BIOSPARGE TREATMENT SYSTEM

OPERATION AND MAINTENANCE MANUAL

HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

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1.0 INTRODUCTION

This Operation, Maintenance, and Monitoring O, M & M Manual was prepared for the Hicksville Biosparge Treatment System to address the vinyl chloride monomer (VCM) subplume in the groundwater downgradient of the Hooker Chemical/Ruco Polymers Superfund Site (Hooker/Ruco Site) located in Hicksville, New York. The Hooker/Ruco Site is a 14-acre former polymer manufacturing facility and is located as shown on Figure 1.1 and Figure 1.2.

The Hooker/Ruco Site operation occurred between 1945 and 2002. During this time period, chemical releases into the hydrogeologic environment occurred. The impacts to the soils at the Hooker/Ruco Site have been addressed through remedial activities. However, impacts due to the historic chemical releases persist in the groundwater. The groundwater impact migrated off-site and is now commingled within the regional total volatile organic compounds (TVOC) groundwater plume from neighboring facilities. The studies that have been performed have defined the horizontal and vertical extent of the VCM subplume emanating from the Hooker/Ruco Site. The Record of Decision (ROD) that was issued for the Site identified that the appropriate remedy for the off-site groundwater subplume of VCM would incorporate in situ biosparging.

This biosparge treatment scenario incorporates the injection of air, through injection wells. The air injection will occur at a sufficient rate to convert the anaerobic groundwater in the area near and down gradient of the wells to aerobic conditions. Air is to be injected to create aerobic conditions suitable for the biodegradation of the VCM subplume. Treated groundwater from the downgradient Northrop-Grumman groundwater collection system will also be utilized as a source of oxygen to be injected into the VCM impacted zone within the groundwater. The treated groundwater is saturated with oxygen due to its treatment in an air stripper. In addition, the Northrop-Grumman treated groundwater may also be utilized to inject nutrients and/or carbon (i.e. sugar byproducts) supplements to accelerate the rate of biodegradation. The need for nutrient and/or carbon supplements will be determined based upon the results of the monitoring program that is being implemented to track the success of this biosparge scenario. If monitoring shows that insufficient nutrients and/or carbon are inhibiting biodegradation, these will be added through the use of diammonium phosphate (DAP), sugar byproducts or other suitable materials.

The biosparge system is being installed in the three Phases:

i.) Phase 1 – middle section of middle fence of injections wells;

ii.) Phase 2 – remainder of middle fence; and iii.) Phase 3 - northern fence of injection wells and any needed southern injection wells.

The components included in Phase 1 of the remedy are shown on Figure 1.2.

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 startup, 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 Health and Safety 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. A list of contact names associated with the Site will be posted on the outside of the building.

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

1.2.1 PROCESS MANAGER

The Process Manager has the overall responsibility to ensure that the proper Site operation, maintenance, monitoring, and inspection requirements of this plan are performed. The Process Manager has remote oversight and control of the system under MSRMI direction.

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, consultants, 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 System Operator 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 Biosparge 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 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
Compressor Manual
Supplement Mixing Unit Manual

1.3.2 REFERENCE DRAWINGS

Description	Drawing Number
Engineering Flow Sheets	EF-01 through EF-10
Civil Drawings	CI-01 through CI-04
Structural Drawings	ST-01 through ST-07
Mechanical/Piping Drawings	MP-01 through MP-06
Electrical/Instrumentation Drawings	E-01 through E-16

* Note: Site plans are included in above drawings.

1.3.3 DEFINITIONS

DAP - Diammonium Phosphate

HMI – Human-Machine Interface

MSRMI – Miller Springs Remediation Management, Inc.

PC – Personal Computer

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

Sequence – Series of parameters that indicate equipment is operating out of normal limits. It triggers an alarm and locks out the designated equipment.

2.0 BIOSPARGE TREATMENT SYSTEM

2.1 INTRODUCTION

The Biosparge Treatment System consists of:

- Control Building
- Air Injection Wells
- Liquid Injection Wells
- Air and Liquid Distribution System

Each of these is briefly described in the following:

The Biosparge Treatment System may be divided into two primary systems; 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 independently using an integrated control system.

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 (maximum of three wells at once) and time length. The system will automatically cycle through all stages continuously at the specified intervals unless 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 oxygenated water and supplements are also distributed to the injection wells in stages. Treated Northrop-Grumman water will be injected into the wells. In the event that treated Northrop-Grumman water is not available, potable water from the local municipal supply system will be substituted. Treated Northrop-Grumman water is preferred over municipal supply water because the treated water is saturated with oxygen and does not contain chlorine. Each stage allows injection of water 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 (maximum of three wells at once) and time length. The system will automatically cycle through all stages continuously at the specified intervals unless interrupted by the operator, the air injection system, or abnormal conditions.

Two air injection wells set at different depths are installed at each injection location. In addition, one liquid injection well is installed at each injection location for delivery of oxygenated water. The Biosparge Treatment System is operated in a fail-safe manner. If abnormal conditions are detected, system sequences will be tripped causing automatic shutdown of the Biosparge Treatment System. The system sequence will also trigger the autodialer, which will notify the System Operator and Process Manager of the shutdown. The Biosparge Treatment System (after a sequence shutdown) can only be restarted remotely after all abnormal conditions have been identified and corrected. Abnormal conditions caused by a compressor fault require the System Operator to re-start the Biosparge Treatment System manually at the site. The compressor fault can only be reset from the local display. For more information on sequences, refer to Appendix A.

2.2 AIR DISTRIBUTION SYSTEM

2.2.1 PROCESS DESCRIPTION

The compressor provides air for injection into the air injection wells and is controlled by a variable frequency drive (VFD). Refer to Drawing EF-01. The VFD allows the compressor to vary airflow consistent with the flow setpoint entered by the System Operator. Airflow, 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, which is then drained to the sewer. A copy of the Discharge permit is shown in Appendix M.

When the air and water systems are being injected simultaneously in one well, the water needs to start injecting 15 minutes before and 15 minutes after the air injection. This will cause a small delay in the air injection when switching from one well to another.

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, PD-260
Size:	2 ½-inches
Design:	551 scfm, 232 psi

Moisture/Oil Separator Drum

Standard 55 gallon drum with overflow to the floor drain.

The discharge line from the compressor is protected from over pressurization by pressure relief valve, PSV-300. This line discharges to the floor of the Treatment Building. The valve is set at 200 psig. Compressor shutdown is set at 210 psig.

