410.4	Filtered COD	1	1	1	1	1
410.4	Non Filtered COD	1	1	1	1	1
2150	Ferrous Iron	1	1	1	1	1
<i>EPA Method Numbers</i>	<i>Water Bearing Zone 2 Method Description</i>	<i>Well ID 07-113</i>	<i>Well ID 07-122</i>	<i>Well ID 07-133</i>	<i>Well ID 07-135</i>	
	Dioxin Analysis*	1	1	1	1	
8260b	VOC	1	1	1	1	

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150.1	pH	1	1	1	1
SM2550.B	Temperature	1	1	1	1
SM 2510B	Conductivity	1	1	1	1
SM2580.B	REDOX	1	1	1	1
SM 20TH ED 2320B	Alkalinity	1	1	1	1
360.1	Dissolved Oxygen	1	1	1	1
180.1	Turbidity	1	1	1	1
SM 2540C	Total Dissolved Solids	1	1	1	1
160.2	Total Suspended Solids	1	1	1	1
300	Chloride	1	1	1	1
200.7	Total Phosphorus	1	1	1	1
300	Ortho-Phosphate	1	1	1	1
410.4	Filtered COD	1	1	1	1
410.4	Non Filtered COD	1	1	1	1
2150	Ferrous Iron	1	1	1	1

Part VII: Area B Remediation Monitoring

Groundwater monitoring at Area B consists of sampling 18 existing monitoring wells, 8 extraction wells, and 11 additional monitoring wells in WBZ-1 as shown on Table 3. Well locations are shown on Figure 2 of the Appendix. Twelve of the existing monitoring wells are located in WBZ-1 and the other six are located in WBZ-2. The extraction wells are located in WBZ-1. All of the groundwater wells were sampled once at startup of the groundwater treatment system. Sampling during the remedial duration which was conducted under previous LTOMPs was conducted quarterly. Samples were also analyzed for SVOCs and perchlorates on a quarterly basis for one year, April 2003-April 2004).

Beginning Calendar year 2009, an additional 5 years of remediation were added to Area B. All existing wells will continue to be sampled but the frequency has been reduced from quarterly down to semi-annually. New wells in water bearing zone 1 were added for the duration of the 5 year remedial period. The new wells will be sampled quarterly for 2 years, and will then be reduced to semi-annual collection beginning calendar year 2011.

See Table L1 and L2 below for monitoring well identification, sampling frequency, and parameters.

Table L1: Area B Monitoring Wells (Semi-Annual collections)

EPA	Water Bearing Zone	WBZ-1						
Method	Well Identification:	12-03	12-05	12-06	12-07	12-11	18-09	18-07
Numbers								
8260b	VOC	2	2	2	2	2	2	2
200.7	Dissolved Iron	2	2	2	2	2	2	2
405.1	BOD	2	2	2	2	2	2	2
415.2	TOC	2	2	2	2	2	2	2
EPA Tech. Paper	Methane	2	2	2	2	2	2	2
EPA Tech. Paper	Ethane	2	2	2	2	2	2	2
EPA Tech. Paper	Ethylene	2	2	2	2	2	2	2
200.7	Cations	2	2	2	2	2	2	2
SM 4500-S ² F	Sulfide	2	2	2	2	2	2	2
300	Nitrates	2	2	2	2	2	2	2

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	150.1	pH	2	2	2	2	2	2	2
SM2550B		Temperature	2	2	2	2	2	2	2
SM 2510B		Conductivity	2	2	2	2	2	2	2
SM2580.B		REDOX	2	2	2	2	2	2	2
SM 2320B		Alkalinity	2	2	2	2	2	2	2
	360.1	Dissolved Oxygen	2	2	2	2	2	2	2
	180.1	Turbidity	2	2	2	2	2	2	2
SM 2540C		TDS	2	2	2	2	2	2	2
	160.2	TSS	2	2	2	2	2	2	2
	300	Chloride	2	2	2	2	2	2	2
	200.7	Total Phosphorus	2	2	2	2	2	2	2
	300	Ortho-Phosphate	2	2	2	2	2	2	2
	410.4	Filtered COD	2	2	2	2	2	2	2
	410.4	Non Filtered COD	2	2	2	2	2	2	2
	2150	Ferrous Iron	2	2	2	2	2	2	2
		Water Level	2	2	2	2	2	2	2

