APPENDIX H

DRAFT OPERATION AND MAINTENANCE PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

LIST OF TABLES

LIST OF APPENDICES

(Appendices to be provided after construction fo the Phase I System)

1.0 INTRODUCTION

This operating manual was prepared for the Hicksville Biosparge Treatment System to address the vinyl chloride subplume in the groundwater downgradient of the Hooker Chemical/Ruco Polymers Superfund Site (Hooker/Ruco Site) located in Hicksville, New York. The Site is a 14-acre former polymer manufacturing facility. The site location is shown on Figure 1.1.

The Hooker/Ruco Site operated between 1945 and 2002 during which time some chemical releases into the hydrogeologic environment occurred. While the impacts to soils at the Hooker/Ruco Site have been addressed through remedial activities, some impacts due to the historic chemical releases persist in the groundwater. The groundwater impact has migrated off-site and is now commingled within the regional groundwater. The studies that have been performed over the years have defined the horizontal and vertical extent of the chemical plume emanating from the Hooker/Ruco Site which is primarily characterized as a vinyl chloride monomer (VCM) plume. The Record of Decision (ROD) that was issued for the Site in 2000 determined that the appropriate remedy for the off-site groundwater plume of VCM would incorporate the use of in situ biosparging.

This treatment system consists of the injection of air at a rate sufficient to convert the generally anaerobic conditions in the groundwater downgradient of the injection wells located within the VCM subplume to aerobic conditions and then supply sufficient oxygen to continue to maintain aerobic conditions as biodegradation of the chemical compounds, principally VCM, occurs. Treated groundwater from the adjacent Northrop-Grumman groundwater collection system is also being considered for use. The treated groundwater is saturated with oxygen due to its treatment in an air stripper. To further accelerate the rate of biodegradation, low level concentrations of a carbon source (i.e., sugar byproducts) will also be injected. If monitoring shows that biodegradation is being inhibited by insufficient nutrients, nutrients will be added through the use of diammonium phosphate (DAP) or a similar material.

The Process Manager is the primary contact responsible for the Biosparge Treatment System.

1.1 PURPOSE AND SCOPE

The purpose and scope of this operating manual is to aid in training operating personnel with a description of the process, an understanding of the unit operations and control parameters involved, an explanation of the system's start-up, normal operation, and shutdown procedures (including alarm conditions), and a description of the performance monitoring to be performed.

A thorough review and understanding of this manual and the Safety and Health Plan will lead to safe, environmentally sound, and efficient operation of the facility.

1.2 ORGANIZATIONAL STRUCTURE

This section presents the organizational structure for the operation, maintenance, and monitoring of the Biosparge Treatment System, and identifies the various personnel involved.

Miller Springs Remediation Management, Inc. (MSRMI) holds the overall management responsibility for the Biosparge Treatment System. The day-to-day operation of the system is the primary responsibility of the Process Manager and the System Operator. Descriptions of the positions are presented in the following section.

1.2.1 PROCESS MANAGER

The Process Manager is responsible for the overall management of the operation and maintenance of the Biosparge Treatment System. The Process Manager has the overall responsibility to ensure that the proper Site operation, maintenance, monitoring, and inspection requirements of this plan are accomplished.

The Process Manager's duties include, but are not necessarily limited to, the following:

1. managing the day-to-day operation, maintenance, monitoring and inspection requirements;
2. financial accounting for supply and equipment purchases, invoices, and disbursements associated with the operation, maintenance, and monitoring requirements of the Site;
3. attending meetings regarding the Site operation, maintenance, and monitoring activities;
4. providing liaison at the Site with various equipment suppliers, consulting engineers, Agency representatives, and contract service companies regarding the operation, maintenance, and monitoring activities;

5. reviewing operating and monitoring data; and
6. providing technical advice to technician and maintenance personnel.

1.2.2 SYSTEM OPERATOR

The System Operator reports to the Process Manager and is primarily responsible for the day-to-day operation and maintenance of the water treatment system such as routine inspections, minor system adjustments, equipment operation, equipment cleaning and monitoring.

The System Operator's duties include, but are not necessarily limited to, the following:

1. operating and maintaining all Site equipment in an efficient manner;
2. performing the day-to-day inspection, monitoring, adjustments, and data compilation, all in accordance with the Site operation requirements;
3. performing the day-to-day non-scheduled maintenance, scheduled maintenance, and equipment servicing, all in accordance with the Site maintenance requirements;
4. completing all daily, weekly, and monthly operation logs for the Site;
5. being available on a scheduled basis to report to the Site in order to respond to unusual conditions which may develop when the Site is unmanned;
6. preparing periodic reports on system operation, as required;
7. coordinating operation and maintenance contractors; and
8. process troubleshooting and adjustments for quality control.

1.3 REFERENCES

1.3.1 REFERENCE MANUALS

Health and Safety Plan
Quality Assurance Project Plan
Compressor Manual
Supplement Mixing Unit Manual

1.3.2 REFERENCE DRAWINGS

Description	Drawing Number	Sheets
Engineering Flow Sheet	EF-01 through EF-10	

1.3.3 DEFINITIONS

DAP - Diammonium Phosphate

HMI – Human-Machine Interface

MSRMI – Miller Springs Remediation Management, Inc.

PID – Proportional/Integral/Derivative; control scheme to maintain a setpoint

PLC – Programmable Logic Controller

ROD – Record of Decision

VCM – Vinyl Chloride Monomer

VFD – Variable Frequency Drive

2.0 BIOSPARGE TREATMENT SYSTEM

2.1 INTRODUCTION

The Biosparge Treatment System may be divided into the Air Distribution System and the Liquid Supplement Delivery System. The Air Distribution System utilizes the air compressor and the air distribution forcemains. The Liquid Supplement Delivery System utilizes the Supplement Mixing Unit and the liquid distribution forcemains.

Both the Air Distribution System and the Liquid Supplement Delivery System are required for optimization of the Biosparge Treatment System. However, both systems are operated on independent control systems.

The Air Distribution System distributes air to the injection wells in "stages". Each stage allows injection of air into specific wells for a specific time length. Once the specified time length is complete, the next stage will start which involves a different set of injection wells and time length. The system will automatically cycle through all stages continuously until interrupted by the operator, or abnormal conditions.

The Liquid Supplement Delivery System can distribute oxygenated water, on its own, or with appropriate nutrient/carbon supplements. The Liquid Supplement Delivery System also distributes supplement to the injection wells in stages. However, in this case, a stage consists of a supplement dosage and a water flush using either treated water from Northrop-Grumman's GP-1/GP-3 treatment system or potable water. The initial phase of a stage is the supplement injection into all wells. This phase will last for a specific time length. The second phase is the water flush, which is also injected into all wells for a specific time length. Once the flush phase is complete, the system will return to the supplement injection phase involving a different set of injection wells. The system will automatically cycle through these stages continuously until interrupted by the operator, or abnormal conditions.

In situ bioremediation involves the installation of two fence lines of air and liquid injection wells into the middle of the VCM subplume. The injection system is comprised of two injection well fences, approximately 700-feet apart, with 10 and 12 injection locations for the middle and northern fences, respectively. In addition, air and liquid injection wells may be installed in the southern part of the VCM subplume at select locations, based on the results of the performance monitoring of the two fences. Injection wells for the middle and northern fences are set at a spacing of approximately 100-feet. Two air injection wells at different depths are installed at each location. One liquid injection well is installed at each location for supplement addition, water flush, and delivery of oxygenated water.

