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FINAL

Conceptual Design

for

Groundwater Pump and Treat System

at

Nassau Uniform Services, Inc.
525 Ray Street
Freeport, New York 11520

RECEIVED
Hazardous Waste Remediation
NYSDEC Region 1

Site No. 130063

Date: August 8, 2002

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Project No. 03023

"Your Environmental Partner"

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1.0 Introduction and Purpose of the Groundwater Remediation System

This document describes a conceptual design, installation and operation of a proposed Pump and Treat (P&T) system for remediating the groundwater at the property known as Nassau Uniform Services, Inc., 525 Ray Street, Freeport, Town of Hempstead, Nassau County, New York. This document also includes a description of P&T system pilot tests to obtain information that will be used in the final design of a P&T system for the site.

After installation, the proposed final design P&T system will remediate the elevated concentrations of volatile organic compounds (VOCs) present in the groundwater under the building at 525 Ray Street. Elevated concentrations of numerous VOCs were detected in the groundwater samples collected from monitoring wells and piezometers installed on-site. Three of the most significant VOCs detected in the groundwater are tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride (VC). The later two compounds are breakdown products of PCE, a liquid commonly called PERC and widely used in the dry cleaning industry.

In 1998, Anson Environmental Ltd. (AEL) completed a Focused Remedial Investigation (FRI) for the Nassau Uniform Services site and the FRI findings were submitted to New York State Department of Environmental Conservation (NYSDEC) in the FRI Investigation Report dated January 27, 1999 (revised).

Based on the FRI investigation, AEL concluded that the source of the groundwater contamination was contaminated soils at three locations on the Nassau Uniform Services property.

During July 2002, AEL submitted to NYSDEC a revised work plan for installing a Soil Vapor Extraction System (SVES) for remediating the on-site contaminated soil. The SVES and the final design P&T system will operate in concert to remediate both the soils and groundwater on-site. These remedial efforts will be performed concurrently; however, soil remediation will start first.

The proposed final design P&T system will address the groundwater contamination below the floor of the Nassau Uniform Services building. The crosshatched lines on Figure 1 outline the approximate horizontal extent of the contaminated groundwater plume. The vertical extent of the groundwater plume is illustrated in Figure 7-4 of the aforementioned FRI Investigation Report, and indicates that the vertical extent of the groundwater contamination is approximately 20-feet below floor surface (bfs). For reference, Figure 7-4 is contained herein on Page 1B.

This design plan describes a limited P&T System testing period to gather information that will be used to determine the final design of the system. Prior to any limited P&T testing, AEL plans to verify the vertical and horizontal extent of the groundwater contamination by sampling the existing on-site monitoring wells and piezometers. AEL

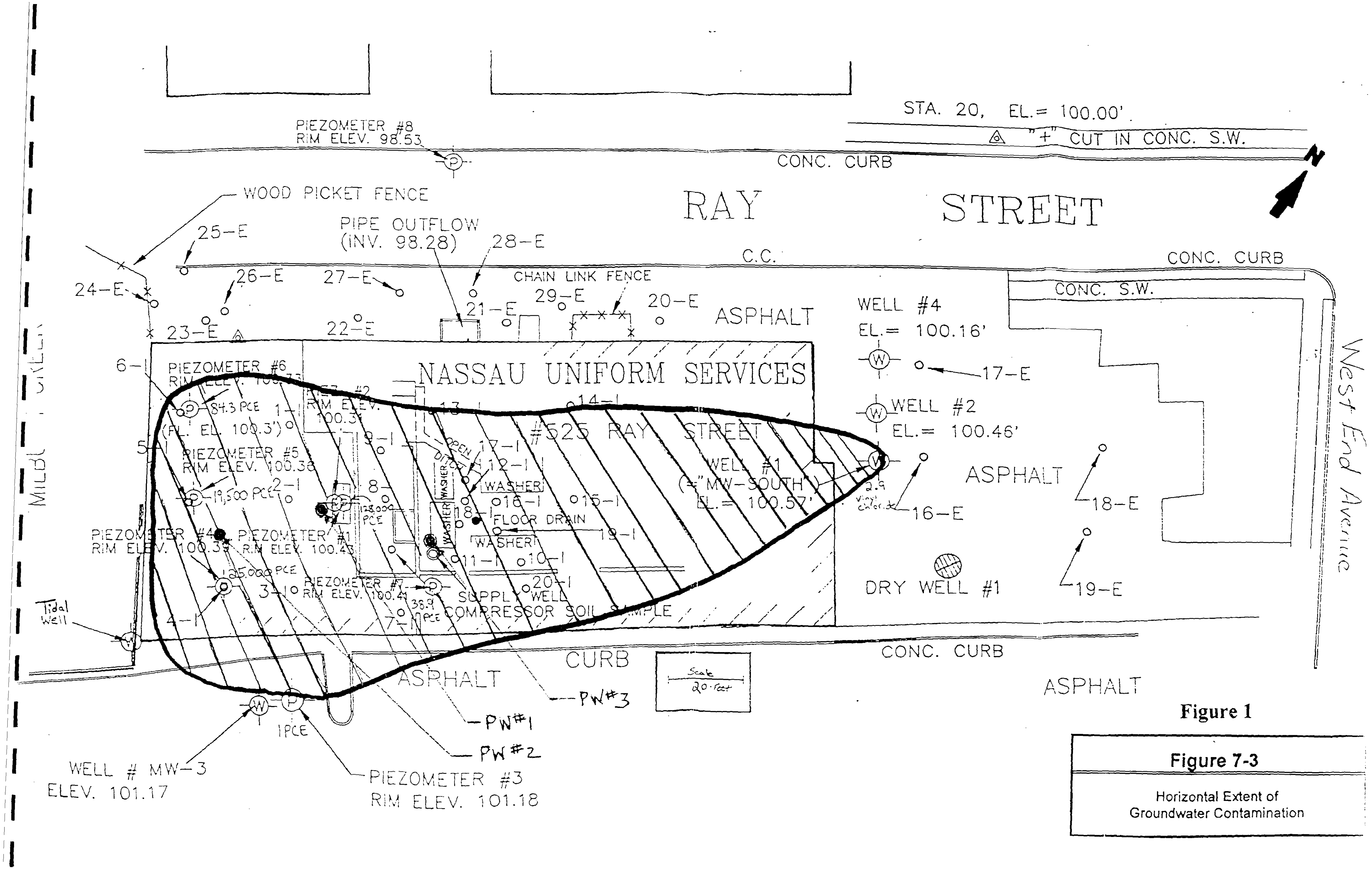


Figure 1

Figure 7-3

Horizontal Extent of
Groundwater Contamination

Prepared By: Anson Environmental Ltd 525 Ray Street Freeport, N.Y.	Cross Sectional Survey Nassau Uniforms Freeport Site
Scale: 1" = 20'	Date: 10/31/97
Drawn By: J.B.	Job Number: 95100

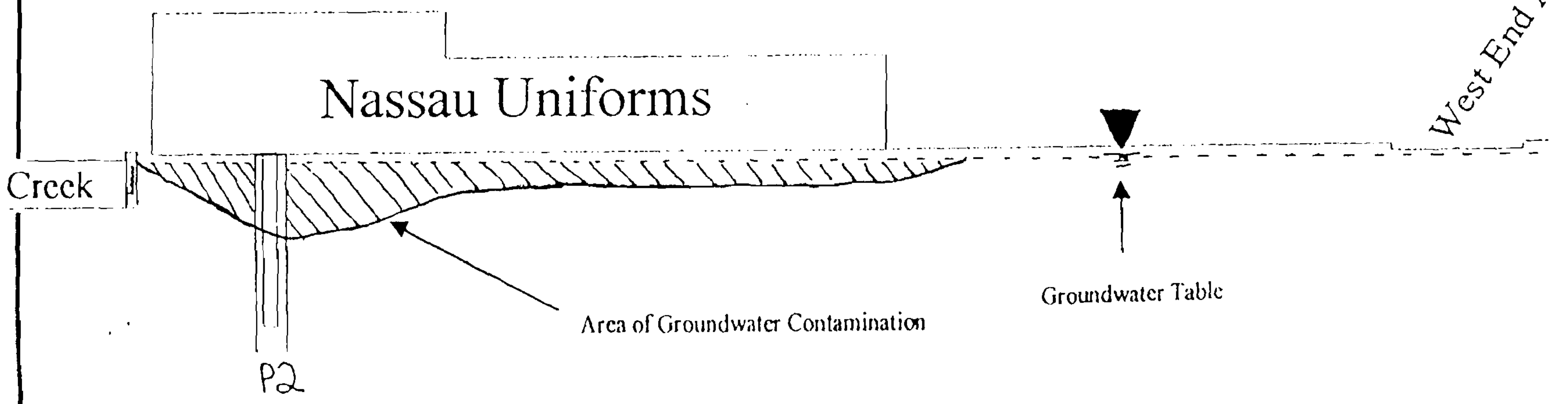


Figure 7-4
Vertical Extent of Groundwater Contamination

also plans to install additional piezometers at locations where it is anticipated that deeper groundwater samples are required to confirm the vertical extent of the contamination plume. One such location that will be sampled is downgradient of the oil/water separator along the northern side of the site building adjacent to Ray Street. The collected groundwater samples will be delivered to a State certified laboratory and analyzed for concentrations of VOCs, Semi-VOCs, and metals. The results of the analysis will be forwarded to the NYSDEC Project Manager.

The nominal depth to water (DTW) at the Nassau Uniform Services site is 5-feet bfs. The maximum depth of the groundwater contamination was found to be at the present location of Piezometer #2 (Figure 1). This is also the former location of a 2,000-gallon underground storage tank (UST) that was used to stockpile used PERC. Piezometer #2 is installed to approximately 36-feet bfs.