2.2.3 INSTRUMENT OVERVIEW

The flow rate 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). Refer to Drawing E-09. The flow setpoint is entered on the Human Machine Interface (HMI) in the Control Building. The PLC compares this operator-entered setpoint to the flow transmitter, FE-300, reading to determine the speed of the compressor. The speed is determined using a Proportional/Integral/Derivative (PID) loop in the PLC. As the flow rate deviates from a specified flow setpoint, the PLC automatically adjusts an analog control signal to "ramp up" or "ramp down" the speed of the compressor in order to compensate for the difference in flow. As the flow rate returns to the set point, the PLC decreases the rate at which the analog control signal changes and attempts to maintain the compressor's speed. The PID loop adjusts the compressor's speed to maintain a constant airflow to the injection wells.

Compressor

The compressor can be stopped locally using the emergency stop button. To operate the compressor from the local keypad the operator must change the operating mode at the keypad from remote control to local control. Under normal conditions the compressor mode will be in remote control and will be started and stopped from the HMI. . The compressor "DISABLE" pushbutton on the HMI in the Control Building and Control Sequence will also shutdown the Compressor.

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

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 and help determine when it is necessary to change the filters. Each filter also has an automatic drain valve (LCV-303 for the pre-filter and LCV-304 for the polish filter). These drains automatically removes oil and water as their levels rise.

Air Injection Wells

Each air injection well has an air pressure indicator to monitor the conditions at each well. Each air injection well is also equipped with 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 shutoff valve is closed when the system is not indicating air into the location. This prevents air blow back or short-circuiting. The flow indicator and manual valve are used to set the desired air flow rate to an individual well. The flow switch provides remote indication of flow to a well.

2.2.4 OPERATING PARAMETERS

This section provides operating parameters and functions for the components of the compressor and injection wells. For information on system setpoints, refer to Appendix B.

Compressor

Parameter	*Alarm Point*	*Normal Range*	*Instruments*	*Sequence*
Moisture/Oil Separator Filter Differential	N/A	4.6-8.0 psi	DPI-303, DPI-304, LCV-303, LCV-304	N/A
Pressure and Level	N/A	CLOSED		N/A

Reason for Monitoring:

A high differential pressure (8 psi) indicates it is necessary to change the filters.

Function:

DPI-303 and DPI-304 are used for monitoring the moisture/oil separator filters. LCV-303 and LCV-304 automatically open and close based on oil and water levels.

Parameter	*Alarm Point*	*Normal Range*	*Instruments*	*Sequence*
Compressor Discharge Pressure	Low - 50 High - 150 High-high - 180	psi	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 System Operator of abnormal conditions. These alarms are displayed on the HMI. PAHH-302 and PAHH-305 will also trip Sequence 1 shutting down the system. 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 – 10 High – 325	100-300 scfm	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 System Operator on the HMI screen, the compressor VFD changes the 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 System Operator of abnormal conditions. This alarm is displayed on the HMI. Instantaneous flow is also trended in the HMI.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Compressor Discharge Temperature	High –200 High-high – 210	70-120 °F	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 System Operator of abnormal conditions. These alarms are displayed on the HMI. TAHH-300 will also trip Sequence 1 shutting down the system. 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	Not in position commanded by PLC	OPEN or CLOSED	ZSL-300, ZSH-300	1

Reason for Monitoring:

If the compressor is not running and this valve (YV-300) is open, back flow from the injection wells may occur. If the compressor is running and this valve is closed, no air will be delivered to the wells and the compressor or discharge line may be damaged.

Function:

ZSL-300 and ZSH-300 are used for monitoring valve position. YA-300 indicates to the System Operator the valve is not in position commanded by the PLC. This alarm is displayed on the HMI and will trip Sequence 1 shutting down the system. Valve position is displayed on the HMI.

Injection Wells

Parameter	*Alarm Point*	*Normal Range*	*Instruments*	*Sequence*
Injection Well Pressure	-	125-165 psi	See Table 2.1	-

Reason for Monitoring:

Pressure deviations from normal may indicate inefficiency of the compressor or pluggage of the air forcemain/injection well.

Function:

PI-XXX (See Table 2.1) is used for monitoring of the air discharge line pressure.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Injection Well Flow	Low – 80 scfm	100 scfm	See Table 2.1	-

Reason for Monitoring:

Flow is used to monitor airflow into the injection well. The low flow switch indicates that there may be a loss of air, pluggage in the air forcemain or injection well, or that the well is not on-line.

Function:

FAL-XXX (See Table 2.1) notifies the System Operator that there is a flow problem at that injection point. This alarm is displayed on the HMI.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Injection Point Flow Valve Status	Not in position commanded by PLC	OPEN or CLOSED	See Table 2.1	-

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 (See Table 2.1) are used for monitoring valve position. YA-XXX (See Table 2.1) notifies the System Operator if the valve is not in 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)

Operating procedures per the following activities are described in the following section

1. Compressor Local and Remote Control;
2. Normal Compressor Operation; and
3. Replacement of Moisture/Oil Separator Filters Procedure

COMPRESSOR LOCAL AND REMOTE CONTROL

Introduction: This procedure outlines the steps necessary to operate the compressor locally from the keypad.

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

1. Select F1 (Menu) on the keypad. This will display the list of available parameters.
2. Scroll down using the down arrow key to (Modify Parameters).
3. Highlight (Modify Parameters) using the right arrow key.
4. After selecting (Modify Parameters) scroll down using the down arrow key to (Configuration).
5. Highlight (Configuration) using the right arrow key.
6. Select F2 (Mod.) The keypad will start blinking (Remote Control), scroll down using the down arrow key to (Local Control).
7. Highlight (Local Control) using the right arrow key.
8. Select F1 (Prog.) This will change the compressor mode to local control.
9. Select F1 (Menu) to return to the main menu screen.
10. To switch back to remote control repeat steps 1 through 6. Note at step 6 the keypad will start blinking (Local Control), scroll down using the down arrow key to (Remote Control).
11. Highlight (Remote Control) using the right arrow key.
12. Select F1 (Prog.) This will change the compressor mode to remote control.
13. Select F1 (Menu). This will return to the main menu screen.

NORMAL COMPRESSOR OPERATION

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

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

1. Verify the compressor is in remote control mode on the local keypad display.
2. Place the flow controller (FIC-300) in auto mode and set the setpoint to the desired flow rate on the HMI screen in the Control Building.
3. Start the compressor by clicking the Injection Mode ON button on the HMI screen in the Control Building.
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.

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

Additional compressor information is provided in Appendix E.

REPLACEMENT OF MOISTURE/OIL SEPARATOR FILTERS

Introduction: This procedure outlines the steps necessary to replace the moisture/oil separator filters.