The Biosparge Treatment System is controlled in a fail-safe manner. If abnormal conditions are detected, system sequences will be tripped. A system sequence will cause automatic shutdown of the Biosparge Treatment System and trigger the autodialer. The operator should only remotely re-start the Biosparge Treatment System (after a sequence shutdown) after he has identified and corrected all abnormal conditions prior to the system restart. For more information on sequences, refer to Appendix A. The following sections describe the normal operation of the Biosparge Treatment System.

2.2 AIR DISTRIBUTION SYSTEM

2.2.1 PROCESS DESCRIPTION

The Compressor provides the air for injection into the air injection wells and is controlled by a variable frequency drive (VFD). This drive allows the compressor to change its frequency, hence its discharge air flow. The frequency of the drive changes to maintain an air flow consistent with the flow setpoint entered by the operator. Air flow, temperature, and pressure are monitored at the compressor discharge prior to exiting the Control Building.

Air is conditioned prior to injection using the Moisture/Oil Separator Pre-filter and Polishing Filter. Removed moisture and oil is automatically drained into the Moisture/Oil Separator Drum.

2.2.2 EQUIPMENT DESCRIPTION AND MATERIAL SPECIFICATIONS

The compressor is a positive displacement, screw type design. It is located in the west end of the Control Building.

Compressor

Manufacturer:	Atlas-Copco
Model:	GA-75VSD
Size:	8-feet, 6-inches length by 4-feet width
Design:	337 scfm @ 175 psi
Electrical:	100 horsepower, 460 volts, 2700 revolutions per minute

Moisture/Oil Separator w/Auto Drain Pre-filter and Polishing Filter

Vendor:	Atlas-Copco (supplied with Compressor)
Model:	DD-260
Size:	2 ½-inches
Design:	551 scfm, 232 psi

Moisture/Oil Separator Drum
Standard 55 gallon drum.

Pressure relief valve, PSV-300 protects the compressor discharge line from over-pressurization. This line discharges to the floor of the Control Building. The valve is sized for XXX psi.

2.2.3 INSTRUMENT OVERVIEW

The flowrate for the Air Distribution System is controlled using a flow setpoint, flow transmitter FIT-300, variable frequency controller YC-300, and the Programmable Logic Controller (PLC). The flow setpoint is entered on the Human Machine Interface (HMI) in the Control Building. The PLC will compare this operator-entered setpoint to the flow transmitter, FE-300, reading to determine the frequency of the Compressor. The frequency is determined using a Proportional/Integral/Derivative (PID) loop in the PLC. As the flow rate deviates from a specified flow setpoint, the PLC will automatically adjust an analog control signal to "ramp up" or "ramp down" the frequency of the compressor in order to compensate for the difference in flow. As the flow rate returns to setpoint, the PLC will decrease the rate at which the analog control signal changes and attempt to maintain the compressor's frequency. The PID loop adjusts the compressor's speed to maintain a constant flow to the injection wells.

Compressor
Additional instrumentation is used to monitor the air flow discharge from the compressor. An automatic control valve, YV-300, closes in conjunction with the compressor being off in order to prevent any backflow from the injection wells from entering the Control Building. Temperature and pressure transmitters monitor the conditions of the air in the discharge line to monitor for abnormal conditions which could damage the compressor or the air distribution forcemain. Pressure gauges are also located in the discharge line for additional monitoring.

The compressor may be started and stopped locally with pushbuttons on the VFD. The "System Off" pushbutton on the HMI in the Control Building and Sequence 1 will also shutdown the Compressor.

Each Moisture/Oil Separator filter has a differential pressure indicator (DP--303 for the pre-filter and DPI-304 for the polish filter). These gauges are used to monitor filter performance. Each filter also has an automatic drain valve (LCV-303 for the pre-filter and LCV-304 for the polish filter). These drains automatically drain the filters based on the differential pressure.

Injection Wells

Each injection well has a pressure indicator. Each air injection point has an automatic shutoff valve, a low flow switch to indicate the well is accepting flow, and a flow indicator and manual valve for fine tuning of the air flow. The instrumentation for the air injection wells is summarized in Table 2.1.

2.2.4 OPERATING PARAMETERS

For information on system setpoints, refer to Appendix B.

Compressor

Parameter	Alarm Point	Normal Range	Instruments	Sequence
Moisture/Oil Separator Filter Differential Pressure	-	XXX	DPI-303, DPI-304, LCV-303, LCV-304	-

Reason for Monitoring:
A high differential pressure (XXX) results in autodrain of filters to the Moisture/Oil Separator Drum.

Function:
DPI-303 and DPI-304 are used for monitoring of the Moisture/Oil Separator Filters. LCV-303 and LCV-304 automatically open and close based on differential pressure.

Parameter	Alarm Point	Normal Range	Instruments	Sequence
Compressor Discharge Pressure	Low - XXX High - XXX High-high - XXX	XXX	PI-301, PI-302, PIT-302, PSHH-305	1

Reason for Monitoring:
Pressure deviations from normal may indicate inefficiency of the compressor.

Function:
PI-301, PI-302, and PIT-302 are used for monitoring of the air discharge line pressure. PAHH-302, PAH-302, PAL-302, and PAHH-305 notify the operator of abnormal conditions and these alarms are displayed on the HMI. PAHH-302 and PAHH-305 will

also trip Sequence 1. Pressure (PIT-302) is displayed on the HMI and trended by the HMI to aid in troubleshooting.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Compressor Discharge Flow	Low - XXX High - XXX	XXX	FIT-300	-

Reason for Monitoring:
This flow is used to control air flow to the Air Distribution System. Based on the flow setpoint entered by the operator on the HMI screen, the compressor VFD will change speed to match the flow setpoint to the flow measured by FIT-300. Totalized flow is used in record keeping. Low flow may indicate a pluggage in the compressor's discharge line or inefficiency of the compressor. High flow may indicate inefficiency of the flow control loop.

Function:
Instantaneous flow (FI-300), flow setpoint, and totalized flow (FQI-300) are displayed on the HMI screen. Instantaneous flow is also displayed local to the instrument. FAL-300 and FAH-300 notifies the operator of abnormal conditions and this alarm is displayed on the HMI. Instantaneous flow is also trended on the HMI screen.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Compressor Discharge Temperature	High - XXX, High-high - XXX	XXX	TIT-300, TI-300	1

Reason for Monitoring:
High temperature may indicate an over-heating of the compressor.

Function:
TI-300 and TIT-300 are used for monitoring of the air discharge temperature. TAH-300 and TAHH-300 will notify the operator of abnormal conditions. These alarms are displayed on the HMI. TAHH-300 will also trip Sequence 1. Temperature (TIT-300) is displayed on the HMI and trended by the HMI to aid in troubleshooting.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Compressor Discharge Flow Valve Status	XXX	open	ZSL-300, ZSH-300	1

Reason for Monitoring:
If the compressor is not running and this valve (YV-300) is open, backflow from the injection wells may occur. If the compressor is running and this valve is closed, the compressor or discharge line may be damaged.

Function:
ZSL-300 and ZSH-300 are used for monitoring valve position. YA-300 notifies the operator if the valve position detected is not the position commanded by the PLC. This alarm is displayed on the HMI and will trip Sequence 1. Valve position is displayed on the HMI.

Injection Wells

Parameter	Alarm Point	Normal Range	Instruments	Sequence
Injection Well Pressure	-	XXX	See Table 1	-

Reason for Monitoring:
Pressure deviations from normal may indicate inefficiency of the compressor or pluggage of the air forcemain.