The proposed final design P&T system will use three strategically located vertical pumping wells to extract the contaminated groundwater for processing in the P&T system. The proposed pumping well locations are illustrated in Figure 1.

1.1 Pumping Wells Description

The ceiling height at the proposed locations for the pumping wells precludes using standard vehicle mounted drilling equipment to install the pumping wells. Therefore, AEL plans to install 4-inch diameter pumping wells using a skid mounted drill rig or a motorized cathead and tripod drill rig.

Each pumping well will be constructed with 4-inch DIA flush joint Schedule 40 PVC pipe with a 0.020-inch slot screen zone. The screened zone will be backfilled with Morie No. 2 gravel pack from one-foot below the screen to two-feet above the screen. Each well will have a Morie No. 00 sand seal placed above the gravel pack and a bentonite seal placed on the sand seal. The wells will be backfilled from bentonite seal to grade with drill cuttings. Each well will be completed with an 8-inch DIA manhole and locking J-plug. All drive casings and rods will be decontaminated prior to beginning the drilling activity and between borings by either steam cleaning or Liquinox wash and rinse with the leachate run to waste stored in locked 55-gallon drums for proper disposal. Excess drill cuttings will be placed in locked 55-gallon drums for proper disposal. The wells will be developed by pumping and surging with a submersible pump with the liquids run to waste stored in locked 55-gallon drums for proper disposal.

One pumping well designated Pumping Well No. 1 (PW#1), will be installed adjacent to the present location of Piezometer #2 as indicated in Figure 1. The screened portion of this pumping well will be fabricated using 0.020-inch slotted flush joint Schedule 40 PVC pipe and will be installed from 6-feet bfs to 28-feet bfs. The piping from the floor surface to 6-feet bfs will be fabricated using 4-inch DIA flush joint Schedule 40 PVC pipe.

A second pumping well designated Pumping Well No. 2 (PW#2), will be installed at a point approximately between the present locations of Piezometer #4 and Piezometer #5 (Figure 1). The screened portion of PW#2 will be fabricated using a 0.020-inch flush joint Schedule 40 slotted PVC pipe and will be installed from 6-feet bfs to 21-feet bfs. The piping from the floor surface to 6-feet bfs will be constructed using 4-inch DIA flush joint Schedule 40 PVC pipe.

A third pumping well designated Pumping Well #3 (PW#3), will be installed at the former location of the dry cleaning machines inside the eastern portion of the building. The screened portion of PW#3 will be fabricated using a 0.020-inch flush joint Schedule 40 slotted PVC pipe and will be installed from 6-feet bfs to 21-feet bfs. The piping from the floor surface to 6-feet bfs will be constructed using 4-inch DIA flush joint Schedule 40 PVC pipe.

Additional pumping wells may be installed later based on the performance of the final design P&T system. A submersible pump will be installed in each well. The electrical power to each pump will be independently activated from a P&T system control panel. Ball valves will be installed at strategic locations to control the flow of pumped groundwater. The capacity of the submersible pumps will be from 5 to 14-gallons per minute.

1.2 Limited Pump and Treat System Pilot Testing

The final design P&T system will use a low profile air stripper similar to the ShallowTray units manufactured by North East Environmental Products, Inc. (NEEP), West Lebanon, New Hampshire. The pumped groundwater will be piped to the air stripper that is equipped with a high volume blower that aerates the groundwater and converts the contaminants in the groundwater from the liquid phase to the vapor phase. The vapor phase effluent discharge from the air stripper is then delivered to air purification canisters where the contaminating VOCs are removed from the vapor. The vapor is then discharged to the atmosphere through an exhaust pipe from the air stripper and terminating above the roof of the site building.

The P&T system will use an NEEP ShallowTray Model 2631 air stripper. A Grundfos Redi-Flo submersible pump, Model No. 10E8, will be installed in each extraction well. The pumped water from each well will be piped to the air stripper. The Manufacturer's information sheets for the aforementioned items are in Appendix 1. NEEP is designing the air stripper to be capable of operating within design parameters up to 40-gallons per minute.

Providing that the liquid effluent from the P&T system is in compliance with Nassau County Department of Public Works (NCDPW) regulations, it may be discharged into the local sewer district pipelines. An application to discharge P&T system liquid effluent into the sewer will be filed with NCDPW before system operation begins.

Presently, sanitary waste from the site building is discharged into the Nassau County Sewer District No. 3. Ideally, the liquid discharge from the final design P&T system will also be discharged into the local sewer system.

Prior to purchasing the air stripper and the initiation of any P&T system pilot testing or operation, NCDPW will be contacted for guidance regarding the maximum allowable concentrations of contaminants that can be discharged into the local sewer system.

In anticipation of the County standards for effluent discharged into the sewer system, AEL will first perform a groundwater investigation of the three new pumping wells. A groundwater sample will be collected from each pumping well and delivered to a State certified ELAP laboratory where the samples will be analyzed in accordance with the Target Compound List (TCL) VOCs plus Tentatively Identified Compounds (TICs), TCL Semi- VOCs (SVOCs), plus TICs, and 23 Metals on the Target Analyte List (TAL) by report only (no data package to be supplied). The samples will also be analyzed for concentrations of metals using test methods in accordance with EPA publication SW-846, entitled “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods”. Later, the laboratory results can be used as a baseline measurement of the groundwater condition before the application of any P&T system technology.

As requested by NYSDEC, no groundwater investigation report will be submitted. However, a copy of the laboratory results will be forwarded to the Project Manager.

Later, the condition of the groundwater in the pumping wells as revealed by the aforementioned investigation will be used to determine the preliminary design of the ShallowTray air stripper. The laboratory results of that investigation will be delivered to the air stripper manufacturer so the unit can be designed to address each contaminant detected in the groundwater.

Before completing the final design of the P&T system, AEL proposes to perform a two phase P&T system limited pilot test, using a prototype air stripper. The first phase (Phase One) of the pilot test will be limited to approximately one-hour and will test the operation of the P&T System using one pumping well. The second phase (Phase Two) of the pilot test will test the operation of the P&T System continuously for a short term two-week period test period.

The first phase of the P&T limited pilot test will be performed using Pumping Well PW#1 and the prototype ShallowTray air stripper. The results of the limited pilot test will be used to complete the design of the Final P&T system. A submersible pump will be installed in PW#1 and the liquid output of that pump will be fed to the air stripper for treatment and evaluation. The capacity of the submersible pump will be approximately 5 to 14-gallons per minute.

It is anticipated that vapor phase effluent from the P&T pilot test system will require treatment prior to being discharged to the atmosphere. For first phase of the pilot test, the P&T system will be equipped with two moderate sized canisters containing granular activated carbon for removing VOCs from the system exhaust stream. To clean the exhaust of possible concentrations of vinyl chloride, the P&T system will also be equipped with two canisters containing potassium permanganate. The four canisters will be connected in series with the system exhaust stack leading to the exit port at least 10-feet above the roof of the site building.

During the first phase of the pilot test, the liquid effluent from the P&T system will be discharged into on-site 55-gallon drums with locked covers. The drums and their contents will be stored on-site for appropriate disposal at a later date. The duration of the first phase of the pilot test will be approximately one hour.

During the first phase of the pilot test, samples of the groundwater pumped from PW#1 will be will be collected at the both the input to the air stripper and its liquid effluent discharge to the drums. Organic vapor meter (OVM) readings, gas detector tube readings, and Tedlar air bag samples will also be collected at the vapor output of the air stripper and the outputs of the air purification canisters. The groundwater samples collected from the extraction well at the input to the air stripper will be analyzed in accordance with the Target Compound List (TCL) VOCs plus Tentatively Identified Compounds (TICs), TCL Semi- VOCs (SVOCs) plus TICs, and 23 Metals on the Target Analyte List (TAL) by report only (no data package to be supplied).

The OVM is a photoionization detector (PID) based instrument used for measuring the total concentrations of volatile organic compounds present in the surrounding atmosphere. Since the OVM works by moving a fixed flow rate of air past an ionization lamp, the monitoring of P&T vapor emissions at the inputs and outputs of the air purification canisters will be performed using a clean Tedlar air bag. First the air bag will be filled with gas vapor from the sampling port and then the OVM will be used to sample the gas vapor in the air bag. Placing the OVM sampling probe directly into an air stream emanating from the P&T system may result in inaccurate measurements.

The Tedlar air bag samples will be delivered to a State certified ELAP laboratory where they will be analyzed for concentrations of VOCs and SVOCs using EPA Method 8260 and 8270.

A copy of the Phase One P&T pilot test results will be delivered to the NYSDEC Project Manager. As requested by NYSDEC, the results of the pilot tests will be summarized in the P&T final design work plan.

The results of the Phase One P&T system pilot tests will be used by AEL and the air stripper manufacturer to finalize the design of the air stripper and the P&T system.

After the Phase One P&T system pilot test results are reviewed and it is determined that the system is working efficiently, NCDPW will be petitioned to permit the discharge of liquid effluent into the local sewer for a period of two weeks (Phase Two).

Dependent upon the efficiency of the prototype air stripper and its supporting air purification canisters, the liquid effluent from the unit could be discharged into the local sewer district under authorization of NCDPW. Based on the results of the Phase Two P&T system pilot test, NCDPW may require additional treatment of the liquid effluent before continuously discharging it into the sewer system.

During the Phase Two 2-week test, the operation of the P&T system pilot test will be in full compliance with NYSDEC and NCDPW schedules for influent and effluent sampling. The liquid effluent discharged to the local sewer system will meet Nassau County specified discharge limits and sampling schedules.