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

STEP ONE - Preparation

1. Verify that the differential pressure across the moisture/oil separator filter is greater than 8 psi.
2. Stop and lock-out the compressor.
3. Verify YV-300 and the by-pass loop ball valve is closed.
4. Bleed air from process line (at PI-301).

STEP TWO - Replace Filter in Housing

1. Remove spent moisture/oil separator filter.
2. Insert new moisture/oil separator filter.
3. Spent filter should be placed in 55-gallon drum to be handled by a waste oil recycler, Safety-Kleen.

STEP THREE - Place System On-line

1. Unlock the compressor.
2. Complete the "Startup Treatment System" Procedure.

2.2.6 TROUBLESHOOTING

Compressor High-High Pressure, PAHH-302	**Reason for Alarm:** The compressor discharge pressure is above 170 psi. **Action to Take:** Verify selected wells. Verify YV-300 and other valving is open.
Compressor High Pressure, PAH-302	**Reason for Alarm:** The compressor discharge pressure is above 150 psi. **Action to Take:** Verify selected wells. Verify YV-300 and other valving is open.
Compressor Low Pressure, PAL-302	**Reason for Alarm:** The compressor discharge pressure is below 50 psi. **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 180 psi. **Action to Take:** Verify selected wells. Verify YV-300 and other valving is open.
Compressor High Flow, FAH-300	**Reason for Alarm:** The compressor discharge flow is above 325 scfm. **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 10 scfm. **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 210 F. **Action to Take:** Verify operation of compressor. Verify YV-300 and other valving is open.
Compressor High Temperature, TAH-300	**Reason for Alarm:** The compressor discharge temperature is above 200 F. **Action to Take:** Verify operation of compressor. Verify YV-300 and other valving 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.
Injection Point Low Flow, FAL-XXX (See Table 2.1)	**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 (See Table 2.1)	**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. A delay will be added between the air and water injection. This allows the air pressure buildup in the well to dissipate before water injection begins. This delay will be determined in the field by pressure readings on the local indicators. The water will continuously be injected into each well, one at a time in one hour increments. The water sequence will be interrupted twice a month when the air injection starts. Water needs to be injecting in one well for 15 minutes before and after the air injection begins in that well. This will cause a small delay in the air injection when switching from one well to another.

2.3.1 PROCESS DESCRIPTION

The mixing unit is used to combine the carbon/nutrient supplement (sugar byproducts) with water for transfer to the injection wells. Refer to Drawing EF-01. The mixing unit includes 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 specified and consistent supplement concentration to the forcemain.

The flow to the liquid injection 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 System Operator. Liquid flow rate, from both the mixing unit and the flushing water, is monitored for the flow rate 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. Refer to Drawings ST-02 and MP-02.

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 5 gallon bucket

Supplement Metering Pump (Part of Mixing Unit)

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

2.3.3 INSTRUMENT OVERVIEW

The flow rate 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 entered on the Human Machine Interface (HMI) in the Control Building. The PLC compares the System Operator-entered set point 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 the specified flow setpoint, the PLC automatically adjusts an analog control signal to open or close the valve in order to compensate for the difference in flow. As the flow rate returns toward the set point, the PLC decreases the rate at which the analog control signal changes and attempts 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 carbon supplement injected into the forcemain is a constant concentration set by the PLC and determined by the System Operator. The mixing unit receives an analog control signal based on the System Operator input to control the injection of supplement.

Mixing Unit

The mixing unit is controlled using an ON-OFF-REMOTE switch local to the mixing unit. When the mixing unit is placed into REMOTE, and enabled at the HMI (ENABLE), the mixing unit is in automatic mode. In automatic mode, the mixing unit automatically starts when commanded by the liquid distribution sequencer, and continues 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 System Operator on the HMI screen in the Control Building. The mixing unit receives an analog control signal based on the System Operator input to control the injection of supplement. Sequence 3 will shutdown the mixing unit.

Automatic control valves, YV-306 and YV-311, close in conjunction with the Supplement/Make-up Injection being off in order to prevent any back flow from the injection wells from entering the Control Building. Sequence 2 will close these valves.

A pressure gauge is located upstream of all controls on the Northrop make-up water line.

Liquid Injection Wells
Each liquid 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.

2.3.4 OPERATING PARAMETERS

For information on system setpoints, refer to Appendix B.

Mixing Unit

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Mixing Unit	General Alarm	-	UA-310	2

Reason for Monitoring:

System alarm is used to monitor mixing unit.

Function:

Alarm notifies the System Operator that the mixing unit is not functioning properly. This alarm will be displayed on the HMI and will trip Sequence 2 and shutdown the system.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Make-up Water Line Pressure	-	70 psi max	PI-306	-

Reason for Monitoring:

Excessive pressure indicates a restriction in flow to the liquid injection wells (i.e. improper valving) or the mixing unit. Low pressure indicates a loss of forcemain pressure from Northrop.

Function:

Manual monitoring of Make-up Water Line pressure.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Make-up Water Valve Status	Not in position commanded by PLC	OPEN or CLOSED	ZSL-306, ZSH-306	2

Reason for Monitoring:

The status of this valve determines whether the make-up water is either available or shut off.

Function:

ZSL-306 and ZSH-306 are used for monitoring valve position. YA-306 notifies the System 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 2 and shutdown the system. Valve position is displayed on the HMI.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Liquid Delivery Valve Status	Not in position commanded by PLC	0-100%	ZSL-312, ZSH-312	2

Reason for Monitoring:

The status of this valve determines whether the supplement water or flush water is being injected into the wells or it is shut off.

Function:

ZSL-312 and ZSH-312 are used for monitoring valve position. FV-312 notifies the System 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 2 and shutdown the system. Valve position is displayed on the HMI.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Liquid Delivery Flow	Low - <4 gpm/well High - >6 gpm/well	5 gpm/well	FIT-306	2

Reason for Monitoring:

This flow is used to monitor liquid flow to the injection wells. Totalized flow is used in record keeping. This flow meter 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 System Operator of flow deviations during water flush. FAL-312 and FAH-312 notify the System Operator of flow deviations during supplement injection. These alarms are displayed on the HMI and will trip Sequence 2 and shutdown the system.

Injection Wells

Parameter	*Alarm Point*	*Normal Range*	*Instruments*	*Sequence*
Liquid Injection Well Pressure	-	0-38 psi	See Table 2.2	-

Reason for Monitoring:

Pressure deviations from normal may indicate inefficiency of the supplement injection pump, mixing unit and Delivery System, loss of potable water, or pluggage of the liquid forcemain.