Function:
PI-XXX is used for monitoring of the air discharge line pressure.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Injection Point Flow	Low - XXX	XXX	See Table 1	-

Reason for Monitoring:
Flow is used to monitor air flow into the injection point. The low flow switch indicates that the well is not on-line.

Function:
FAL-XXX notifies the operator that the injection point is not on-line and this alarm is displayed on the HMI.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Injection Point Flow Valve Status	XXX	open	See Table 1	-

Reason for Monitoring:
The status of this valve determines whether the air injection point is on-line or off-line.

Function:
ZSL-XXX and ZSH-XXX are used for monitoring valve position. YA-XXX notifies the operator if the valve position detected is not the position commanded by the PLC. This alarm is displayed on the HMI. Valve position is displayed on the HMI.

2.2.5 PROCEDURES (OPERATING INSTRUCTIONS)

1. Start-up Compressor Procedure

2. Normal Compressor Operating Procedure
3. Replacement of Moisture/Oil Separator Drum Procedure

START-UP COMPRESSOR

Introduction: This procedure outlines the steps necessary to startup the compressor.
Required PPE: Safety Glasses, Hard Hat, and Safety Shoes.

STEP ONE - Make sure the system is ready to run. See "Start-up Treatment System" Procedure.

STEP TWO – Start Compressor.

1. Press the START pushbutton local to the Compressor.

NORMAL COMPRESSOR OPERATING PROCEDURE

Introduction: This procedure outlines the steps necessary to ensure the compressor is operating properly.

Required PPE: Hard Hat, Safety Glasses, and Safety Shoes.

1. Complete the "Start-up Compressor" Procedure.
2. Check flow, temperature, and pressure and verify normal operating conditions.
3. Check Moisture/Oil Separator Filters for proper operation.
4. Check injection points for proper operation.
5. Monitor the air flow, flow setpoint, and compressor speed.
6. Monitor the temperature and pressure and verify normal operating conditions.
7. The Compressor frequency should be kept above XXX%.

Note: All problems should be noted on the Daily Inspection Form and brought to the Supervisor's attention.

REPLACEMENT OF MOISTURE/OIL SEPARATOR DRUM

Introduction: This procedure outlines the steps necessary to replace the Moisture/Oil Separator Drum.

Required PPE: Hard Hat, Safety Glasses, and Safety Shoes.

STEP ONE - Preparation

1. Verify that the differential pressure across the Moisture/Oil Separator Filters is less than XXX.

STEP TWO – Remove Equipment from Used Drum

1. Remove filter autodrain discharge line from full drum.
2. Remove drum.

STEP THREE – Place New Drum On-line

1. Verify proper labeling on new drum.
2. Relocate new drum for moisture/oil collection.
3. If required, replace filter autodrain discharge line.
4. Place filter autodrain discharge line in new drum.
5. If last drum and/or label in storage is used, notify supervisor (or order more drums and/or labels).

2.2.6 TROUBLESHOOTING

Compressor High-High Pressure, PAHH-302	**Reason for Alarm:** The compressor discharge pressure is above XXX. **Action to Take:** Verify selected wells. Verify YV-300 is open.
Compressor High Pressure, PAH-302	**Reason for Alarm:** The compressor discharge pressure is above XXX. **Action to Take:** Verify selected wells. Verify YV-300 is open.
Compressor Low Pressure, PAL-302	**Reason for Alarm:** The compressor discharge pressure is below XXX. **Action to Take:** Verify flow setpoint. Verify selected wells. Verify compressor frequency.
Compressor High-High Pressure, PAHH-305	**Reason for Alarm:** The compressor discharge pressure is above XXX. **Action to Take:** Verify selected wells. Verify YV-300 is open.
Compressor High Flow, FAH-300	**Reason for Alarm:** The compressor discharge flow is above XXX. **Action to Take:** Verify flow. Verify selected wells. Verify compressor frequency.
Compressor Low Flow, FAL-300	**Reason for Alarm:** The compressor discharge flow is below XXX. **Action to Take:** Verify flow. Verify selected wells. Verify compressor frequency.
Compressor High-High Temperature, TAHH-300	**Reason for Alarm:** The compressor discharge temperature is above XXX. **Action to Take:** Verify selected wells. Verify YV-300 is open.
Compressor High Temperature, TAH-300	**Reason for Alarm:** The compressor discharge temperature is above XXX. **Action to Take:** Verify selected wells. Verify YV-300 is open.
Valve YV-300 Failure, YA-300	**Reason for Alarm:** Valve position detected is not valve position commanded by PLC. **Action to Take:** Verify valve position. Verify

	selected wells.
Injection Point Low Flow, FAL-XXX	**Reason for Alarm:** The injection point flow is below XXX. **Action to Take:** Verify flow. Verify well is selected.
Injection Point Valve Failure, YA-XXX	**Reason for Alarm:** Valve position detected is not valve position commanded by PLC. **Action to Take:** Verify valve position. Verify selected wells.

2.3 LIQUID SUPPLEMENT MIXING UNIT AND DELIVERY SYSTEM

The liquid supplement is pumped from the Supplement Drum through the Mixing Unit to the liquid injection wells. Water is used to flush the pipeline following every liquid supplement injection to prevent biofouling of the supply lines, well screens, and soils immediately adjacent to the well screen.

2.3.1 PROCESS DESCRIPTION

The Mixing Unit is used to combine the liquid supplement (sugar byproducts) with water for transfer to the injection wells. The Mixing Unit will include a metering pump that transfers the supplement from the Supplement Drum to the Mixing Unit for an initial mixing/dilution. The diluted supplement from the Mixing Unit is then diluted further with water through a static mixer before being injected into the injection wells. The Mixing Unit is used to maintain a consistent supplement concentration to the forcemain.

The flow to the wells is controlled using a flow transmitter and a flow control valve. The valve modulates its position to maintain a liquid flow consistent with the flow setpoint entered by the operator. Liquid flow, from either the Mixing Unit and/or the flushing water, is monitored prior to exiting the Control Building.

2.3.2 EQUIPMENT DESCRIPTION AND MATERIAL SPECIFICATIONS

The Mixing Unit is located in the south end of the Control Building.

Supplement Mixing Unit

Manufacturer:	US Filter Stranco
Model:	M601-D4AA
MOC:	PVC (w/stainless steel frame)
Size:	36-inches wide, 16-inches deep, 40-inches high
Capacity:	30-300 gallons per hour (primary mixing and post dilution)

Supplement Drum
Standard 55 gallon drum

Supplement Metering Pump (Part of Mixing Unit)

Manufacturer:	LMI
Design:	0.3-4.0 gallons per hour (concentrated molasses) @ 50 pounds per square inch
Electrical:	120 volts

2.3.3 INSTRUMENT OVERVIEW

The flowrate for the Liquid Distribution System is controlled using a flow setpoint, flow transmitter FIT-306, flow control valve FV-312, and the PLC. The flow setpoint is determined by the PLC based on the number of wells selected by the operator on the Human Machine Interface (HMI) in the Control Building. The PLC will compare the PLC-determined setpoint to the flow transmitter, FE-306, reading to determine the position of the valve. The position is determined using a PID loop in the PLC. As the flow rate deviates from a specified flow setpoint, the PLC will automatically adjust an analog control signal to open or close the valve in order to compensate for the difference in flow. As the flow rate returns to setpoint, the PLC will decrease the rate at which the analog control signal changes and attempt to maintain the valve's position. The PID loop adjusts the valve's position to maintain a constant flow to the injection wells.