During the Phase Two two-week P&T system pilot test vapor phase samples and liquid effluent samples will be collected for laboratory analysis in accordance with NCDPW and/or NYSDEC requirements. Daily sampling of the air influent and effluent of the P&T system will be performed using a calibrated PID and gas vapor detector tubes for PCE and vinyl chloride.

Sampling of the P&T system pilot test air influent and effluent for laboratory analysis will be performed at the start and completion of the Phase Two testing unless additional testing is requested by NYSDEC or NCDPW.

A full description of the Nassau County specific sampling and monitoring requirements that must be followed to operate the P&T system pilot test will be delivered to the NYSDEC Project Manager and will be contained in the design plan for the final P&T system.

During Phase 2 tests, the radius of influence (ROI) of the pumping action in PW#1 will be determined by using presently installed piezometers. If needed to properly define the ROI, additional piezometers will be installed within the expected area of influence.

After completing both Phases of the P&T pilot testing a final design work plan will be submitted to NYSDEC for review and approval. The final design work plan will include the detailed schedule for periodic sampling of water and air.

2.0 Summary of Existing and Background Information

2.1 Site Location, Ownership and Access

In 1993, NYSDEC designated Nassau Uniform Services an Inactive Hazardous Waste Disposal Site. The size of the subject site location is approximately three-quarters of an acre. Nassau Uniform Services is designated Site Number 130063 on the New York State Registry of Inactive Hazardous Waste Disposal Sites.

The subject property is owned by Nassau Industrial Dry Cleaning Corp., 525 Ray Street Freeport, New York 11520.

2.2 Site Description

Nassau Uniform Services property contains one large building and a parking lot paved with asphalt (Figure 1). The primary access to the unfenced property is from Ray Street.

According to Nassau County Land and Tax Map information, the Nassau Uniform Services property is designated as follows:

Section: 54 Block: 315 Lots: 98 through 107

2.3 Background Information

2.3.1 Geology

The geology of the Nassau Uniform Services property is generally defined to a depth of 12-feet at its western portion. Groundwater Technologies Inc. (GTI) installed the borings that defined the aforementioned western portion of the property on September 23, 1994 (Appendix 2).

The lithologic description of the soil borings indicates that the following soil types are present at the Nassau Uniform Services property:

Depth Below Grade (ft)	Soils Description
0 to 4	mostly brown fine sand, poorly sorted, some gravel, trace clay and fill material.
4 to 8	mostly black organic marsh deposits to approximately 7-feet depth below grade (DBG), then transitions to fine sands and clay material.
8 to 12	gray and brown fine sands to approximately 10-feet DBG, then transitions to orange sand.

In general, the area surrounding Nassau Uniform Services consists of marsh associated with nearby Millburn Creek. The marshlands have been developed by covering them with clean fill and are now occupied by residential and commercial buildings and properties.

Groundwater at the Nassau Uniform Services property has been measured at approximately 5-feet DBG. However, the groundwater on the property is directly influenced by the tidal fluctuations that can range between 5 and 7-feet DBG.

2.3.2 Previous Investigations

The following is a brief chronological summary that reflects some of the events that have occurred at or near the Nassau Uniform Services property:

1925 to 1962	Information from the Village of Freeport files indicates that the building now occupied by Nassau Uniform Services was constructed in 1925. This information was obtained from a property diagram that was updated in 1965. No additional information was revealed about the property prior to 1962.
1962 to 1965	Historical aerial photographs taken in 1962 and 1965 illustrated that an addition to the Nassau Uniform Services building was constructed between those years. The addition is placed at the western end of the original building and extends to the adjoining bulkhead.
1964	During December 1964, Nassau Industrial Services agrees to purchase from American Permac, Inc. the following equipment: • Two 120 pound SE Industrial dry cleaning machines • One Titan 700 Industrial dry cleaning machine • One Model 200 Activated Carbon Recovery Unit The aforementioned equipment was delivered and installed in 1965.
1965	In August 1965, Nassau Industrial Uniform Services agrees to purchase a Permac Industrial Cleaning Machine (330 SE).
1975	A letter dated October 6, 1975 confirms the Nassau Uniform Services purchase of a Brill X-40 oil skimmer. Western Environmental Engineering supplied the skimmer.
1982	In May 1982, oily waste from the on-site oil/water separator accidentally discharged into the property soils and Millburn Creek. Oil washed from soiled clothing is collected in the oil/water separator and the remaining wastewater is discharged into the local

sewer system. Subsequently, Nassau Uniform Services excavated the oil-contaminated soil for disposal.

1984 July 5, 1984, a hydrostatic test was performed on a 2,000-gallon underground gasoline storage tank located at the eastern side of the Nassau Uniform Services building near the front door. The tank test failed and was reported to NYSDEC and Spill Number 84-0959 was assigned to the event. The subsequent site remediation included the removal of the storage tank and the installation of three groundwater monitoring wells on-site

When the storage tank was excavated from the ground, it was reported that several holes were observed in the tank. The three monitoring wells are installed in the Nassau Uniform Services parking lot at the comer of Ray Street and West End Avenue. One monitoring well is installed at the center of the former tank location. The other two monitoring wells are located to the northwest and southeast of the former tank location. One of these two monitoring wells could not be located during recent site inspections.

Nassau County Department of Health (NCDH) inspected the spill location on October 20, 1984. According to NYSDEC database information, Spill Number 84-0959 was closed to their satisfaction on December 30, 1998.

1988 On February 1, 1988, NCDH issued a permit to Nassau Uniform Services to maintain the storage of the following items:

Tank/Storage Area Number	Tank Capacity (gallons)	Type of Toxic/Hazardous Material Stored
1	260	multiple chemical stored
2	2,000	oil, fuel No. 2
3	30	multiple chemicals stored
4	2,000	oil, fuel No. 2
5	2,000	tetrachloroethylene
6	500	tetrachloroethylene

The expiration date for the aforementioned permit was February 1, 1993.

1990 On April 27, 1990, a 2,000-gallon waste oil / waste tetrachloroethylene tank was excavated and removed after being in place for approximately 12 years. Prior to removal, the tank was reported to be leaking. Subsequently, NCDH collected soil samples from the tank excavation for laboratory analysis. The laboratory analysis of the collected soil samples identified high concentrations of tetrachloroethylene (9,000,000 parts per billion (ppb)), trichloroethene (34,000 ppb), c-1, 2-dichloroethylene (67,000 ppb) and other VOCs.

A letter from NCDH dated June 1, 1990, directed Nassau Uniform Services to perform site remediation as soon as possible.

1991 Soil samples were collected by NCDH on December 17, 1991 from 14-feet beneath the ground surface at the former tank excavation location. Laboratory analysis of the collected soil samples reported the following contaminant concentrations:

tetrachloroethylene	2,900,000 ppb
1, 1,2-trichloroethene	130,000 ppb
1,2-dichloroethylene	38,000 ppb

Laboratory analysis of groundwater samples taken the same day downgradient of the former tank location also reported contaminant concentrations as follows:

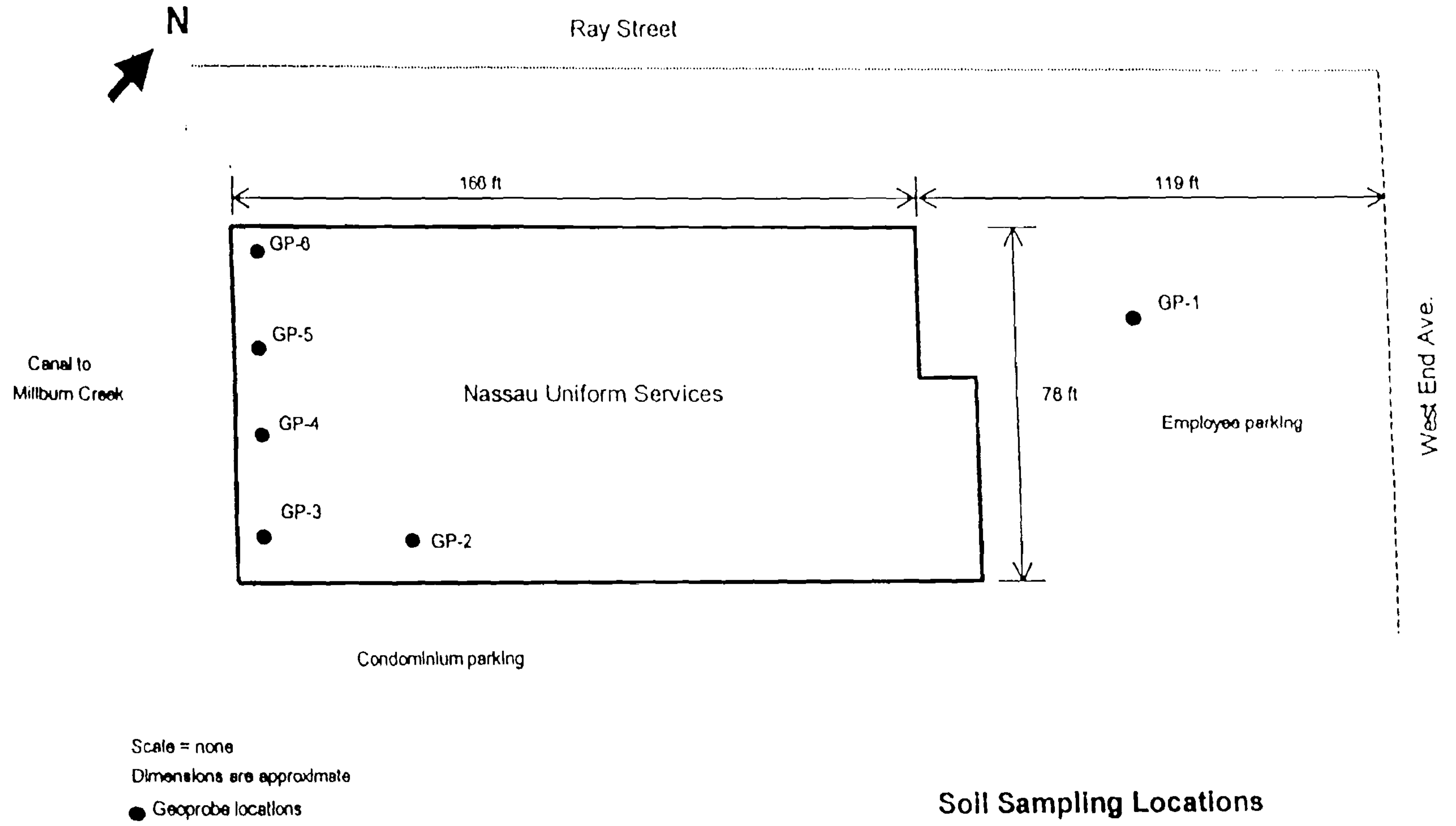
tetrachloroethylene	20,000 ppb
1, 1,2-trichloroethene	3,600 ppb
1,2-dichloroethylene	10,000 ppb
vinyl chloride	1, 200 ppb