Table L1: Area B Monitoring Wells (Semi-annual Collections) Cont'd

EPA Method		WBZ-2	WBZ-2	WBZ-2	WBZ-2	WBZ-2	WBZ-2	WBZ-1
Numbers	Well ID:	14-Dec	20-Dec	18-12	18-13	18-16	18-17	EX-1 thru EX- 8
8260b	VOC	2	2	2	2	2	2	2
200.7	Dissolved Iron	2	2	2	2	2	2	2
405.1	BOD	2	2	2	2	2	2	2
415.2	TOC	2	2	2	2	2	2	2
	Methane	2	2	2	2	2	2	2
	Ethane	2	2	2	2	2	2	2
	Ethylene	2	2	2	2	2	2	2
200.7	Cations	2	2	2	2	2	2	2
SM 4500-S ² F	Sulfide	2	2	2	2	2	2	2
300	Nitrates	2	2	2	2	2	2	2
150.1	pH	2	2	2	2	2	2	2
SM2550B	Temperature	2	2	2	2	2	2	2
SM 2510B	Conductivity	2	2	2	2	2	2	2
SM2580.B	REDOX	2	2	2	2	2	2	2
SM ED 2320B	Alkalinity	2	2	2	2	2	2	2
360.1	Dissolved Oxygen	2	2	2	2	2	2	2
180.1	Turbidity	2	2	2	2	2	2	2
SM 2540C	TDS	2	2	2	2	2	2	2
160.2	TSS	2	2	2	2	2	2	2
300	Chloride	2	2	2	2	2	2	2
200.7	Total Phosphorus	2	2	2	2	2	2	2
300	Ortho-Phosphate	2	2	2	2	2	2	2
410.4	Filtered COD	2	2	2	2	2	2	2
410.4	Non Filtered COD	2	2	2	2	2	2	2
2150	Ferrous Iron	2	2	2	2	2	2	2
	Water Level	2	2	2	2	2	2	2

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Table L2: Area B Monitoring Wells (Quarterly Collections)

EPA Method Numbers	Water Bearing Zone 1 Method Description	Well Id 12-08	Well Id 12-10	Well Id 12-15	Well Id 12-16	Well Id 12-17	Well Id 18-04	Well Id 18-06	Well Id 18-10	Well Id 18-11	Well Id 18-14	Well Id 19-C
8260b	VOC	4	4	4	4	4	4	4	4	4	4	4
200.7	Dissolved Iron	4	4	4	4	4	4	4	4	4	4	4
405.1	BOD	4	4	4	4	4	4	4	4	4	4	4
415.2	TOC	4	4	4	4	4	4	4	4	4	4	4
EPA Tech. Paper	Methane	4	4	4	4	4	4	4	4	4	4	4
EPA Tech. Paper	Ethane	4	4	4	4	4	4	4	4	4	4	4
EPA Tech. Paper	Ethylene	4	4	4	4	4	4	4	4	4	4	4
200.7	Cations	4	4	4	4	4	4	4	4	4	4	4
SM 4500-S ² F	Sulfide	4	4	4	4	4	4	4	4	4	4	4
300	Nitrates	4	4	4	4	4	4	4	4	4	4	4
150.1	pH	4	4	4	4	4	4	4	4	4	4	4
SM2550B	Temperature	4	4	4	4	4	4	4	4	4	4	4
SM 2510B	Conductivity	4	4	4	4	4	4	4	4	4	4	4
SM2580.B	REDOX	4	4	4	4	4	4	4	4	4	4	4
SM ED 2320B	Alkalinity	4	4	4	4	4	4	4	4	4	4	4
360.1	Dissolved Oxygen	4	4	4	4	4	4	4	4	4	4	4
180.1	Turbidity	4	4	4	4	4	4	4	4	4	4	4
SM 2540C	TDS	4	4	4	4	4	4	4	4	4	4	4
160.2	TSS	4	4	4	4	4	4	4	4	4	4	4
300	Chloride	4	4	4	4	4	4	4	4	4	4	4
200.7	Total Phosphorus	4	4	4	4	4	4	4	4	4	4	4
300	Ortho-Phosphate	4	4	4	4	4	4	4	4	4	4	4
410.4	Filtered COD	4	4	4	4	4	4	4	4	4	4	4
410.4	Non Filtered COD	4	4	4	4	4	4	4	4	4	4	4
2150	Ferrous Iron	4	4	4	4	4	4	4	4	4	4	4
	Water Level	4	4	4	4	4	4	4	4	4	4	4

Part VIII: Area C Remediation Monitoring

Area C groundwater monitoring consists of the sampling and analysis of eleven (11) existing monitoring wells and five (5) extraction wells. Upon start-up of the pump and treat facility in February 2002, all monitoring wells were collected and analyzed. Quarterly samplings have continued and are scheduled for review in 2015. The Table below lists the Sampling Frequency, well identifications, and parameters of interest for the monitoring wells associated with area C:

First five year review conducted in November 2007 resulted in a reduction from quarterly sampling of the monitoring wells at Area C down to semi-annual sampling beginning Calendar year 2009. Semi-annual collections to continue in accordance to the current LTOMP.