The concentration of the supplement injected into the forcemain is determined by the operator, and input at the HMI. The Mixing Unit will receive an analog control signal based on the operator input to control the injection of supplement.

Supplement Mixing Unit
The Mixing Unit is controlled using a HAND-OFF-AUTO switch local to the Mixing Unit. When the Mixing Unit has been placed into AUTO and enabled at the HMI, the Mixing Unit will be in automatic mode. In automatic mode, the Mixing Unit will automatically start when commanded by the liquid distribution sequencer, and will continue to run based on the sequencer. The make-up sequencer calculates the time length to run the Mixing Unit based on the totalized flow of make-up water and the

percent solution entered by the operator on the HMI screen in the Control Building. The Mixing Unit will receive an analog control signal based on the operator input to control the injection of supplement. Sequence 3 will shutdown the Mixing Unit.

An automatic control valve, YV-312, closes in conjunction with the Supplement/Make-up Injection being off in order to prevent any backflow from the injection wells from entering the Control Building. Sequence 3 will close this valve.

A pressure gauge is located upstream of all controls on the make-up water line. A pressure gauge is located in the discharge line for additional monitoring.

Injection Wells
Each injection well has a pressure indicator. Each injection point has an automatic shutoff valve a low flow switch to indicate the well is accepting flow, and a flow indicator and manual valve for fine-tuning of the flow. The instrumentation for the liquid injections wells is summarized in Table 2.2.

2.3.4 OPERATING PARAMETERS

For information on system setpoints, refer to Appendix B.

Supplement Mixing Unit

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Mixing Unit	General Alarm	-	XXX	3

Reason for Monitoring:
System alarm is used to monitor Mixing Unit.

Function:
Alarm notifies the operator that the Mixing Unit is not functioning properly. This alarm will be displayed on the HMI and will trip Sequence 3.
Manual monitoring of Supplement Injection Pump discharge pressure.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Make-up Water Line Pressure	-	XXX	PI-306	-

Reason for Monitoring:
Excessive pressure indicates a restriction in flow to the injection wells (i.e. improper valving) or the Supplement Tank. Low pressure indicates a loss of forcemain pressure.

Function:
Manual monitoring of Make-up Water Line pressure.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Make-up Water Valve Status	XXX	-	ZSL-306, ZSH-306	3

Reason for Monitoring:
The status of this valve determines whether the make-up water is available (shutoff).

Function:
ZSL-306 and ZSH-306 are used for monitoring valve position. YA-306 notifies the operator if the valve position detected is not the position commanded by the PLC. This alarm is displayed on the HMI and will trip Sequence 3. Valve position is displayed on the HMI.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Liquid Delivery Valve Status	XXX	-	ZSL-312, ZSH-312	3

Reason for Monitoring:
The status of this valve determines whether the supplement water or flush water is being injected into the wells (shutoff).

Function:
ZSL-312 and ZSH-312 are used for monitoring valve position. FV-312 notifies the operator if the valve position detected is not the position commanded by the PLC. This alarm is displayed on the HMI and will trip Sequence 3. Valve position is displayed on the HMI.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Liquid Delivery Flow	Low - XXX High – XXX	XXX	FIT-306	3

Reason for Monitoring:
This flow is used to monitor liquid flow to the injection wells. Totalized flow is used in record keeping. This flowmeter is used for water flush flow and supplement injection flow.

Function:
Instantaneous flow and totalized flow for water flush (FI-306 and FQI-306), and supplement injection (FI-312 and FQI-312) are displayed on the HMI screen. Instantaneous flow is also displayed local to the instrument and is trended on the HMI screen. FAL-306 and FAH-306 notify the operator of flow deviations during water flush. FAL-312 and FAH-312 notify the operator of flow deviations during supplement injection. These alarms are displayed on the HMI and will trip Sequence 3.

Injection Wells

Parameter	Alarm Point	Normal Range	Instruments	Sequence
Injection Well Pressure	-	XXX	See Table 2	-

Reason for Monitoring:
Pressure deviations from normal may indicate inefficiency of the Supplement Injection Pump, loss of potable water, or pluggage of the liquid forcemain.

Function:
PI-XXX is used for monitoring of the liquid discharge line pressure.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Injection Point Flow	Low - XXX	XXX	See Table 2	-

Reason for Monitoring:
Flow is used to monitor liquid flow into the injection point. The low flow switch indicates that the well is not on-line.

Function:
FAL-XXX notifies the operator that the injection point is not on-line and this alarm is displayed on the HMI.

Parameter	Alarm Point	Normal Range	Instrument	Sequence
Injection Point Flow Valve Status	XXX	Open	See Table 2	-

Reason for Monitoring:
The status of this valve determines whether the injection point is on-line or off-line.

Function:
ZSL-XXX and ZSH-XXX are used for monitoring valve position. YA-XXX notifies the operator if the valve position detected is not the position commanded by the PLC. This alarm is displayed on the HMI. Valve position is displayed on the HMI.

2.3.5 PROCEDURES (OPERATING INSTRUCTIONS)

1. Enable Transfer of Supplement to Mixing Unit Procedure
2. Replacement of Supplement Drum Procedure

See Mixing Unit manual for detailed procedures.

ENABLE TRANSFER OF SUPPLEMENT TO MIXING UNIT

Introduction: This procedure outlines the steps necessary to transfer Supplement to the Mixing Unit.

Required PPE: Hard Hat, Safety Glasses, and Safety Shoes.

STEP ONE - Check Supplement Drum Level.

1. The level in the Supplement Drum should be more than XXX% to allow for operation for a minimum of XXX hours. If level is below XXX follow the "Replacement of Supplement Drum" procedure.

STEP TWO – Check System

1. Check for leaks or other pumping problems.

STEP THREE - Follow-up

1. Notify the Process Supervisor of any pumping problems.
2. Clean up any spills as soon as possible.

REPLACEMENT OF SUPPLEMENT DRUM PROCEDURE

Introduction: This procedure outlines the steps necessary to replace the Supplement Drum.

Required PPE: Hard Hat, Safety Glasses, and Safety Shoes.

STEP ONE - Preparation

1. Verify that the Supplement Mixing Unit is off.

STEP TWO – Remove Equipment from Used Drum

1. Remove pump suction line from used drum.
2. Remove drum.

STEP THREE – Place New Drum On-line

1. Verify contents of new drum.
2. Relocate new drum for supplement addition.
3. If required, replace Supplement Metering Pump suction line.
4. Place Supplement Metering Pump suction line in new supplement drum.
5. If last drum in storage is used, notify supervisor (or order more supplement).

2.3.6 TROUBLESHOOTING

Supplement Addition Low Flow, FAL-310	**Reason for Alarm:** Supplement flow is below XXX. **Action to Take:** Verify Supplement Metering Pump is operational. Verify level in Supplement Drum.
Supplement Injection Pump Failure, YA-311	**Reason for Alarm:** Pump status detected is not status commanded by PLC. **Action to Take:** Verify pump status.
Valve YV-309 Failure, YA-309	**Reason for Alarm:** Valve position detected is not valve position commanded by PLC. **Action to Take:** Verify valve position. Verify selected wells.
Supplement Injection Low Flow, FAL-312	**Reason for Alarm:** Flow is below XXX when YV-306 is closed. **Action to Take:** Verify operation of Supplement Injection Pump. Verify flow setpoint. Verify operation of FV-312.
Supplement Injection High Flow, FAH-312	**Reason for Alarm:** Flow is above XXX when YV-306 is closed. **Action to Take:** Verify flow setpoint. Verify operation of FV-312.
Water Flush Injection Low Flow, FAL-306	**Reason for Alarm:** Flow is below XXX when YV-306 is open. **Action to Take:** Verify operation YV-306. Verify flow setpoint. Verify operation of FV-312.
Water Flush Injection High Flow, FAH-306	**Reason for Alarm:** Flow is above XXX when YV-306 is open. **Action to Take:** Verify operation YV-306. Verify flow setpoint. Verify operation of FV-312.
Valve FV-312 Failure, YA-312	**Reason for Alarm:** Valve position detected is not valve position commanded by PLC. **Action to Take:** Verify valve position. Verify selected wells.
Injection Point Low Flow, FAL-XXX	**Reason for Alarm:** The injection point flow is below XXX. **Action to Take:** Verify flow. Verify well is selected.
Injection Point Valve Failure, YA-XXX	**Reason for Alarm:** Valve position detected is not valve position commanded by PLC. **Action to Take:** Verify valve position. Verify selected wells.