1994 On September 23, 1994, Groundwater Technology, Inc. (GTI) supervised the installation of six Geoprobe points designated GP-1, GP-2, GP-3, GP-4, GP-5 and GP-6. These Geoprobe points were installed for the collection of soil and groundwater samples. A site map showing the locations of the six Geoprobe points is in Figure 2.

Laboratory analysis of the soil samples collected at 2 to 4-feet DBG at GP-2 and GP-3 reported concentrations of contaminants that exceeded NYDEC recommended Soil Cleanup Objectives for 1,2-dichloroethene, trichloroethene, tetrachloroethylene, and for total VOCs. Laboratory analysis of the soil samples collected from GP-5 also reported elevated levels of trichloroethene that exceeded NYSDEC Recommended Soil Cleanup Objectives.

Laboratory analysis of groundwater samples collected on the same day reported concentrations above NYSDEC Class GA Standards for the following compounds:

tetrachloroethylene



Soil Sampling Locations
Sample Date: 9/23/94
Nassau Uniform Services
525 Ray Street
Freeport, NY 11520

Figure 2

vinyl chloride
1,2-dichloroethene
chlorobenzene
1,1-dichloroethene
1,1,1-trichloroethane

Laboratory analysis of groundwater samples collected upgradient of Nassau Uniform Services reported no elevated concentrations of chemical compounds.

1996 February 1, 1996, representatives from NYSDEC and Anson Environmental Ltd. performed a site reconnaissance at Nassau Uniform Services. The purpose of the site reconnaissance was to observe the Nassau Uniform Services plant operations, the physical constraints of the property and to determine future sampling locations.

In 1996, Nassau Uniform Services plant operations include the washing and dry cleaning of commercial uniforms and industrial cleaning rags. Wastewater from the plant operations flows into open troughs that are located in the plant floor and into an oil/water separator. The oil/water separator discharges into the Nassau County sewer system. In plant dry cleaning is performed in two machines manufactured by Spencer (Model GT 165) and Bowe, respectively. Safety Kleen, a permitted waste disposal company, collects lint and sludge waste that is contaminated with tetrachloroethylene for disposal off-site. Safety Kleen also supplies Nassau Uniform Services with raw materials for cleaning, including tetrachoroethylene.

The major portion of the cleaning performed at Nassau Uniform Services involves the machine-washing of industrial uniforms and rags. A smaller amount of the cleaning operations require dry cleaning.

On December 4, 1996 Freedom of Information requests were submitted to Nassau County Department of Health. Access to these records was performed on January 22, 1997.

1997 On July 22, 1997, Anson Environmental Ltd. (AEL) collected soil samples from 22 boring locations on the Nassau Uniform Services property. The collected soil samples were delivered to Accredited Laboratories, Inc., Cateret, New Jersey where they were analyzed for concentrations of VOCs using EPA Method 8240. Copies of the laboratory analytical reports for the collected soil samples are contained in Appendix 3, Section 3 of the Draft Final Focused Remedial Investigation (FRI) Report prepared for NYSDEC by AEL, dated October 15, 1998 and revised January 27, 1999.

1997 On August 28, 1997, AEL collected a wastewater sample from the floor trough inside the Nassau Uniform Services building. The collected wastewater sample was delivered to Accredited Laboratories, Inc., Cateret, New Jersey where it was analyzed for concentrations of VOCs using EPA Method 8240. A copy of the laboratory analytical report for the collected wastewater sample is contained in Appendix 3, Section 4 of the Draft Final Focused Remedial Investigation (FRI) Report prepared for NYSDEC by AEL, dated October 15, 1998 and revised January 27, 1999.

On December 30, 1997, AEL collected a wastewater sample from the floor trough inside the Nassau Uniform Services building. The collected wastewater sample was delivered to EcoTest Laboratories, Inc., North Babylon, New York where it was analyzed for concentrations of VOCs using EPA Method 624. A copy of the laboratory analytical report for the collected wastewater sample is contained in Appendix 3, Section 4 of the Draft Final Focused Remedial Investigation (FRI) Report prepared for NYSDEC by AEL, dated October 15, 1998 and revised January 27, 1999.

On April 21, 1998, AEL collected soil samples from 20 borings at the Nassau Uniform Services property. The collected soil samples were delivered to Environmental Testing Laboratories, Inc. Farmingdale, New York where they were analyzed for concentrations of VOCs using EPA Method 8010 and RCRA metals.

On April 22, 1998, AEL collected groundwater samples from two monitoring wells and eight piezometers at the Nassau Uniform Services property. The collected groundwater samples were delivered to Environmental Testing Laboratories, Inc. Farmingdale, New York where they were analyzed for concentrations of VOCs using EPA Method 601.

On April 23, 1998, AEL collected a groundwater sample from Piezometer No. 6 (P #6) at the Nassau Uniform Services property. The collected groundwater sample was delivered to Environmental

Testing Laboratories, Inc., Farmingdale, New York where it was analyzed for concentrations of RCRA metals.

Copies of the complete laboratory analytical reports for the groundwater and soil samples collected in 1998 and noted above are contained in Appendix 4 of the Draft Final Focused Remedial Investigation (FRI) Report prepared for NYSDEC by AEL, dated October 15, 1998 and revised January 27, 1999.

1999 On November 23, 1999, AEL excavated approximately 50-tons of contaminated soil from a location at the northwest corner of the property at 525 Ray Street. Horwith Trucks, Inc. transported the contaminated soil to Michigan Disposal, Inc., Bellville, Michigan for disposal in the landfill at that location.

Laboratory analysis of the six end-point samples collected from the excavation indicated that four of the samples contained elevated concentrations of VOCs and Semi-VOCs that exceed NYSDEC soil cleanup objectives. The aforementioned VOCs and their detected concentrations are as follows:

acetone	920 ppb
methylene chloride	700 ppb
trans-1, 2-dichloroethene	370 ppb
cis-1, 2-dichloroethene	52,000 ppb
trichloroethene	4,800 ppb
tetrachloroethene	30,000 ppb

The full TCL analysis of the collected soil samples indicated that the soil remaining at the excavation site is also contaminated with elevated concentrations of semi-VOCs and metals.

A description of the work performed during the excavation of the contaminated soil is found in the Project Report letter to NYSDEC dated February 3, 2000. The letter report summarizes soil excavation and disposal activities at Nassau Uniform Services, Inc.

2000 On March 16, 2000, AEL collected soil-gas samples from three soil borings that were installed using a Geoprobe unit. One boring was installed at the northeast corner of the Nassau Uniform Services property. The other two borings were installed off-site along the northern boundary of the condominium property located south of the Nassau Uniform Services building. On May 2, 2000, three additional soil gas samples were collected from Geoprobe borings installed on the condominium property. All six soil-gas samples were collected from approximately 4-feet below grade surface (bgs). The soil-gas samples were delivered to a State certified laboratory and analyzed for concentrations of VOCs. The results of that analysis were included in AEL letter report to NYSDEC dated May 24, 2000. The laboratory detected no concentrations of VOCs above their method detection limit (MDL).

On September 27, 2000, AEL collected groundwater samples from three on-site monitoring wells and eight on-site piezometers. The groundwater samples were delivered to a state certified laboratory and analyzed for concentrations of VOCs. A report summarizing the results of that analysis is being prepared and will be submitted to NYSDEC in the immediate future.

On October 16, 2000, in accordance with a work plan approved by NYSDEC, AEL began the installation of a Pilot Test SVES. The SVES test system was installed to provide information needed to complete the final design of a SVES for the site.

2001 On January 10, 2001, the pilot test SVES system began 24-hour operation. On February 1, 2001, the operation of the pilot test SVES was terminated.

2003 On August 4, 2003, the SVES partial system (SVES#1) began 24-hour operation.

3.0 Conclusions Based on On-Site Groundwater and Soil Sampling

The Draft Final Focused Remedial Investigation (FRI) Report prepared for NYSDEC by AEL, dated October 15, 1998 and revised January 27, 1999, Section 7.0 Summary, describes the primary source areas of contamination at Nassau Uniform Services Property; namely:

- The former waste PCE tank
- The soils in the vicinity of the garbage container
- Former hole in the compressor room floor
- Former supply well near the former location of the dry cleaning machines
- Sample 19-1 Location. Location 19-1 is near the center of the building adjacent to the washing machines.