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Table O2: Area E Monitoring Wells (Quarterly collection):

EPA	Well ID:	WBZ-1	WBZ-1	WBZ-1	WBZ-1	WBZ-2
		37-06	37-10	37-11	37-15	37-18
<i>Method</i>						
8260b	VOC	4	4	4	4	4
150.1	pH	4	4	4	4	4
SM2550B	Temperature	4	4	4	4	4
SM 2510B	Conductivity	4	4	4	4	4
SM2580.B	REDOX	4	4	4	4	4
SM 2320B	Alkalinity	4	4	4	4	4
360.1	Dissolved Oxygen	4	4	4	4	4
180.1	Turbidity	4	4	4	4	4
SM 2540C	TDS	4	4	4	4	4
160.2	TSS	4	4	4	4	4
300	Chloride	4	4	4	4	4
200.7	Total Phosphorus	4	4	4	4	4
300	Ortho-Phosphate	4	4	4	4	4
410.4	Filtered COD	4	4	4	4	4
410.4	Non Filtered COD	4	4	4	4	4
2150	Ferrous Iron	4	4	4	4	4
	Water Level	4	4	4	4	4

Part XI: Area F Remediation Monitoring

Area F consists of sampling and analysis of 19 existing monitoring wells and four extraction wells. Contaminated groundwater from Area F is transported to the pump and treat facility at B2211. Startup of Area F wells began in June 2004, at which time the wells were sampled. Quarterly sampling is scheduled during the remedial duration of 2 years. The data will be evaluated in June 2006, and pumping will continue until VOC concentrations level off.

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SM2580.B	REDOX		2	2	2	2	2	2	2	2	2	2	2
SM 20TH ED 2320B	Alkalinity		2	2	2	2	2	2	2	2	2	2	2
360.1	Dissolved Oxygen		2	2	2	2	2	2	2	2	2	2	2
180.1	Turbidity		2	2	2	2	2	2	2	2	2	2	2
SM 2540C	Total Dissolved Solids		2	2	2	2	2	2	2	2	2	2	2
160.2	Total Suspended Solids		2	2	2	2	2	2	2	2	2	2	2
300	Chloride		2	2	2	2	2	2	2	2	2	2	2
200.7	Total Phosphorus		2	2	2	2	2	2	2	2	2	2	2
300	Ortho-Phosphate		2	2	2	2	2	2	2	2	2	2	2
410.4	Filtered COD		2	2	2	2	2	2	2	2	2	2	2
410.4	Non Filtered COD		2	2	2	2	2	2	2	2	2	2	2
2150	Ferrous Iron		2	2	2	2	2	2	2	2	2	2	2
			2	2	2	2	2	2	2	2	2	2	2
	Water Level		2	2	2	2	2	2	2	2	2	2	2

Part XII: Area G Remediation Monitoring

Groundwater monitoring at Area G consists of sampling and analysis of 20 existing monitoring wells and five extraction wells. Contaminated groundwater from Area G is transported to the PTF at B3308. Startup of Area G wells began in June 2004, and quarterly sampling will continue for the remedial duration of three years. In June, 2007, the data will be evaluated and pumping will continue until VOC concentrations level off. Once this is achieved, the natural attenuation process will take over for an estimated 3 years (post-remediation). Samples will also be analyzed for SVOCs and perchlorate on a quarterly basis during the first year of remediation, from 6/04-6/05.

Remediation will continue at Area G but beginning calendar year 2009, it will be reduced to semi-annual monitoring well collections. During the next 5-year review, which is scheduled for 2012, NASA will discuss with MDEQ the possibility of entering post-remediation in January 2013. Post remediation will be conducted for a period of 3 years. Sampling data will be evaluated at the end of post-remediation and if acceptable contaminant levels are observed, NASA will submit an NFA request for Area G. Table on following page lists the monitoring well Identifications and number of samplings per year.

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Table Q: Area G Monitoring Wells Con'd

EPA	Water Bearing Zone2	WBZ-2						WBZ-1					
		WBZ-2	WBZ-2	WBZ-2	WBZ-2	WBZ-2	WBZ-2	WBZ-1	WBZ-1	WBZ-1	WBZ-1	WBZ-1	WBZ-1
Method	Well Identification:	31-14	31-15	31-16	31-17	31-18	31-19	31-21	31-22	01-EX	02-EX	03-EX	04-EX
Numbers													
SM 2540C	Total Dissolved Solids	2	2	2	2	2	2	2	2	2	2	2	2
160.2	Total Suspended Solids	2	2	2	2	2	2	2	2	2	2	2	2
300	Chloride	2	2	2	2	2	2	2	2	2	2	2	2
200.7	Total Phosphorus	2	2	2	2	2	2	2	2	2	2	2	2
300	Ortho-Phosphate	2	2	2	2	2	2	2	2	2	2	2	2
410.4	Filtered COD	2	2	2	2	2	2	2	2	2	2	2	2
410.4	Non Filtered COD	2	2	2	2	2	2	2	2	2	2	2	2
2150	Ferrous Iron	2	2	2	2	2	2	2	2	2	2	2	2
	Water Level	2	2	2	2	2	2	2	2	2	2	2	2

Part XIII: Pump and Treat Operational Monitoring

The pump and treat facilities are monitored for performance on a weekly, monthly and quarterly basis. The evaluations are necessary to assess the performance of the systems. Carbon filters must be monitored for effectiveness and changed out when necessary. The data collected from the laboratory is essential to the decision-making processes and proper maintenance of the systems.