2.4 TREATMENT STARTUP PROCEDURE

Introduction: This procedure outlines the steps necessary to start up the Biosparge Treatment Process after a shutdown.

Required PPE: Hard Hat, Safety Glasses, Leather Gloves, and Safety Shoes.

STEP ONE - Before Start-Up:

1. Verify no Sequences are active.
2. Enable the System by Pressing the SYSTEM ON pushbutton on the HMI in the Control Building.
3. Select the time length for supplement addition on the HMI screen in the Control Building.
4. Select the time length for potable water flush on the HMI screen in the Control Building.
5. Select the air injection point groupings and associated time lengths on the HMI screen in the Control Building.
6. Place the air injection sequence controller (KIC-300) in automatic mode on the HMI screen in the Control Building.
7. Place the air injection block valve (YV-300) in automatic mode on the HMI screen in the Control Building.
8. Enter an air flow setpoint for FIT-300 on the HMI screen in the Control Building.
9. Place the flow controller (FIC-300) in automatic mode on the HMI screen in the Control Building.
10. Enter a supplement percent solution on the HMI screen in the Control Building.
11. Place the Make-up sequence controller (QIC-310) in automatic mode on the HMI screen in the Control Building.
12. Place the make-up water block valve (YV-309) in automatic mode on the HMI screen in the Control Building.
13. Place the supplement addition flow controller (FQIC-310) in automatic mode on the HMI screen in the Control Building.
14. Place the liquid injection sequence controller (KIC-312) in automatic mode on the HMI screen in the Control Building.
15. Enter a liquid flow setpoint for FIT-306 on the HMI screen in the Control Building.
16. Place the flow controller (FIC-312) in automatic mode on the HMI screen in the Control Building.

STEP TWO – Start-Up:

1. Complete the "Enable Transfer of Supplement to Mixing Unit Procedure".
2. Place the Supplement Mixing Unit in Automatic and press the ENABLE pushbutton on the HMI in the Control Building.
3. Complete the "Start-up Compressor Procedure".
4. Complete the "Normal Compressor Operating Procedure".

STEP THREE – Follow-up:

1. Verify pressure on compressor discharge is in normal operating range.
2. Verify air flow rate on FIT-300 is approaching setpoint.
3. Verify liquid flow rate on FIT-312 is approaching desired value.
4. Verify pressure on Supplement Mixing Unit is in normal operating range.
5. Verify air injection points are operational as selected.
6. Verify liquid injection is operational.

Note: All problems should be noted on the Daily Inspection Form and brought to the Supervisor's attention.

2.5 TREATMENT SHUTDOWN PROCEDURE

Introduction: This procedure outlines the steps necessary to shut down the Treatment Process.

Required PPE: Hard Hat, Safety Glasses, Escape Respirator, Leather Gloves

1. Shutdown the compressor by pressing the STOP pushbutton.
2. Shutdown the Supplement Mixing Unit by pressing the DISABLE pushbutton on the HMI in the Control Building.
3. Check system flows and pressures to verify system is down.

OR

1. Press the SYSTEM OFF pushbutton on the HMI in the Control Building.
2. Check system flows and pressures to verify system is down.

Note: Pressure must be relieved from the air and water lines prior to performing any line breaks or any maintenance on system equipment.

3.0 MONITORING AND MAINTENANCE

Monitoring of the Biosparge System is comprised of two components:

i) one to monitor the operation of the system; and
ii) the other to monitor the effectiveness of the system in addressing the VCM subplume.

A description of both components is provided in the following sections.

The operator is responsible for day-to-day operations of the facility including system monitoring, record keeping, and ensuring that potential problems are corrected or identified to the supervisor. Vendor manuals for equipment and instrumentation are provided in Appendices E and F respectively. The spare parts list is given in Appendix G.

3.1 SYSTEM OPERATIONS MONITORING

3.1.1 MONITORING REQUIREMENTS

Monitoring requirements and intervals are described subsequently in general.

Transfer Lines and Piping
1. Inspect piping for evidence of leaks, corrosion, excessive stress, or any other undesirable condition.

Supplement Mixing Unit
1. Inspect unit for evidence of leaks, corrosion, or cracks.
2. Inspect unit for proper operation.

Pumps
1. Inspect pumps monthly.
2. Ensure all suction and discharge valves function properly.

Facility Area
1. Inspect concrete dike for evidence of cracks.
2. Inspect area around dike for evidence of leaks.

3.1.1.1 REPORTING REQUIREMENTS

Detailed operator logs for operation of the system is in Appendix C.

3.1.1.2 RECORD KEEPING

A logbook of all Site activities is kept in the control room.

3.1.2 ROUTINE INSPECTION AND MAINTENANCE

3.1.2.1 MONTHLY INSPECTION AND MAINTENANCE

1. Routine monthly shutdown to include check of oil in compressor (oil should be changed based on manufacturer's recommendation – see original manufacturer's O&M manual).
2. Routine monthly inspection to include verification of proper instrument operation.
3. Routine monthly inspection of piping, valves, and vessels for leakage.
4. Routine monthly inspection of injection wells to verify proper operation of the valves.
5. Routine monthly inspection of the Moisture/Oil Separator Drum. Replace as necessary.

3.1.2.2 SEMI-ANNUAL INSPECTION AND MAINTENANCE

3.1.3 SCHEDULED MAINTENANCE

Scheduled maintenance is to be performed as necessary. These activities may include the following:

- cleaning/repair of metering pump,
- cleaning/repair of mixing unit, and
- cleaning/repair of compressor.

3.2 PERFORMANCE MONITORING

Performance monitoring will include groundwater and vadose zone monitoring and process monitoring. Additional details regarding the scope of the monitoring is provided in the following sections. A summary of performance monitoring is shown in Table 3.1. The frequencies of sampling described below are applicable to each fence section when it becomes operable.

3.2.1 GROUNDWATER MONITORING

The majority of the monitoring points are located at a distance of approximately 100 feet downgradient of the injection wells which is equivalent to approximately 8 months of groundwater travel time. Thus, these wells will be monitored semi-annually. This layout results in 5 and 6 monitoring locations for the middle and north injection fence lines, respectively. The monitoring well nests will be installed at approximately the midpoint between every other pair of injection wells. The midpoint location was selected as the primary monitoring location since this is the area least expected to be impacted by the injected materials. Thus these locations should be typical of worst case conditions. The well nests will typically consist of two wells in the groundwater and two wells in the vadose zone. The screened intervals of the groundwater monitoring wells will be set at:

i) an elevation equal to the mid point between the top and bottom of the VCM subplume; and

ii) in the next overlying sand unit above the VCM subplume.