Laboratory analysis of groundwater samples collected from on-site monitoring wells and piezometers detected concentrations of VOCs that exceeded NYSDEC groundwater standards. Based on these laboratory results, AEL developed a horizontal and vertical profile of the contaminated groundwater plume (Figure 7-4). The groundwater contamination plume is caused by the contamination in the soil under the floor of the Nassau Uniform Services building.

4.0 Proposed Groundwater Pump and Treat System

To remediate the elevated concentrations of VOCs present in the on-site groundwater under the Nassau Uniform Services building, AEL proposes an on-site P&T system. Elevated concentrations of numerous VOCs were detected in the groundwater samples collected from monitoring wells and piezometers installed on-site. Three of the most significant VOCs detected in the groundwater are tetrachloroethene, trichloroethene and vinyl chloride. The later two compounds may be breakdown products of tetrachloroethene.

The minimum P&T system equipment complement consists of vertical groundwater pumping wells, submersible pumps in each well, piping from the wells to a manifold that feeds groundwater to the input of an air stripper, a high volume blower to aerate the groundwater input to the stripper, and granular activated carbon canisters to remove vapor phase VOCs from the vapor discharge to the atmosphere.

Initially, three pumping wells will be installed at locations inside the site building. The approximate locations of the three pumping wells are (see Figure 1):

- Adjacent to existing Piezometer #2
- Selected location between the present locations of existing Piezometer #4 and Piezometer #5
- Selected location at the former positions of the removed dry cleaning machines

To meet NYSDEC clean air standards, it is expected that the exhaust vapor from the proposed final design P&T system will be processed through air purification canisters that are charged with granular activated carbon (GAC). To clean the exhaust stream of anticipated vinyl chloride concentrations, the P&T system will also process the exhaust vapor through canisters filled with potassium permanganate. Exhaust samples will be collected periodically and delivered to a State ELAP certified laboratory for analysis.

Once the vinyl chloride concentrations are reduced to levels that meet DAR-1 standards, the potassium permanganate canisters will be removed from the air remediation series string.

The pumping wells will be fabricated with 4-inch DIA flush joint Schedule 40, PVC pipe with a 0.020-inch slot screen zone.

The design of the P&T system will be finalized upon completion of the P&T system pilot testing described in Section 1.2. However, a preliminary description of the pumping wells characteristics is presented herein for reference.

As previously described in Section 1.1, one pumping well designated Pumping Well No. 1 (PW#1), will be installed adjacent to the present location of Piezometer #2 as shown in Figure 1. The screened portion of this pumping well will be fabricated using Schedule 40, 0.020-inch slotted PVC pipe and will be installed from 6-feet bfs to 28-feet bfs. The piping from the floor surface to 6-feet bfs will be fabricated using Schedule 40, 4-inch DIA PVC pipe.

A second pumping well designated Pumping Well No. 2 (PW#2), will be installed at a point approximately between the present locations Piezometer #4 and Piezometer #5 (Figure 1). The screened portion of PW#2 will be fabricated using Schedule 40, 0.020-inch slotted PVC pipe and will be installed from 6-feet bfs to 21-feet bfs. The piping from the floor surface to 6-feet bfs will be constructed using Schedule 40, 4-inch DIA PVC pipe.

A third pumping well designated Pumping Well #3 (PW#3), will be installed inside and near the center of the building at the location of the previously removed dry cleaning machines. The screened portion of PW#3 will be fabricated using Schedule 40, 0.020-inch slotted PVC pipe and will be installed from 6-feet bfs to 21-feet bfs. The piping from the floor surface to 6-feet bfs will be constructed using Schedule 40, 4-inch DIA PVC pipe.

Additional pumping wells may be installed later based on the performance of the final design P&T system. A submersible pump will be installed in each well. The electrical power to each pump will be independently activated from a P&T system control panel. Ball valves will be installed at strategic locations to control the flow of pumped groundwater. The capacity each submersible pump will be from 5 to 14-gallons per minute.

An assortment of monitoring devices will also be installed to monitor and control the final design P&T operating system. These devices include pressure gauges, flow control valves, flow meters and sampling ports.

4.1 Groundwater Pump and Treat System Effectiveness

The manufacturer of the ShallowTray air stripper, NEEP Systems, was contacted regarding the groundwater conditions at the Nassau Uniform site. The manufacturer was provided with laboratory data from previous groundwater sampling and tasked to recommend a specific model and to estimate the effectiveness of that model. The manufacturer recommended using ShallowTray Air Stripper Model 2631 the effluent from which would have the characteristics identified in Section 4.3.

4.2 Groundwater Pump and Treat System Design

The ShallowTray air stripper uses a forced draft, countercurrent air stripping process that travels through baffled aeration trays that remove VOCs, such as those that were detected in the groundwater on-site. The contaminated water is injected into the top of the unit through a mist nozzle. As the water flows over the baffled aeration trays, clean air is blown through 3/16-inch diameter holes in each of the trays. This airflow causes the formation of bubbles that create a froth thereby increasing the surface area from which the VOCs can volatilize. These vapor phase contaminants can then be fed to air purification canisters where they are treated.

Since the amount of time required to complete the volatilization process varies by compound and compound concentration, the ShallowTray air stripper unit can have additional trays added or the flow rate modified.

The following data were used by the manufacturer to calculate the concentrations identified in section 4.3 of this work plan.

Water flow rate:	40.0 gallons per minute
Airflow rate:	600 cubic feet per minute
Water temperature:	50 degrees F
Air Temperature:	50 degrees F
Air/Water ratio:	112

The dimensions of the system are 6’6” high, 6’2” long, 4’4” wide, and weighs approximately 1,200 pounds dry.

4.3 Groundwater Pump and Treat System Pilot Test

As previously described in Section 1.2, AEL proposes to perform an investigation to determine the present condition of the groundwater in three pumping wells that are to be installed to support proposed P&T system. As requested by NYSDEC, no groundwater investigation report will be submitted. However, a copy of the laboratory results will be forwarded to the Project Manager.

After submitting the laboratory results to NYSDEC for review and comment, it is also proposed that a short-term P&T system pilot test be performed for approximately one-hour using a prototype ShallowTray air stripper. During the short-term P&T system pilot test, samples will be collected at critical locations for laboratory analysis including groundwater influent to the air stripper, liquid effluent from the air stripper, vapor phase emissions from the air stripper and outputs of the air purification canisters. The liquid effluent from the air stripper will be discharged into on-site locked 55-gallon drums and will be stockpiled for later appropriate disposal.

A groundwater sample will be collected from each of the three newly installed pumping wells and will be delivered to a State certified ELAP laboratory where the samples will be analyzed in accordance with the Target Compound List (TCL) VOCs plus Tentatively Identified Compounds (TICs), TCL Semi- VOCs (SVOCs), plus TICs, and 23 Metals on the Target Analyte List (TAL) by report only (no data package to be supplied). The samples will also be analyzed for concentrations of metals using test methods in accordance with EPA publication SW-846, entitled "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods". Later, the laboratory results can be used as a baseline measurement of the groundwater condition before the application of any P&T system technology.

A copy of the laboratory analytical results for the collected groundwater samples will be delivered to the NYSDEC Project Manager and the air stripper manufacturer to verify that the selected unit will adequately volatilize the concentrations of VOCs and SVOCs detected in the pumping wells. Once the manufacturer confirms that the air stripper design will perform adequately, the purchase order for the unit will be placed.

The proposed P&T system pilot test functional block diagram is illustrated in Figure 3.

Based on information obtained from the air stripper manufacturer, air purification canisters will be ordered that will be used to clean the VOC vapor emissions emanating from the exhaust of the air stripper. The canisters will be sized such that they operate with the exit velocity flow rate of the air stripper. The delivery of the canisters to the site is expected to coincide with the delivery of the air stripper unit.

Upon delivery of the air stripper unit, piping will be installed at PW#1 to deliver pumped groundwater from the well to the input of the air stripper. The well will be equipped with a submersible electrical pump with an approximate capacity of 5 to 14 gallons per minute. An electrical contractor will be used to install the electrical power for the pump and the air stripper. Piping will also be installed from the air stripper to the air purification canisters.

A 4-inch DIA Schedule 40 PVC stack will be installed outside of the building to exhaust vapor emissions to the atmosphere. The exhaust stack will have its exit point approximately 10-feet above the building.