Function:

PI-XXX (See Table 2.2) is used for monitoring of the liquid discharge line pressure.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Injection Point Flow	Low - < 4 gpm	5 gpm	See Table 2.2	-

Reason for Monitoring:

Flow is used to monitor liquid flow into the injection point. The low flow switch indicates that there may be a loss of potable water, pluggage in the liquid forcemain/well, or that the well is not on-line.

Function:

FAL-XXX (See Table 2.2) notifies the System Operator that the injection point is not on-line or there is a flow problem. This alarm is displayed on the HMI.

Parameter	*Alarm Point*	*Normal Range*	*Instrument*	*Sequence*
Injection Point Flow Valve Status	Not in position commanded by PLC	OPEN or CLOSED	See Table 2.2	-

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 (See Table 2.2) are used for monitoring valve position. YA-XXX (See Table 2.2) notifies the System 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)

Operating procedures to perform the following tasks are presented in the following:

1. Enable Transfer of Supplement to Mixing Unit; and
2. Replacement of 5 Gallon Supplement Bucket

See the mixing unit manual in Appendix E 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 (5 gallons) should be 50% to allow for operation for a minimum of 14 days. If the level is below 50% follow the "Replacement of Supplement Drum" procedure.
2. Place the ON-OFF-REMOTE switch to REMOTE.
3. Start the blending unit by clicking the Air Injection Mode ON button on the HMI screen in the Control Building.

STEP TWO - Check System

1. Check for leaks or other pumping problems.

STEP THREE - Follow-up

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

REPLACEMENT OF SUPPLEMENT DRUM

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. Place the ON-OFF-REMOTE switch to OFF.

STEP TWO - Remove Equipment from Used Drum

1. Remove pump suction line from used 5-gallon drum.
2. Remove drum.

STEP THREE - Place New Drum On-line

1. Verify contents of new 5-gallon drum.
2. Relocate new 5-gallon drum for supplement addition. Refer to Appendix L, Health and Safety Plan for safe heavy lifting procedures.
3. If required, replace supplement metering pump suction line to the bottom of the new drum.
4. Place supplement metering pump suction line in new supplement drum.
5. Prime supplement metering pump.
6. If last drum in storage is used, notify Process Manager (or order more supplement).
7. Place the ON-OFF-REMOTE switch to REMOTE.

2.3.6 TROUBLESHOOTING

Mixing Unit General Alarm, UA-310	**Reason for Alarm:** Mixing Unit is not functioning properly. **Action to Take:** Verify Supplement Mixing Unit is operational.
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.
Supplement Injection Low Flow, FAL-312	**Reason for Alarm:** Flow is below 5 gpm/well. **Action to Take:** Verify flow setpoint. Verify operation of YV-306 and FV-312.
Supplement Injection High Flow, FAH-312	**Reason for Alarm:** Flow is below 5 gpm/well. **Action to Take:** Verify flow setpoint. Verify operation of YV-306 and FV-312.
Water Flush Injection Low Flow, FAL-306	**Reason for Alarm:** Flow is below 5 gpm/well. **Action to Take:** Verify operation YV-306 and FV-312 Verify flow setpoint.
Water Flush Injection High Flow, FAH-306	**Reason for Alarm:** Flow is below 5 gpm/well. **Action to Take:** Verify operation YV-306 and FV-312 Verify flow setpoint.
Valve YV-306 Failure, YA-3306	**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 (See Table 2.2)	**Reason for Alarm:** The injection point flow is below 5 gpm. **Action to Take:** Verify valve position. Verify selected wells.
Injection Point Valve Failure, YA-XXX (See Table 2.2)	**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

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

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

STEP ONE - Before Startup:

1. Verify no Sequences are active.
2. Select the well sequence for the supplement addition on the HMI screen in the Control Building. Note: If set at zero, the system will not run.
3. Select the air injection point groupings, flow rates, frequency and associated time lengths on the HMI screen in the Control Building.
4. Place the air injection sequence controller (KIC-300) in automatic mode on the HMI screen in the Control Building.
5. Place the air injection block valve (YV-300) in automatic mode on the HMI screen in the Control Building.
6. Place the flow controller (FIC-300) in automatic mode on the HMI screen in the Control Building.
7. Place the make-up sequence controller (QIC-310 in automatic mode on the HMI screen in the Control Building.
8. Place the make-up water block valve (YV-309) in automatic mode on the HMI screen in the Control Building.
9. Place the supplement addition flow controller (FQIC-310) in automatic mode on the HMI screen in the Control Building.
10. Place the liquid injection sequence controller (KIC-312) in automatic mode on the HMI screen in the Control Building.
11. Place the flow controller (FIC-312) in automatic mode on the HMI screen in the Control Building.

STEP TWO - Startup:

Note: If selected liquid flow rate is zero, ignore this section.

1. Complete the "Enable Transfer of Supplement to Mixing Unit" Procedure.
2. Place the mixing unit ON-OFF-REMOTE switch to REMOTE.
3. Complete the "Normal Compressor Operation" Procedure described in Section 2.2.5.

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 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 Process Manager's attention.

2.5 TREATMENT SHUTDOWN

Introduction: This procedure outlines the steps necessary to shutdown the Biosparge Treatment Process.

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

1. Shutdown the compressor by pressing the Air Injection Mode OFF pushbutton on the HMI in the Control Building.
2. Shutdown the mixing unit by pressing the Water Injection Mode OFF pushbutton on the HMI in the Control Building.
3. Check system flows and pressures to verify system is down.

OR

1. Press the Emergency Stop pushbutton local to the compressor.
2. Press the OFF pushbutton local to the mixing unit.
3. 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 Treatment 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 System 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 Process Manager. Vendor manuals for equipment and instrumentation are provided in Appendices E and F respectively. The spare parts list is provided in Appendix G. A list of activities and personnel requirements is provided on Table 3.1.

3.1 SYSTEM OPERATIONS MONITORING

3.1.1 MONITORING REQUIREMENTS

Monitoring requirements and intervals are described in the following subsections :

Transfer Lines and Piping

1. Inspect piping monthly for evidence of leaks, corrosion, excessive stress, or any other undesirable condition.

Mixing Unit

1. Inspect unit for evidence of leaks, corrosion, or cracks.
2. Inspect unit for proper operation (refer to Appendix E).

Pumps

1. Inspect pumps monthly.
2. Ensure all suction and discharge valves function properly (refer to Appendix E).

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 are 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

A schedule of inspection and preventative maintenance is found on Table 3.2.

3.1.2.1 MONTHLY INSPECTION AND MAINTENANCE

1. The routine monthly shutdown is to include a check of the oil in the compressor (oil should be changed based on manufacturer's recommendation - see original manufacturer's O&M manual in Appendix E).
2. Routine monthly inspection to include verification of proper instrument operation.
3. Routine monthly inspection of piping, valves, and vessels for leakage.