The groundwater monitoring well screens will be 10 feet in length.

Furthermore, to provide an early indication of the impact of the biosparging system, groundwater monitoring wells will also be installed at two locations approximately 5 feet downgradient of the injection fence at the midpoint between adjacent injection wells and at two locations approximately 20 feet (2± months travel time) downgradient of each of the injection fences. These last two monitoring locations will be installed at locations that are immediately downgradient of an injection well. The two wells located approximately 5 feet downgradient will be monitored monthly for the first quarter of operation to assess the oxygen distribution and evaluate the zone of biosparging influence. Thereafter, all groundwater monitoring wells located 5 and 20-feet downgradient will be monitored quarterly for a period of two years after startup of operation.

Existing wells, if located in the appropriate location (e.g., MW-61D and MW-61D2 for the middle fence), will be included in the monitoring program in lieu of new installations.

Sample collection and analyses will be in accordance with the procedures presented in the OU-3 QAPP. All groundwater sampling will be performed using the Low Flow Procedures included in the OU-3 QAPP.

Initially, the groundwater will be monitored for VOCs (including TICs), TOC, N, P, and the natural attenuation parameters, DO, ORP, pH, temperature, and conductivity. VOC TICs will be analyzed and reported for the groundwater event samples collected from the first sampling event of each new well installed and the next sampling event from any existing well. If TICs are present in a well, TICs will continue to be analyzed/reported for the subsequent samples from each well until they are no longer present. For wells in which no TICs are present, no future analysis/reporting will be performed. In addition, heterotrophic microorganisms will be analyzed annually for the first two years.

Prior to the start of air injection at each section of the injection well fence, baseline monitoring will be performed at the appropriate wells. The frequency of the baseline monitoring will be once two weeks prior to the initial air injection and then daily for the 3 days immediately prior to the initial air injection. The parameters to be analyzed/monitored are the same as those described above with the exception that VOCs would be sampled/analyzed once for the 4 background events.

3.2.2 VADOSE ZONE MONITORING

Vadose zone wells will be installed in the same locations and monitored at the same frequency as the groundwater monitoring wells installed at distances of 20 and 100 feet from the injection fence. The one exception to this is that the vadose zone wells located 20 feet downgradient will also be monitored shortly after air injection starts and monthly for the first quarter.

Two vadose zone wells will be installed at each location; one at a depth of approximately 8 feet bgs and one immediately above the groundwater table (approximately 60 feet bgs). The 8-foot depth was selected to be representative of a basement depth. The vadose zone wells will be constructed of 1-inch diameter PVC pipe with screens 2 feet in length for the 8-foot deep wells and 5-feet in length for the groundwater table wells. A longer well screen for the deeper vadose zone well is believed prudent to account for fluctuations in the groundwater table. The sandpack will extend 2 feet above the screen. The annulus above the sandpack will be sealed with a 2-foot bentonite pellet/chip seal overlain with cement grout containing 6 percent bentonite to prevent short-circuiting between wells and with the atmosphere. The well head will be airtight and include a stopcock that will allow direct connection of a gas sample monitor and/or container.

The vadose zone gases will be monitored using a PID. If an elevated PID reading (>10 ppm above background) is obtained, a gas sample will be collected for laboratory analysis of VOCs and methane. Sample collection and analyses will be performed in accordance with the procedures presented in the OU-3 QAPP.

In addition, the air immediately above the ground surface at each injection well will be periodically monitored using a PID to determine if short-circuiting up the well annulus is occurring. Short-circuiting will be evidence by a PID reading >10 ppm above background.

3.2.3 PROCESS MONITORING

Injection header pressure and temperature as well as injection on/off cycle times and quantities of materials injected will be monitored and stored by the HMI software on the PC. In addition, in accordance with 40 CFR 144.27, the liquid amendments will be sampled and analyzed annually (TOC for the sugar by-product solution and phosphorus and nitrogen for the DAP). The data will allow estimates to be made of the quantities of materials injected at each point (i.e., the quantity of an injected gas is a function of volume, pressure, and time). These mass estimates will be used to evaluate the distribution of the injected materials at each injection point and, in conjunction with the soil gas and groundwater monitoring, will be used to assist in optimizing the timing, locations, and rates of material injection. The data will be used to assess the rate of VCM biodegradation, injection material distribution and migration, and monitor groundwater flow pathways.

4.0 UTILITIES

Potable water and/or treated groundwater (Northrop) supply will be required for the liquid injection system.

Potable water supply will be required for hose stations, and the lavatory. The source of potable water will be from the water main located on the north side of Hazel Street. A pressure of 30 to 70 psi is available. The potable water shutoff valve is located XXX.

Treated groundwater supply will be required for supplement injection and flushing. The source of treated groundwater will be from the Northrop-Grumman Plant and tied in on the south side of the Control Building. A pressure of 40 to 90 psi is available. The potable water shutoff valve is located XXX.

Sanitary sewage is discharged to the municipal sanitary sewer on Hazel Street.

5.0 CONTROL SYSTEM

The control system used for the Biosparge Treatment Facility is a Programmable Logic Controller (PLC) based system manufactured by Allen-Bradley. This particular system is comprised of a main processor in the Control Building and remote I/O at each injection well. Also in the control building is the personal computer (PC) based HMI system. The HMI allows total process monitoring through pre-established color graphics. The operator can view the entire system by selecting various graphics screens. Process data is stored in the HMI and displayed at the operator's request in the form of trend displays or by viewing alarm pages. An autodialer is also hard-wired to the PLC.

5.1 OVERALL SYSTEM CONFIGURATION

The remote IO is tied to the Main PLC over an Allen-Bradley network. The HMI is connected to the Main PLC via an Ethernet connection. The software used to program the HMI is Intellution version 3.0.

5.1.1 HUMAN MACHINE INTERFACE (HMI) FUNCTIONS

The HMI system is used to monitor the process from the computer screen. The HMI is located in the Control Room in the Control Building. The HMI is divided into several displays associated with specific segments of the system. These displays are in Appendix D and are listed below:

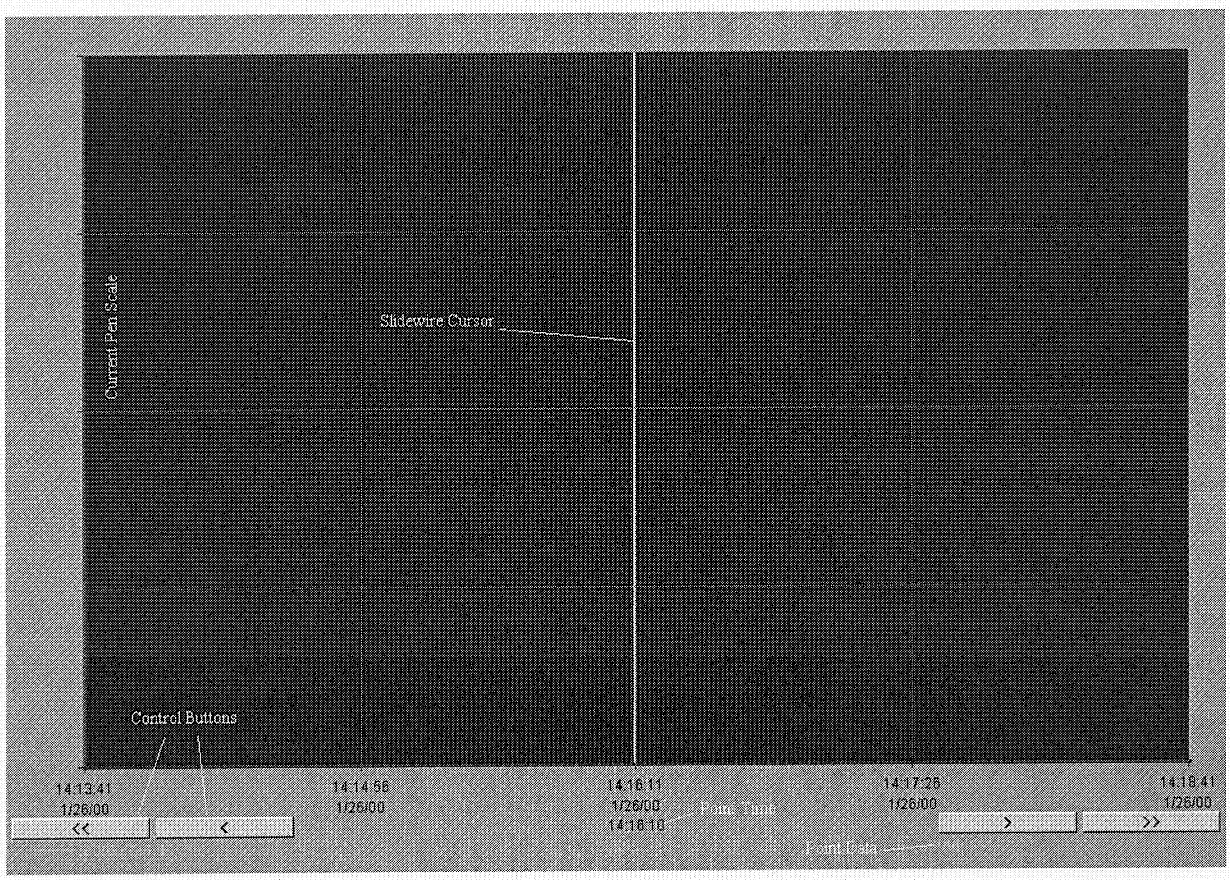
Display Title	Description
Menu	Main screen for navigating to other displays.
Overview (Biosparge Treatment)	Treatment Facility Overview
Air Delivery System	Specific display of the Compressor and associated instrumentation.
Liquid Delivery System	Specific display of the Supplement Mixing Unit and associated equipment and instrumentation.
Air Distribution Staging	Display for setting parameters for Air Distribution.
Sequences	Display of system shutdown sequences.
Injection Well Displays	Displays of injection well groupings and associated instrumentation.
Alarm	Displays current alarms.
View Report Output	Displays the current days report, starting at midnight.

The figure below shows the common display features and their fixed locations.

On the graphic type screens, the following information applies:

- The message ????? or @@@@@ inplace of a value means communication with the I/O device has failed.
- Where displayed a flashing HI, HIHI, LO, or LOLO, a value is exceeding its limits.

The figure below shows the common display features of the trend screens.



The Alarm Screen displays only active alarms. These alarms are displayed in the following colors:

Alarm State	Color
Active Unacknowledged	Red
Active Acknowledged	White
Returned Acknowledged	Green

5.1.2 DIAL-UP FUNCTIONS

The operator may dial-up the Control Room PC via a telephone line. This connection will allow the operator to remotely control the PC. Therefore, the operator will have access to view and shutdown the Biosparge Treatment System in the same manner as if the operator was in the Control Room.

5.1.3 AUTODIALER FUNCTIONS

The autodialer is used to alert the operator if any sequence is tripped. Once a sequence is tripped, the autodialer will start calling a pre-programmed set of telephone numbers until the alarm is acknowledged.

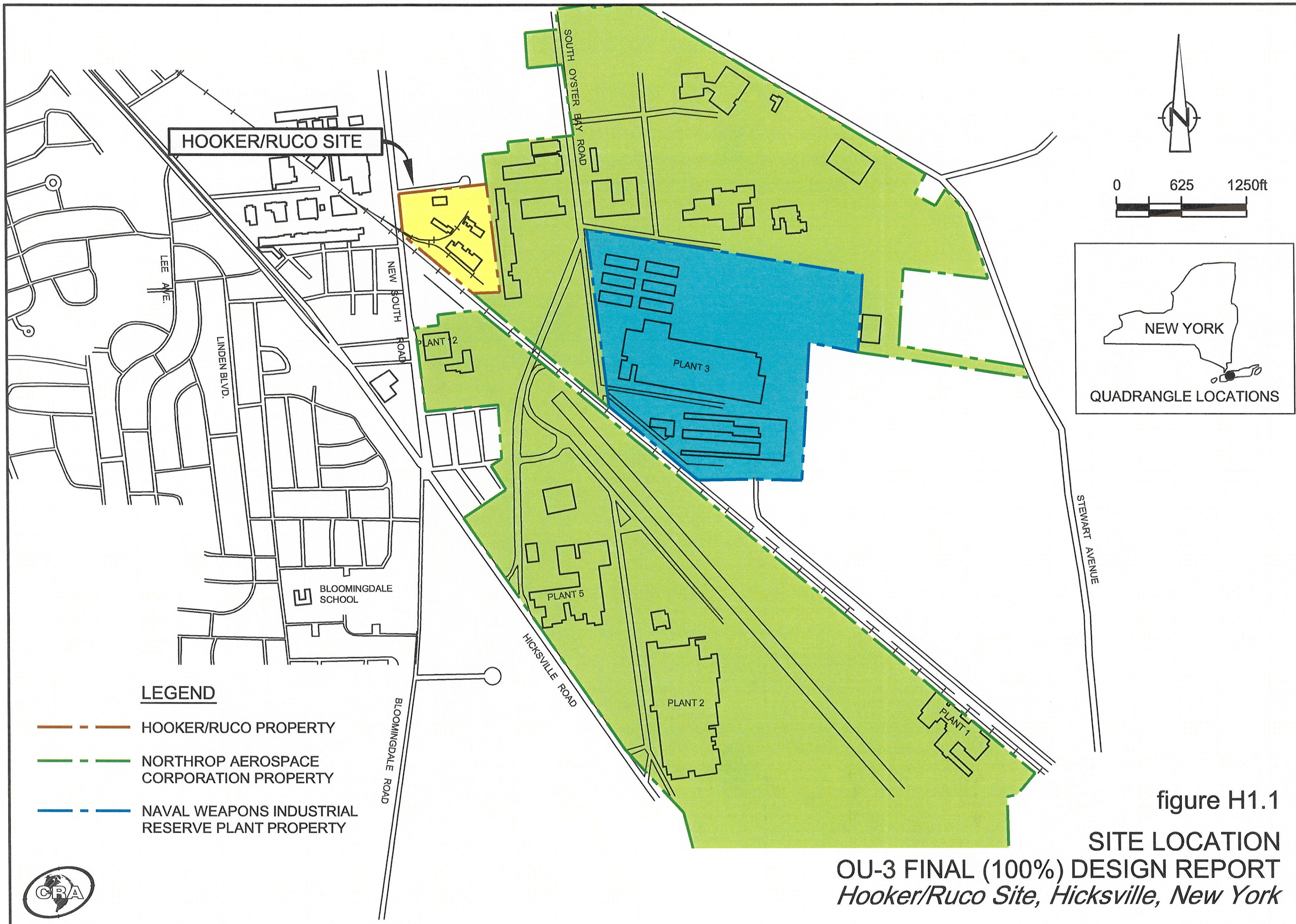


figure H1.1

SITE LOCATION
OU-3 FINAL (100%) DESIGN REPORT
Hooker/Ruco Site, Hicksville, New York