Once the installation of the mechanical and electrical portions of the P&T pilot test system is completed, and with NYSDEC authorization, a short-term preliminary test will be performed. The groundwater from PW#1 will be pumped to the air stripper and vapor and liquid phase samples will be collected at critical locations in the P&T system, including groundwater input to the air stripper, liquid effluent from the air stripper, vapor phase emissions from the air stripper and outputs of the air purification canisters. Vapor phase emission samples will be screened in the field using and OVM and gas detection

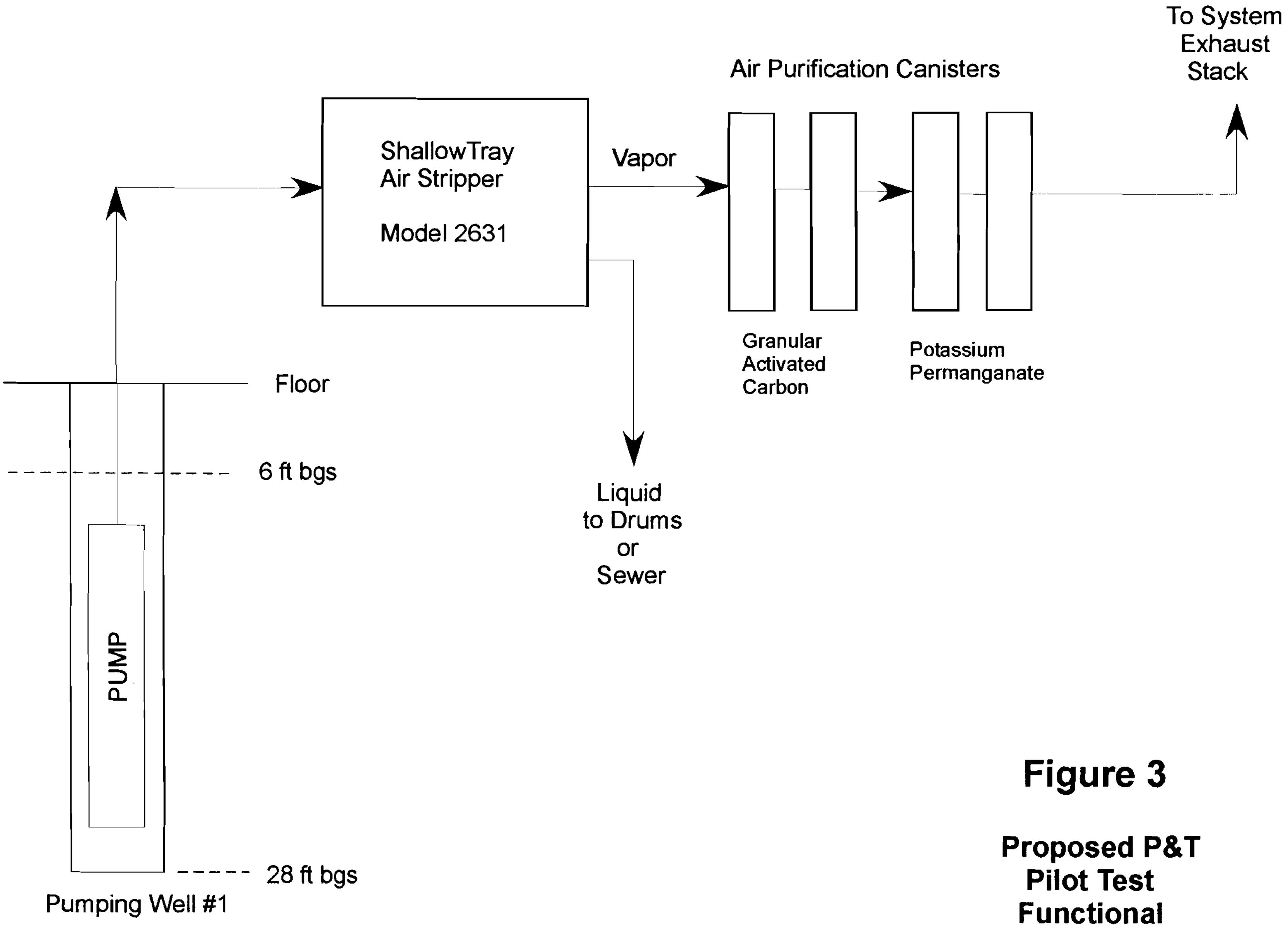


Figure 3

**Proposed P&T
Pilot Test
Functional
Block Diagram**

tubes. Vapor phase samples collected for laboratory analysis will be collected using Tedlar air bags. Liquid samples will be collected using glassware supplied by the laboratory.

The liquid effluent from the air stripper will be stored on-site in locked 55-gallon drums for proper disposal. The collected samples will be delivered to a State certified ELAP laboratory for analysis. The vapor phase effluent samples will be analyzed for concentrations of VOCs using EPA Methods 8260 and 8270. The liquid phase samples will be analyzed in accordance with the Target Compound List (TCL) VOCs plus Tentatively Identified Compounds (TICs), TCL Semi- VOCs (SVOCs) plus TICs, and 23 Metals on the Target Analyte List (TAL) by report only (no data package to be supplied).

A copy of the P&T one-hour Phase One test results will be delivered to the NYSDEC Project Manager. As requested by NYSDEC, the results of the Phase One tests will be summarized in the P&T final design work plan.

With NYSDEC approval and assuming that the one-hour Phase One pilot test indicates that the prototype P&T system operates effectively, the test results will be used to support an application to operate the P&T pilot test system for a two-week period. A petition will be filed with NCDPW and will request authorization to discharge the liquid effluent from the P&T system into the local sewer district pipe line for a two-week period. Prior to the start of any Phase Two P&T tests, a copy of the application/petition will be delivered to NYSDEC.

After receiving Nassau County approval to operate the P&T pilot test system a copy of that approval will be delivered to the NYSDEC Project Manager together with the proposed sampling plan for Phase Two testing. With NYSDEC concurrence, the P&T pilot test system will operate continuously for a two-week period. During that time effluent and vapor emission samples will be collected at strategic sampling points to verify the design of the various system components including the submersible pump, air stripper, and air purification canisters.

Upon completion of the Phase Two two-week pilot test, and ten days after the laboratory analytical data is available, a report will be delivered to NYSDEC describing the results of the two-week test activity. As described in Section 12.1 the installation and testing of the P&T pilot test can be accomplished in 120 days.

The ShallowTray air stripper manufacturer has assembled the following data regarding the anticipated operational results for the untreated influent. The actual results will be determined once the system has been operating and laboratory data have been obtained during the P&T system pilot test.

Contaminant	Effluent Water Model 2631	Untreated Influent
vinyl chloride		
Effluent concentration	<1 ppb	1,300 ppb
Air (lbs/hr)	0.03	
% removal	100%	
1,1-dichloroethylene		
Effluent concentration	<1 ppb	200 ppb
Air (lbs/hr)	0.00	
% removal	99.9966%	
methylene chloride		
Effluent concentration	2 ppb	200 ppb
Air (lbs/hr)	0.00	
% removal	99.1043%	
trichloroethylene		
Effluent concentration	<1 ppb	5900 ppb
Air (lbs/hr)	0.12	
% removal	99.9931%	
tetrachloroethylene		
Effluent concentration	5 ppb	140,000 ppb
Air (lbs/hr)	2.81	
% removal	99.9965	
1,1,1-trichloroethane		
Effluent concentration	<1 ppb	8 ppb
Air (lbs/hr)	0.00	
% removal	99.9840%	

The air stripper manufacturer guarantees performance and will work with AEL to maximize the efficiency of their unit. Since 1983, the manufacturer has been in business as a producer of packed tower air strippers. In 1988, the company invented the ShallowTray low profile air stripping technology. Since then, the manufacturer has delivered to more than 3,000 installations worldwide. In the event that the efficiency of the ShallowTray unit declines to a level that impacts its ability to meet agency specified discharge limits the unit will be immediately turned off. Both the manufacturer and AEL will then investigate the problem and arrive at an engineering solution that will be implemented so that the discharge limits are met.

4.4 Shutdown Criteria for Pump and Treat System Operations

During the P&T system testing activities, emissions from the P&T exhaust stack will be monitored using an OVM, gas detector tubes, and air bag samples. While the OVM and gas detector tubes are useful field monitoring devices, until the laboratory analytical results for the collected air bag samples are available, they are the only monitoring devices that will be used to check the exhaust emissions in real time. Therefore, in accordance with NYSDEC requirements the following initial field screening shutdown criteria will be used to turn off the P&T system:

- The reading from the P&T vapor emission stack using an OVM should not exceed 10 ppm.
- The reading from the P&T vapor emission stack using perchloroethene gas detector tubes should not exceed 10 ppm.
- The reading from the P&T vapor emission stack using vinyl chloride gas detector tubes should not exceed 10 ppm.

When a better correlation between field screening measurements and the air bag laboratory results is established, the above field screening criteria will be reviewed to ensure that these criteria are appropriate. The NYSDEC will be notified immediately whenever the aforementioned emission stack readings are exceeded and necessitate a P&T system shutdown.

On October 10, 2002, AEL received a letter from NYSDEC that presented a refined Division of Air Resources (DAR-1 (Air Guide 1)) dispersion analysis that showed the maximum allowable total emissions of perchloroethylene and vinyl chloride for two planned Soil Vapor Extraction System (SVES) exhaust stacks. Later, the planned installation of a P&T system will require the installation of a third exhaust stack. The NYSDEC letter stated that the total emissions of the aforementioned compounds from the exhaust stacks should not exceed the following quantities:

perchloroethylene	(CAS 00127-18-4)	0.20 pounds per hour
vinyl chloride	(CAS 00075-01-4)	0.06 pounds per hour

During the P&T system tests and during normal system operation, AEL will use the aforementioned refined DAR-1 total emission contaminant rates for perchloroethylene and vinyl chloride as shutdown criteria for turning the SVES and/or the P&T system off.

Gas detector tubes and air bag samples will be used to monitor the exhaust emissions periodically.

The NYSDEC will be notified immediately whenever the laboratory analysis of the exhaust stream air bag samples indicate that emission rates of tetrachloroethene (perchloroethylene) or vinyl chloride have exceeded the refined DAR-1 (Air Guide 1) parameters described above.

AEL will also notify NYSDEC and shut down the P&T system immediately whenever emission odor complaints are received from employees or neighbors.

5.0 Groundwater Pump and Treat System Operation and Monitoring

The air purification canisters will be checked as part of the operation and monitoring of the system. An OVM can be used in the field to check the air emissions from the ShallowTray air stripper operation, the input and output of each air purification canister and before the treated air is emitted to the atmosphere. Whenever the OVM is used to check air emissions it will be used with an air bag sampler. First the air bag will filled with a sample of the emission and then the OVM will sample the contents of the bag. This emission sampling method is used to prevent erroneous readings that could be caused by forcing air into the OVM.