3.1.2.2 SEMI-ANNUAL INSPECTION AND MAINTENANCE

1. Routine monthly inspection of injection wells to verify proper operation of the valves. The locations of the monitoring wells are shown on Drawing MP-01. Well construction details are summarized in Table 3.3. Well Installation logs are provided in Appendix K.

3.1.3 SCHEDULED MAINTENANCE

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

1. cleaning/repair of metering pump,
2. cleaning/repair of mixing unit, and
3. cleaning/repair of compressor.

A list of potential problems and their appropriate corrective actions are found on Table 3.4.

3.2 PERFORMANCE MONITORING

Performance monitoring includes 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 3.5. The frequencies of sampling described below are applicable to each fence section when it becomes operable.

3.2.1 GROUNDWATER MONITORING

The locations of the groundwater monitoring wells are shown in Drawing MP-01. The majority of the monitoring points are located at a distance of approximately 50 feet downgradient of the injection wells which is equivalent to approximately 4 months of groundwater travel time. Thus, these wells are monitored semi-annually, except for the wells corresponding to Phase 1, which will be monitored quarterly for the first year of operation. This layout results in:

- i.) 7 monitoring locations for Phase 1 of the middle fence;
- ii.) up to 3 additional monitoring locations for the remainder of the middle fence; and
- iii.) up to 12 monitoring locations for the north fence.

Most of the monitoring well nests were 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 typically consist of two wells in the groundwater and two wells in the vadose zone. The screened intervals of the groundwater monitoring wells are generally 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 are 10 feet in length.

Furthermore, to provide an early indication of the impact of Phase 1 of the biosparging system, groundwater monitoring wells (i.e., MW-82) were also installed. These wells were installed at one location approximately 5 feet downgradient of the injection fence at the midpoint between adjacent injection wells and at two locations (i.e., MW-83 and MW-84) approximately 20 feet (2± months travel time) downgradient of the injection fence. These last two monitoring locations are installed at locations that are immediately downgradient of an injection well. The two well nests located approximately 5 feet downgradient (i.e., MW-61 and MW-82) are 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 are monitored quarterly for a period of two years after startup of operation.

Sample collection and analyses will be in accordance with the procedures presented in the OU-3 QAPP. All groundwater sampling is 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 well, TICs will continue to be analyzed/reported for the subsequent samples from each well until they are no longer present or have minimal concentration (i.e. 10 µg/L). 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 was 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 prior to the initial air injection. The parameters to be analyzed/monitored are the same as those described above with the exception that VOCs will be sampled/analyzed once for the 4 background events.

3.2.2 VADOSE ZONE MONITORING

Vadose zone wells were installed in the same locations and will be monitored at the same frequency as the groundwater monitoring wells installed at distances of 20 and 50 feet from the injection fence. The one exception to this frequency 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 were installed at each groundwater monitoring well 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 were 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 was used to account for fluctuations in the groundwater table. The sand packs extend 2 feet above the screen. The annulus above the sand pack was 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 is airtight and includes a stopcock that allows 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 evidenced 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 are monitored and stored by the HMI software. In addition, in accordance with 40 CFR 144.27, the liquid amendments are sampled and analyzed annually (TOC for the sugar by-product solution and phosphorus and nitrogen for the DAP). The data allows 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 are used to evaluate the distribution of the injected materials at each injection point and, in conjunction with the soil gas and groundwater monitoring, are used to assist in optimizing the timing, locations, and rates of material injection. The data are used to assess the rate of VCM biodegradation, injection material distribution and migration, and monitor groundwater flow pathways.

3.3 DECISION LOGIC

All of the decision logic for operation of the injection system will be based upon the redox conditions, VCM concentrations, and TOC concentrations measured in the monitoring wells in the vicinity of the injections. The primary goal of the injections is to create an aerobic environment. The collected data will be used to assess what actions may be necessary to improve the remedy.

Dissolved Oxygen
- the desired concentration is >2 mg/L
- if <2 mg/L, the options are:
  - increase the length of time of oxygen injection
  - increase the frequency of oxygen injection
  - increase the volume of oxygenated water injection
  - install an additional injection well at the midpoint between the injection wells

TOC
- the desired concentration is $5 \leq TOC \leq 10$mg/L
- if < 5mg/L, the options are:
  - increase the injection volume
  - increase the injection frequency
  - check whether the VCM concentration is decreasing
  - evaluate other injection materials

VCM
- the measured concentrations should be decreasing
- if not decreasing
  - increase the dissolved oxygen and/or TOC concentration
  - install additional injection well at the midpoint between the injection wells
  - install injection well in south portion of subplume

Of the above three parameters, the VCM concentration is the critical one. If the VCM concentrations are decreasing and consistent with meeting the remediation objectives, the significance of the remaining parameters in achieving their desired levels is not significant.

3.4 EVALUATION OF MONITORING PROGRAMS

The scope of the groundwater monitoring and vadose zone monitoring will be evaluated using the first two years of data. Based on the evaluation, the scope of monitoring may be modified for the next 5-year period. USEPA concurrence will be obtained prior to implementation of any modifications.

3.5 REPORTING

The reporting schedule shall be:

i.) Monthly progress until completion of Phase 1 Construction;

ii.) Quarterly progress reports thereafter until submittal of the modified design for the remainder of the middle fence; annually thereafter. These reports will contain validated biosparge system performance monitoring data, as they become available. The third and fourth quarterly reports from the first year of the Phase 1 operational period will provide the information regarding the completion of the design of the middle fence, the northern fence, and a potential injection scheme for the southern portion of the subplume;

iii.) Biosparge Construction Drawings 30 days after the Final Inspection for each Phase (one for each of Phase 1 and the remainder of the middle fence);

iv.) Biosparge Construction Report and Drawings (90 days after completion of construction of the north fence/south wells); and

v.) O, M &M Manual Biosparge System (30 days after the Final Inspection for Phase 1). Modified for remainder of middle fence and north fence. South wells, as needed.

4.0 UTILITIES

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

Potable water supply is required for hose stations and the lavatory. Potable water may also be used for supplement injection and flushing. The source of potable water is 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 on the East Side of Jeffrey Ave. at the west fence.

Treated groundwater supply will be used for supplement injection and flushing. The source of treated groundwater is from the Northrop-Grumman GP-1/GP-3 groundwater treatment system and is tied in on the southeast side of the Control Building. A pressure of 40 to 90 psi is available. The treated groundwater shutoff valve is located on Northrop-Grumman property east of South Oyster Rd at the fence. (If there is a leak in the building piping on the Northrop water supply line, the water shutoff valve must be closed immediately.) Phone numbers will be posted on the outside of the building and in Appendix J.