06883-95(045)GN-WA016 MAR 11/2005

TABLE H2.1

INJECTION WELLS - AIR INSTRUMENTATION
OU-3 BIOSPARGE REMEDY
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

Injection Well	*Injection Point*	*PI*	*FI/FSL /FAL*	*YV/YA/ ZSH/ZSL*	*Injection Well*	*Injection Point*	*PI*	*FI/FSL /FAL*	*YV/YA/ ZSH/ZSL*
IW-01	Low	120	11	11	IW-12	Low	120	121	121
IW-01	Intermediate	120	12	12	IW-12	Intermediate	120	122	122
IW-01	High	120	13	13	IW-12	High	120	123	123
IW-02	Low	110	21	21	IW-13	Low	130	131	131
IW-02	Intermediate	110	22	22	IW-13	Intermediate	130	132	132
IW-02	High	110	23	23	IW-13	High	130	133	133
IW-03	Low	30	31	31	IW-14	Low	140	141	141
IW-03	Intermediate	30	32	32	IW-14	Intermediate	140	142	142
IW-03	High	30	33	33	IW-14	High	140	143	143
IW-04	Low	40	41	41	IW-15	Low	150	151	151
IW-04	Intermediate	40	42	42	IW-15	Intermediate	150	152	152
IW-04	High	40	43	43	IW-15	High	150	153	153
IW-05	Low	50	51	51	IW-16	Low	160	161	161
IW-05	Intermediate	50	52	52	IW-16	Intermediate	160	162	162
IW-05	High	50	53	53	IW-16	High	160	163	163
IW-06	Low	60	61	61	IW-17	Low	170	171	171
IW-06	Intermediate	60	62	62	IW-17	Intermediate	170	172	172
IW-06	High	60	63	63	IW-17	High	170	173	173
IW-07	Low	70	71	71	IW-18	Low	180	181	181
IW-07	Intermediate	70	72	72	IW-18	Intermediate	180	182	182
IW-07	High	70	73	73	IW-18	High	180	183	183
IW-08	Low	80	81	81	IW-19	Low	190	191	191
IW-08	Intermediate	80	82	82	IW-19	Intermediate	190	192	192
IW-08	High	80	83	83	IW-19	High	190	193	193
IW-09	Low	90	91	91	IW-20	Low	200	201	201
IW-09	Intermediate	90	92	92	IW-20	Intermediate	200	202	202
IW-09	High	90	93	93	IW-20	High	200	203	203
IW-10	Low	100	101	101	IW-21	Low	210	211	211
IW-10	Intermediate	100	102	102	IW-21	Intermediate	210	212	212
IW-10	High	100	103	103	IW-21	High	210	213	213
IW-11	Low	110	111	111	IW-22	Low	220	221	221
IW-11	Intermediate	110	112	112	IW-22	Intermediate	220	222	222
IW-11	High	110	113	113	IW-22	High	220	223	223

TABLE H2.2

INJECTION WELLS - LIQUID INSTRUMENTATION
OU-3 BIOSPARGE REMEDY
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

INJECTION WELL	*PI*	*FI/FSL/FAL*	*YV/YA/ ZSH/ZSL*
IW-01	015	014	014
IW-02	025	024	024
IW-03	035	034	034
IW-04	045	044	044
IW-05	055	054	054
IW-06	065	064	064
IW-07	075	074	074
IW-08	085	084	084
IW-09	095	094	094
IW-10	105	104	104
IW-11	115	114	114
IW-12	125	124	124
IW-13	135	134	134
IW-14	145	144	144
IW-15	155	154	154
IW-16	165	164	164
IW-17	175	174	174
IW-18	185	184	184
IW-19	195	194	194
IW-20	205	204	204
IW-21	215	214	214
IW-22	225	224	224

TABLE H3.1

SUMMARY OF PERFORMANCE MONITORING [1]
OU-3 BIOSPARGE REMEDY
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

Phase I System

Media	*Location*	*Frequency*	*Parameters*
Groundwater	MW-81, MW-82	- Background [2] - Monthly for First Quarter - Quarterly for remainder of first 2 years of operation	- VOCs + TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
	MW-83, MW-84	- Background [2] - Quarterly for first 2 years of operation	- VOCs + TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
	MW-61I/D/D2, MW-87, MW-88	- Background [2] - Semi-Annually	- VOCs + TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
Soil Gas	VZ-10, VZ-11	- Background [2] - Shortly after initial Air Injection - Monthly for First Quarter - Quarterly for remainder of first 2 years of operation	- Monitor with PID - If elevated PID reading collect sample for VOCs and methane
	VZ-14, VZ-15, VZ-16	- Background [2] - Semi-Annually	- Monitor with PID - If elevated PID reading collect sample for VOCs and methane
Liquid Supplements	Mixing Unit	- Annually for 3 years	- TOC, N, P

TABLE H3.1

SUMMARY OF PERFORMANCE MONITORING [1]
OU-3 BIOSPARGE REMEDY
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

Remainder of Middle Fence

Media	*Location*	*Frequency*	*Parameters*
Groundwater	MW-85	- Background [2] - Quarterly for first 2 years of operation	- VOCs + TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
	MW-86, MW-89	- Background [2] - Semi-Annual	- VOCs + TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
Soil Gas	VZ-12	- Background [2] - Shortly after initial injection - Monthly for First Quarter - Quarterly for remainder of first 2 years of operation	- Monitor with PID - If elevated PID reading, collect sample for VOCs and methane
	VZ-13, VZ-17	- Background [2] - Semi-Annually	- Monitor with PID - If elevated PID reading, collect sample for VOCs and methane
Liquid Supplements	Included in Phase I		

TABLE H3.1

SUMMARY OF PERFORMANCE MONITORING [1]
OU-3 BIOSPARGE REMEDY
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

North Fence

Media	*Location*	*Frequency*	*Parameters*
Groundwater	MW-70, MW-71	- Background [2] - Monthly for First Quarter - Quarterly for remainder of first 2 years of operation	- VOCs + TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
	MW-64I/D, MW-72, MW-73, MW-74	- Background [2] - Quarterly for first 2 years of operation	- VOCs + TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
	MW-75, MW-76, MW-77, MW-78, MW-79 MW-80	- Background [2] - Semi-Annual	- VOCs + TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
Soil Gas	VZ-1, VZ-2 VZ-3	- Background [2] - Shortly after initial injection - Monthly for First Quarter - Quarterly for remainder of first 2 years of operation	- Monitor with PID - If elevated PID reading, collect sample for VOCs and methane
	VZ-4, VZ-5, VZ-6, VZ-7, VZ-8, VZ-9	- Background [2] - Semi-Annually	- Monitor with PID - If elevated PID reading, collect sample
Liquid Supplements	Included in Phase I		

Notes:

(1) Scope of monitoring to be evaluated after receipt of first 3 years of monitoring results.

(2) Background monitoring will be performed at those wells associated with each segment of the biosparge injection well fences prior to initial air injectic thatsegment. Monitoring will be once 2 weeks before the initial injection and then daily for the first 3 days immediately prior to the initial air injectio addition,daily monitoring of these wells for DO and ORP will occur on the first 4 days following the start of injection. Samples for VOC analyses will collected only once.

(3) TICs will be analyzed/reported for first sampling event of each new well and next sampling event of any existing well. If TICs are not present in a we futureanalysis/reporting of TICs in such well will be performed. If TICs are present in a well, TIC analysis/reporting will continue until TICs are no longer present.