The ShallowTray air stripper is resistant to fouling caused by oxidized iron. The system will be visually checked during each visit to make sure that no scale up has occurred in the vicinity of the 3/16-inch diameter holes. If such scale up has occurred, the ports will be cleaned using a washing wand and pressure washer. In the event that such washing does not remove the scale, the tray(s) will be removed and thoroughly washed. Following this cleaning, the system will be re-assembled and put back into operation.

5.1 Overview of Groundwater Pump and Treat System Monitoring Program

According to the manufacturer, monitoring requirements vary from site to site and are dependent on the site-specific condition of the groundwater. The ShallowTray air stripper is designed to require minimal monitoring activities and the Model 2631 has stainless steel parts to further reduce the impact of operation in saltwater environs such as Freeport, New York.

The ShallowTray Air Stripper Model 2631 has several gauges installed to allow the system to be checked for operation within compliance with the manufacturer's guidelines for temperature, air pressure and water flow rate. These gauges are located on the side of the system for ease of observation.

System monitoring will include checking the system for scale and other fouling conditions. Periodic visual checking of the system will identify such conditions. Visual inspections will initially be scheduled for each visit to the site. The frequency of such visits may change following system shakeout.

The other components of the P&T system that require monitoring include the air purification canisters. The vapor emissions from the canisters will be sampled periodically and submitted for laboratory analysis to determine the concentrations of VOCs being released to the environment.

Emissions monitoring will be of three different methods. One method will use Tedlar air bags or carbon tubes to collect vapor samples at pre-canister and post-canister sampling ports. The second method for field screening will be using precision gas detector tubes to sample both tetrachloroethylene and vinyl chloride vapors at these same sampling ports. The third method uses the OVM and an air sampling bag to measure the concentration of total volatile organic compounds in the vapors at the air purification canister sampling ports.

The discharge of the treated groundwater from the P&T system liquid effluent to the Nassau County sewer system will require periodic sampling of the effluent to ensure compliance with NCDPW discharge limits.

5.2 Groundwater Pump and Treat System Monitoring Schedule

The schedule for monitoring of the final design P&T system will initially be identical to that of the soil vapor extraction system (SVES). The monitoring schedules of the two systems may differ following the shakeout of the SVES.

The monitoring schedule for the P&T system may change depending on system performance during the startup/shakedown period. This monitoring schedule will be identified following the startup/shakedown period.

5.3 Daily Measurements During Pump and Treat System Startup/Shakedown

During the startup/shakedown of the P&T system, the system will be observed to record the air pressure using the manufacturer installed gauge, the water level and temperature gauge. System operation will be observed daily and compared to the manufacturer's specification for the system.

The area around the system will be observed to determine if the system has been leaking water during its operation. Should such leakage be observed, connections will be checked for tightness and the manufacturer contacted to determine how to best stop the leakage.

5.4 Pump and Treat System Sampling First Week After Shakedown Completed

The vapor emissions will be checked by collecting carbon tube samples before and after each air purification canister to determine the efficiency of the canister at removing the VOCs before discharge to the atmosphere. These carbon tubes will be sent to a State certified ELAP laboratory for analysis using EPA Method 8260 and specific attention will be paid to the concentrations of tetrachloroethylene and its breakdown products including vinyl chloride.

Water samples will be collected before the pumped liquid enters the ShallowTray air stripper. A water sample will also be collected at the liquid output of the air stripper before the liquid is discharged to the local sewer system. The collected samples will be delivered to a State certified ELAP laboratory for analysis. When available, the laboratory analytical data will be compared to the Nassau County specified discharge limits. If the discharge limits are exceeded the electrical power to the P&T system will be turned off immediately.

5.5 Weekly Measurements for Duration of Remedial Activities

Weekly measurements will include monitoring the emissions before and after each air purification canister using an OVM and an air bag sampler. This measurement will check the total concentration of VOCs at critical sampling ports and will be used as a predictor of canister breakthrough.

5.6 Monthly Measurements and Sampling for Duration of Remedial Activities

Carbon tubes will be used to sample the inputs and outputs of the air purification canisters to determine the effectiveness of the canister air purification medium and to calculate the quantity of volatile organic compounds removed from the groundwater. The carbon tubes will be delivered to a State certified ELAP laboratory and analyzed for concentrations of VOCs using EPA Method 8260.

Effluent samples will also be collected for laboratory analysis to ensure that the P&T liquid discharge into the local sewer system meets Nassau County specified limits. If the discharge limits are exceeded the electrical power to the P&T system will be turned off immediately.

5.7 Shutdown Criteria for Pump and Treat System

During startup activities, emissions from the P&T system exhaust stack will be monitored using an OVM, gas detector tubes, and air bag samples. While the OVM and gas detector tubes are useful field monitoring devices, until the laboratory analytical results for the collected air bag samples are available, they are the only monitoring devices that will be used to check the exhaust emissions in real time. Therefore, in accordance with NYSDEC requirements the following initial field screening shutdown criteria will be used to turn off the P&T system:

- The total of the OVM readings from all on-site remediation emission stacks should not exceed 20 ppm.
- The total readings from all on-site remediation emission stacks using perchloroethene gas detector tubes should not exceed 10 ppm.
- The total readings from all on-site remediation emission stacks using vinyl chloride gas detector tubes should not exceed 10 ppm.

When a better correlation between field screening measurements and the air bag laboratory results is established, the above field screening criteria will be reviewed to ensure that these criteria are appropriate. The NYSDEC will be notified immediately whenever the aforementioned emission stack readings are exceeded and necessitate a P&T system shutdown.

The first air bag samples will be collected from the P&T system emission points on the first day of startup operations and the laboratory analytical results for the samples will be available within 7-days. When the laboratory results are available, they will be compared to the field screening measurements to confirm that both monitoring methods correlate. Throughout the P&T system operational schedule, this comparison will be performed whenever new laboratory analytical results are available.

Section 4.4 references a letter received from NYSDEC that presents a refined Division of Air Resources (DAR -1) dispersion analysis showing the maximum allowable total emissions at the Nassau Uniform Services site. At P&T system startup and during normal system operation, AEL will use the aforementioned refined DAR-1 total emission contaminant rates for perchloroethylene and vinyl chloride as shutdown criteria for turning the P&T system off.

Gas detector tubes and air bag samples will be used to monitor the exhaust emissions periodically.

The NYSDEC will be notified immediately whenever the laboratory analysis of the exhaust stream air bag samples indicate that emission rates of tetrachloroethene (perchloroethylene) or vinyl chloride have exceeded the refined DAR-1 (Air Guide 1) parameters described in Section 4.4.

AEL will also notify NYSDEC and shut down the P&T system immediately whenever emission odor complaints are received from employees or neighbors.

6.0 Groundwater Sampling

Groundwater samples will be collected from the site prior to system startup and just prior to completing the pilot test and every three months following startup. Collected samples will be delivered to a State certified ELAP laboratory where they will be analyzed in accordance with the Target Compound List (TCL) VOCs plus Tentatively Identified Compounds (TICs), TCL Semi- VOCs (SVOCs) plus TICs, and 23 Metals on the Target Analyte List (TAL) by report only (no data package to be supplied).

Groundwater sampling performed to demonstrate that groundwater cleanup objectives have been accomplished will be in accordance with the aforementioned list of compounds and metals and will require a NYSDEC ASP Category B data package.

Groundwater samples will be collected for analysis from the on-site monitoring wells, pumping wells and piezometers.

7.0 Groundwater Pump and Treat System Maintenance Procedure

This section describes the procedure for applying and disengaging electrical power to the groundwater ShallowTray air stripper. It also summarizes the weekly and monthly operational checks to confirm system performance.

A dedicated electrical starter switch for the ShallowTray air stripper will be mounted on the eastern wall of the garage. The starter switch is magnetically operated and has a **START** control pushbutton and a **STOP** control pushbutton. The starter switch front panel also contains a reset pushbutton that is used to reset the internal controls of the starter switch. By depressing the **START** pushbutton connects electrical power to the air stripper and it immediately begins to operate the pump and blower and attains full rotational speed within a few seconds. Depressing the **STOP** pushbutton disconnects electrical power from the blower and water pump.

System shut down is accomplished by turning off the water feed to the system. After a five-minute wait to allow the water in the stripper trays to be completely treated, then the blower is shut down. The treated water in the trays will drain into the sump tank. The air stripper can be turned off at that point.

If the proper shut down procedures are not followed, contaminated water will drain into the sump tank and contaminate the water that has collected in the tank. Allowing the blower to run for the additional five minutes described above will prevent this water from being contaminated.

8.0 Waste Manifests

Copies of waste manifests for hazardous and non-hazardous waste material transported from the site for disposal will be forwarded to the NYSDEC as they become available. These manifests will include those associated with the disposal of drill cuttings, contents of air purification canisters and filters.

9.0 Reports

Progress reports will be submitted to NYSDEC and NYSDOH (Department of Health) each month to demonstrate that the P&T system is operating in compliance with the final P&T system design plan.

The results of the P&T system daily, weekly, and monthly checks/tests will be summarized in quarterly reports that will be submitted to NYSDEC. The reports will include tables and/or graphs presenting the baseline concentrations measured before the startup of the P&T system and the monthly results acquired thereafter. The quarterly report will discuss the results of any soil and/or soil gas sampling. In addition, estimates will be made of the mass of contaminants that have been removed by the system.

10.0 Quality Assurance/Quality Control Plan

The Work Plan for the installation and operation of the SVES will comply with the existing Quality Assurance/Quality Control Plan for the Nassau Uniform Services property as described in the Focused Remedial Investigation Work Plan filed with NYSDEC and dated March 25, 1997. Section 6.0 of the QA/QC Plan describes the sample custody procedures that will be used to document the history of sample containers and samples from the time of preparation of sample containers through sample collection and analysis. To maintain and document sample possession, chain of custody procedures will be followed. A chain-of-custody form contains the signatures of individuals who have possession of the samples after collection and identification in the field. Copies of chain-of custody forms used during the implementation of this work plan will be submitted to NYSDEC with the laboratory analytical report for the collected samples.