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

Electronix Systems monitors the alarm system. Refer to Appendix J for the contact information.

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 located in the Control Building is the personal computer (PC) based HMI system. The HMI allows total process monitoring through pre-established color graphics. The System Operator can view the entire system by selecting various graphics screens. Process data is stored in the HMI and displayed at the System 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 provided in Appendix D and are listed below:

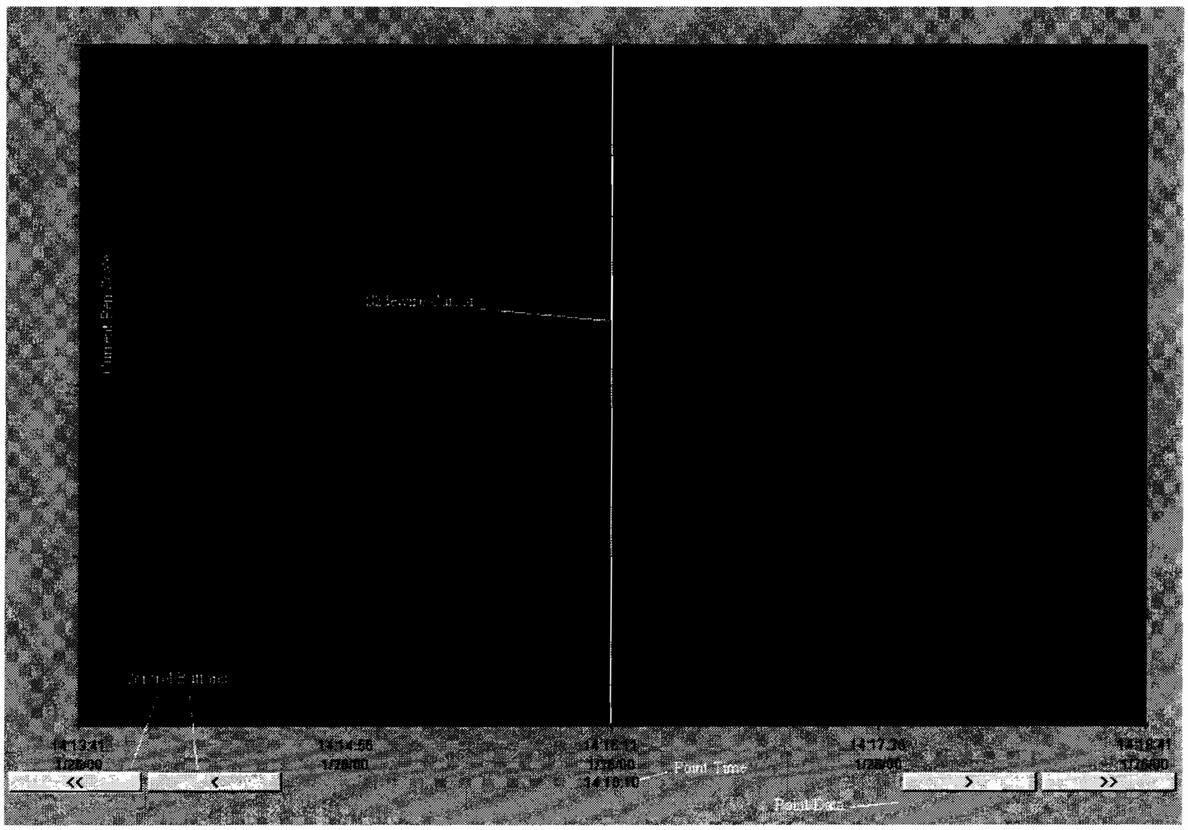
Display Title	*Description*
Flow Menu	Main screen for navigating to other displays.
System Overview	Display for viewing the treatment facility overview.
Air Injection Schedule	Display for setting parameters for Air Distribution.
Water Injection Schedule	Display for setting parameters for Water Distribution.
Injection Wells	Displays of injection well groupings and associated instrumentation.
Alarm Setpoints	Display for setting alarm setpoints.
Air Injection Trend	Display for viewing air injection trends.
Water Injection Trend	Display for viewing water injection trends.

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

On the graphic type screens, the following information applies:

- The message ????? or @@@@@ in place of a value means communication with the I/O device has failed.
- A flashing HI, HIHI, LO, or LOLO, indicates that 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 System Operator may dial-up the Control Room PC via a telephone line or connect directly on the MSRMI network through the T-1 line. This connection allows the operator to remotely control the PC. Therefore, the operator has 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 System 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.