Calibration Activities for the Pump and Treat facilities:

Once a month a calibration of the pH meters at each facility is performed and documented. A copy of the calibration data is forwarded to FOSC Environmental for their records. Area B, bldg 2211, has three probes that are calibrated monthly as does Area E, bldg 3308. Areas C and D each have two probes requiring monthly calibrations.

Semi-annual calibration is performed on the hydrogen peroxide pumps.

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Weekly Sampling points

Weekly Sample Points for B2211, 2208, 2413, 3308:	Parameters:	Frequency:	Duration:
<i>Effluent (after secondary Carbon)</i>	VOCs, 8260 list	WEEKLY (52 sampling events)	**

**2211 – to be sampled 5 years, 2208 to be sampled 13 years, 2412 to be sampled 5 years, 3308 to be sampled 20 years.

Monthly Sampling Points

Monthly Sample Points for 2211 and 3308:	Parameters:	Frequency:	Duration:
<i>Influent 1 (EQ Tank)</i>	COD, TOC	Monthly	**
<i>Influent 2 (before UV)</i>	COD	Monthly	**
<i>Before Primary Carbon (after UV)</i>	COD	Monthly	**
<i>Between Carbons 1 and 2</i>	COD	Monthly	**
Monthly Sample Points for 2208 and 2413	Parameters:	Frequency:	Duration:
<i>Influent 1 (EQ Tank)</i>	TOC	Monthly	**

**2211 – to be sampled 5 years, 2208 to be sampled 13 years, 2412 to be sampled 5 years, 3308 to be sampled 20 years

** Area D Building # 2418 was changed to # 2413 in July 2007.

Quarterly Sampling Points

Monthly Sample Points for 2211 and 3308:	Parameters:	Frequency:	Duration:
<i>Influent 1 (EQ Tank)</i>	*Metals, Water Quality	Quarterly	**
<i>Influent 2 (before UV)</i>	*Metals, Water Quality	Quarterly	**
<i>Before Primary Carbon (after UV)</i>	*Metals, Water Quality	Quarterly	**
<i>Between Carbons 1 and 2</i>	*Metals, Water Quality	Quarterly	**
Monthly Sample Points for 2208 and 2413	Parameters:	Frequency:	Duration:
<i>Influent 1 (EQ Tank)</i>	*Metals, Water Quality	Quarterly	**
<i>Influent 2 (before Primary Carbon)</i>	*Metals, Water Quality	Quarterly	**
<i>Between Carbons 1 and 2</i>	*Metals, Water Quality	Quarterly	**

*See Chart on next page for listing of Metals and Water Quality parameters.

**2211 – to be sampled 5 years, 2208 to be sampled 13 years, 2412 to be sampled 5 years, 3308 to be sampled 20 years

** Area D Building # 2418 was changed to # 2413 in July 2007.

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Responsible Office: Science Laboratory Services		
SUBJECT: Science Laboratory Annual Sample Plan		

Listing of parameters for Pump and Treat Monitoring

All Areas

<i>Analysis Category</i>	Analyte	EPA Method
<i>VOCs</i>	8260b List	8260b
<i>Metals</i>	Target Analyte List	200.7
	Iron (soluble/insoluble)	
	Manganese (soluble/insoluble)	
	Hardness	
<i>Water Quality Parameters</i>	pH	150.1
	Temperature	
	Conductivity	120.1
	Redox potential	SM 2580 B
	Alkalinity	310.2
	Dissolved Oxygen	360.1
	Turbidity	180.1
	TDS	160.1
	TSS	160.2
	Chloride	300.0
	Total Phosphorus	200.7
	Orthophosphate	300.0
	COD (soluble/insoluble)	410.1
	Ferrous Iron	2150
	TOC*	415.2

Additional Analytes for AreaB/B2211

<i>Water Quality Parameters</i>	BOD	405.1
<i>(AREA B ONLY)</i>	Methane	QUALITATIVE
	Ethane	QUALITATIVE
	Ethylene	8260B
	Sulfides	Std. Method 4500-S ² F
	Nitrates	300.0

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NASA Procedural Requirements

COMPLIANCE IS MANDATORY

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