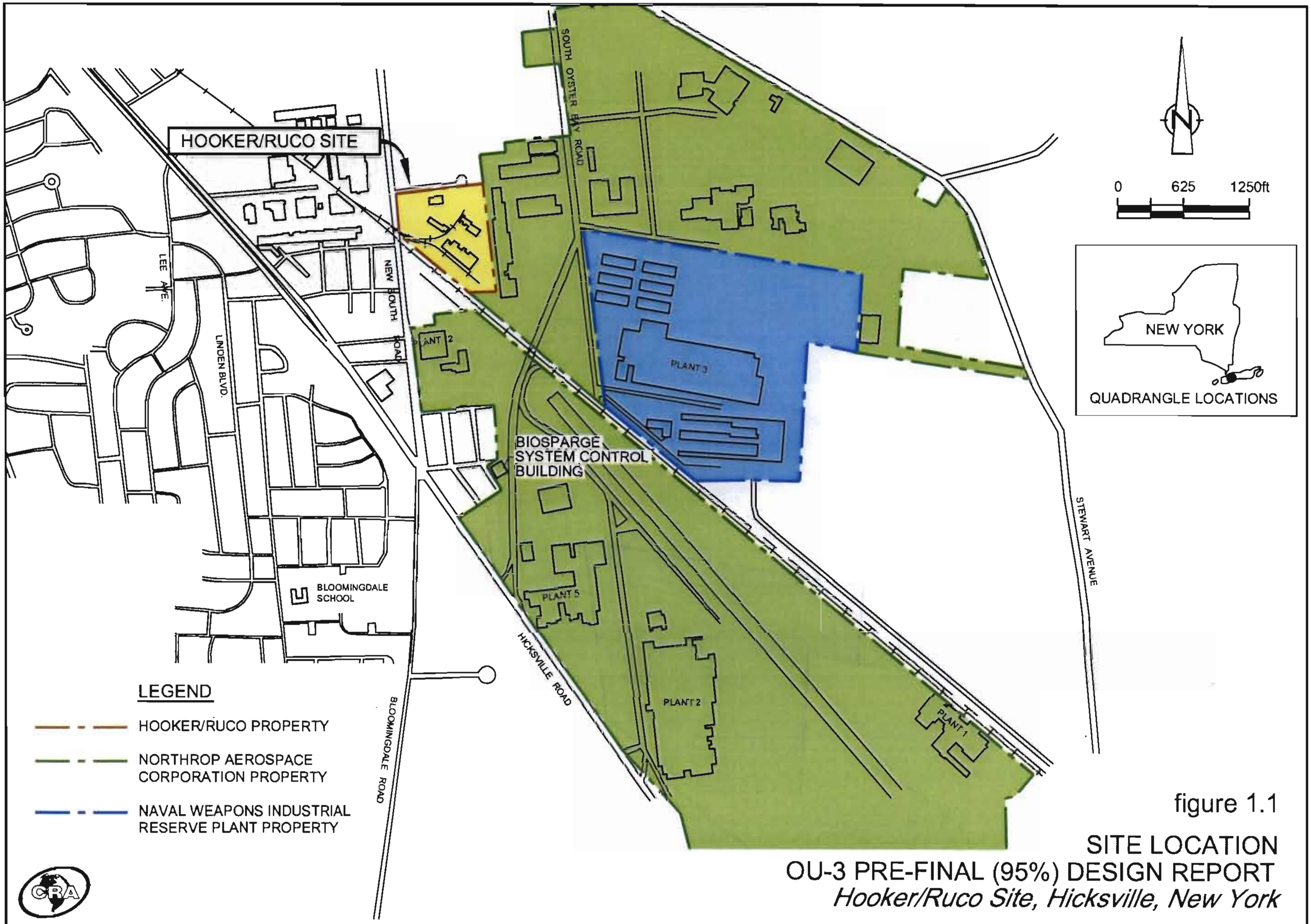


figure 1.1

SITE LOCATION
OU-3 PRE-FINAL (95%) DESIGN REPORT
Hooker/Ruco Site, Hicksville, New York

06883-00(046)GN-NF002 DEC 21/2006

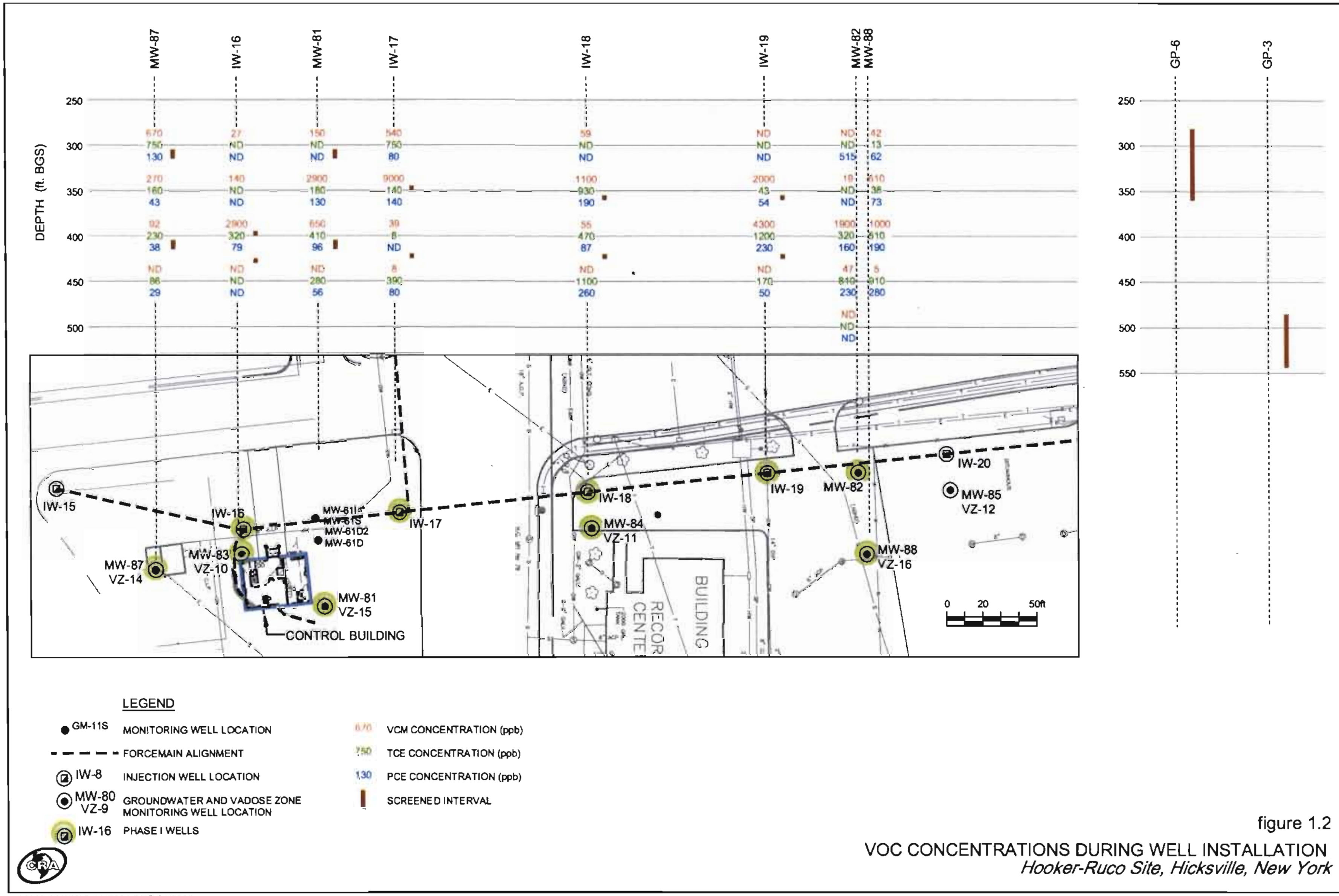


figure 1.2

VOC CONCENTRATIONS DURING WELL INSTALLATION

Hooker-Ruco Site, Hicksville, New York

06883-00(046)GN-NF001 DEC 21/2006

TABLE 2.1

INJECTION WELLS - AIR INSTRUMENTATION
BIOSPARGE TREATMENT SYSTEM
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	10	11	11	IW-12	Low	120	121	121
IW-01	Intermediate	10	12	12	IW-12	Intermediate	120	122	122
IW-01	High	10	13	13	IW-12	High	120	123	123
IW-02	Low	20	21	21	IW-13	Low	130	131	131
IW-02	Intermediate	20	22	22	IW-13	Intermediate	130	132	132
IW-02	High	20	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 2.2

INJECTION WELLS - LIQUID INSTRUMENTATION
BIOSPARGE TREATMENT SYSTEM
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 3.1

PERSONNEL REQUIREMENTS
BIOSPARGE TREATMENT SYSTEM
OPERATION AND MAINTENANCE PLAN
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

Monitoring and Testing Activities	
• groundwater monitoring	one or two person monitoring/sampling crew
Inspection Activities	
• all inspection activities except those requiring confined space entry	one Inspector
• all inspection activities requiring confined space entry	one Inspector and Support Team
Maintenance Activities	
• all maintenance activities	one Inspector plus Maintenance Contractor's crew
Operation Activities	
• all operation activities	as appropriate

TABLE 3.2

INSPECTION AND PREVENTATIVE MAINTENANCE SCHEDULE
OPERATION AND MAINTENANCE PLAN
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

	Item	*Inspect For*	*Monthly*	*Quarterly*	*Annually*
1.	**Injection System**				
	Vaults	- doors in place	*		
		- condition of door and lock	*		
		- condition of inside of vault	*		
	Wells	- cover securely locked	*		
		- condition of cover and lock	*		
2.	**Building and Surroundings**				
	Vegetated Soil Cover	- erosion, bare areas, washouts, length of grass, dead/dying grass		*	
	Access Roads	- erosion, obstructions, potholes, puddles, debris		*	
	Grass	- bare areas, length of grass, dead/dying grass		*	

TABLE 3.3

POTENTIAL PROBLEMS AND APPROPRIATE CORRECTIVE ACTIONS
OPERATION AND MAINTENANCE PLAN
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

Areas of Concern	*Potential Problem*	*Action*
Building/Surroundings		
Locks for Doors	Vandalism. Site security.	Replace and secure locks as necessary. Make sure locks are operational.
Vegetated Soil Cover	Washout and erosion of grass, topsoil, clay, or sand. Typically on steep slopes.	Take immediate action to prevent further erosion and to protect exposed refuse. Recover washed out soil. This material may be used to restore the eroded area. Backfill with additional soil to original cover design thickness. Reseed with grass. If seeding slopes, erosion control mat is recommended.
	Bare areas.	Loosen and till topsoil. Re-seed and mulch as necessary. Perform restoration as soon as possible.
	Settlement of original cover. Standing water. Dry bare areas.	Assess size of settlement and potential impact to drainage or low permeability layers. Till topsoil and grade. Add additional topsoil if necessary. Check final elevation to ensure adequate drainage. Re-seed and mulch. Topsoil regrading should be sufficient to correct minor ponding. Additional soil may be required for significant ponding.
	Dead/dying grass (potential for erosion).	Till topsoil and re-seed. Cover with erosion control mat or mulch.
	Weeds/bushes. Deterioration of grasses. Potential penetration through cover if left unattended.	Remove all bushes and tall weeds. Re-seed as required. Perform annually as a minimum.
	Animal holes/burrows. Safety hazard. Potential for soil cover erosion.	Capture and remove rodents. Excavate area carefully and inspect HDPE liner. Seal any holes in liner. Replace cover soil and topsoil as required in specifications. Seed and mulch.
	Sediment or obstruction in ditch or swale. Smothering and killing of sod and interruption of normal surface water flow pattern.	Remove sediment and stockpile as topsoil for future repairs. Replace sod or re-seed and mulch if damaged.

TABLE 3.3

POTENTIAL PROBLEMS AND APPROPRIATE CORRECTIVE ACTIONS
OPERATION AND MAINTENANCE PLAN
HOOKER/RUCO SITE, HICKSVILLE, NEW YORK

Areas of Concern	*Potential Problem*	*Action*
Building/Surroundings (continued)		
Access Roads	Washed out surface gravel or sub-base material.	Recover washed out gravel. This material may be used to restore the eroded area. Backfill to specifications. Backfill and compact to original grade.
	Potholes (potential safety hazard).	Backfill and compact to grade as required in specifications.
	Puddles (potential safety hazard).	Backfill and compact to grade as required in specifications.
	Obstructions (safety hazard).	Remove obstructions as soon as possible. Place in secure area pending off-Site removal.
Gates and Locks	Vandalism. Site security.	Replace and secure locks as necessary. Make sure locks are operational.
Signs	Tampering or theft.	Repair or replace signs.

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

Phase 1 System

Media	*Location*	*Frequency*	*Parameters*
Groundwater	MW-611/D/D2 MW-82	- Background [2] - Monthly for First Quarter - Quarterly for remainder of first 2 years of operation	- VOCs, TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
	MW-87, MW-83, MW-84	- Background [2] - Quarterly for first 2 years of operation	- VOCs, TOC, N, P, DO, ORP, pH, Temperature, Conductivity - Heterotrophic microorganisms annually
	MW-81 MW-88	- Background [2] - Semi-Annually	- VOCs, 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

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, Fe^{+2} - Heterotrophic microorganisms annually
	MW-86, MW-89	- Background[2] - Semi-Annual	- VOCs +TICs[3], TOC, N, P, DO, ORP, pH, Temperature, Conductivity, Fe^{+2} - 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
		- Semi-Annually	- VOCs and methane
	VZ-13, VZ-17	- Background [2] - Semi-Annually	- Monitor with PID - VOCs and methane
Ambient Air	-4	- Semi-Annually	- If elevated PID reading collect sample for VOCs and methane
Liquid Supplements	Included in Phase 1		

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TABLE 3.4

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, Fe^{+2} - 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, Fe^{+2} - 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, Fe^{+2} - 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
		- Semi-Annually	- VOCs and methane
	VZ-4, VZ-5, VZ-6, VZ-7, VZ-8, VZ-9	- Background [(2)] - Semi-Annually	- Monitor with PID - TOC and methane
Ambient Air	4	- Semi-Annually	- If elevated PID reading collect sample for TOC and methane
Liquid Supplements	Included in Phase 1		

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 injection at that segment. Monitoring will be once 2 weeks before the initial injection and then once within the first 3 days after injection begins. In 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 be 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 well no future analysis/reporting of TICs in such a well will be performed. If TICs are present in a well, TIC analysis/reporting will continue until TICs are no longer present.

(4) Ground Surface in vicinity of Shallow Vadose Zone Well with the highest PID reading greatrer than 10 above background.

N as nitrate, nitrite, and ammonia

FILE ON EDOC'S ✓ YES ______ NO

SITE NAME Hooker Ruco

SITE # 1-30-004-003-OMM

COUNTY Nassau TOWN T 013

FOILABLE ✓ YES ________ NO

SC/PSA ______ RI/FS ______

RD ______ RA ______

SM ______ OTHER OU3-OMM

NAME DESCRIPTION:

OU3 Biosparge OMM Manual