The samples collected during the implementation of this work plan will be submitted to H2M Labs, Inc., Melville, New York. A copy of their Standard Operating Procedure for Sample Preparation and Analysis of Volatile Organics by GC/MS in Air is presented in Appendix 3.

11.0 Health and Safety Plan

The Work Plan for the installation and operation of the P&T system will comply with the existing Health and Safety Plan for the Nassau Uniform Services property as described in the Focused Remedial Investigation Work Plan filed with NYSDEC and dated March 25, 1997.

Three P&T pumping wells will be installed within the Nassau Uniforms Services building. Two of the wells will be located in the truck parking garage area of the building and will be installed after the trucks have been removed. The third well will be installed at the former location of the dry cleaning machines that have been removed from the site, and will be installed when no washing machine activities are being performed to minimize the number of building inhabitants.

Prior to start of any drilling activities an OVM and gas detector tubes will be used to determine the background level of air quality within the garage and former dry cleaning machine areas.

During drilling activities the OVM will be used to continuously monitor the total concentration of VOCs in the ambient air in the vicinity of the boring hole. If the OVM indicates that the ambient air total concentration of VOCs exceeds 5 parts per million (ppm) above the background level for a 15-minute average, work activities will be temporarily halted and monitoring will continue. If the total concentration of VOCs level readily decreases below 5 ppm over background, work activities will resume with continued monitoring.

If the OVM indicates that total concentration of VOCs in the ambient air persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of the vapors identified, corrective actions taken to abate emissions and monitoring continued. After these steps, work activities can resume provided that the total concentration of VOCs measured 20-feet from the work area and beyond is below 5 ppm over background for a 15-minute average.

If the total concentration of VOCs in the ambient air is above 25 ppm at 20-feet from the work area activities will be shutdown.

All 15-minute readings will be recorded and will be available for State personnel to review.

12.0 Project Schedule

12.1 Work Schedule for the Proposed P&T Pilot Test

Installation and Test Phase

Project Events	ARA + business days
NYSDEC approves P&T Conceptual Design Plan	0
AEL begins P&T pilot test system installation	10
Pumping Well No. 1 (PW#1) installed	20
Air purification canisters delivered to site	45
Air Stripper delivered to site	45
Piping from PW#1 to air stripper installed	50
Piping from air stripper to air purification canisters installed	50
Exhaust stack to building roof installed	55
Start P&T preliminary installation testing	60
Demonstrate Phase One P&T operation to NYSDEC	65
Collect P&T effluent and vapor emission samples for analysis	65
Laboratory analytical report available	80
Application to operate Phase Two P&T pilot test submitted to NCDPW	85
Begin P&T pilot testing two week operation	100
Phase Two P&T pilot testing complete	120
Deliver P&T Final Design Work Plan to NYSDEC	150

Total elapsed time to complete P&T pilot testing phase = 120 days

ARA = after receipt of Work Plan approval from NYSDEC

12.2 Work Schedule for the Proposed Final Design P&T System

The work schedule for the Final Design P&T system will be presented in the work plan for the final design P&T system.

13.0 Certification

The undersigned certifies that the attached Work Plan for a Conceptual Design Groundwater Pump and Treat system at Nassau Uniform Services, 525 Ray Street, Freeport, NY, and dated August 21, 2003, has been reviewed, and this plan with its described equipment can achieve the cleanup goals identified herein.

John V. Soderberg, P.E.
49975

Date: 2/14/02

Appendix 1

Manufacturer's Information Sheets

North East Environmental Products, Inc.
7 Commerce Avenue
West Lebanon, NH 03784
603-298-7061 603-298-7063 fax
sales@neepsystems.com

Integrated Environmental Technologies

Home - About NEEP - Contact Us - Product Lines - Online Catalog - Request a Quote - Journal - Tech Support

Integrated Systems - Air Strippers - Pumps - Controls/SCADA

Technology - Modeler - Model Info - Patent Info

1300 - 1300P - 2300 - 2300P - 2600 - 3600 - 31200 - 41200 - 61200 - Clearadon

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ShallowTray®
low profile air strippers

2600 Series

Model Pictured: 2631

Standard System Includes: Sump tank, cover, and trays, 304L stainless steel; TEFC air blower sized to number of trays; Blower inlet screen and damper; Mist eliminator, 304L stainless steel; Water inlet spray nozzle; Water level sight tube; Gaskets; Latches, stainless steel; Internal piping, Schedule 80 PVC; Tray cleanout ports.

Capacities & Dimensions

click on model no. for a drawing in PDF format

Model	Flow Rate	# Trays	Width	Length	Height	CFM
2611	2 - 115 gpm	1	4' 4"	6' 2"	5'	600
2621	2 - 115 gpm	2	4' 4"	6' 2"	5' 9"	600
2631	2 - 115 gpm	3	4' 4"	6' 2"	6' 6"	600
2641	2 - 115 gpm	4	4' 4"	6' 2"	7' 3"	600
2651	2 - 115 gpm	5	4' 4"	6' 2"	8'	600
2661	2 - 115 gpm	6	4' 4"	6' 2"	8' 9"	600

Actual dimensions will vary depending on options or blower selection. Please consult your NEEP representative for system specific dimensions.

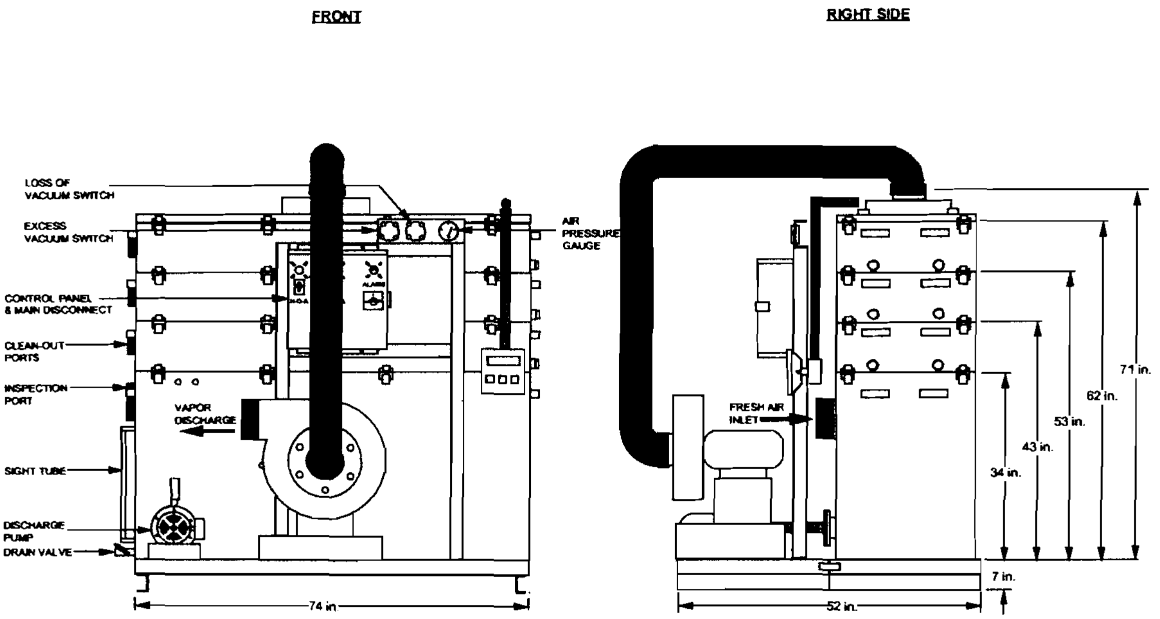
Available Options

Air Pressure Gauge*
Discharge Pump
Standard NEMA 4 Controls*
Gravity Discharge Piping*
Feed pump
Custom NEMA 7 Controls
Steel Frame Mounting*
Blower Start/Stop Panel
Strobe Alarm Light
EXP Motors
Main Disconnect Switch
Alarm Horn

Low Air Pressure Alarm Switch*
Digital Flowmeter/Totalizer
Air Blower Silencer
Viewports (Stainless models only)
High Water Level Alarm Switch*
Air Flow Meter
Autodialer
Shed Enclosures
Discharge Pump Level Switch
Temperature Gauges
Remote Telemetry
Trailer Enclosures
Water Pressure Gauges
Line Sampling Ports
Well Pump Controls

(*) Designates standard option

Specifications subject to change without notice.



MINIMUM CLEARANCE

FRONT	1.5 ft.
TOP	15 in.
REAR	N/A
LEFT	6.5 ft.
RIGHT	1 ft.

BASIC SYSTEM

- ✓ SUMP TANK
- ✓ STRIPPER TRAYS
- ✓ BLOWER
- ✓ MIST ELIMINATOR
- ✓ PIPING
- ✓ SPRAY NOZZLE
- ✓ WATER LEVEL SIGHT TUBE
- ✓ GASKETS
- ✓ LATCHES

OPTIONAL ITEMS

- ✓ SKID & STANCHION
- ___ GRAVITY DISCHARGE PIPING
- ✓ DISCHARGE PUMP
- ___ FEED PUMP
- ___ ADDITIONAL BLOWER
- ___ EXPLOSION-PROOF MOTOR(S)
- ___ LOCAL DISCONNECT NEMA 7
- ✓ CONTROL PANEL
- ✓ MAIN DISCONNECT SWITCH
- ___ I.S. COMPONENTS/REMOTE MOUNT
- ✓ INTERMITTENT OPERATION
- ___ STROBE LIGHT
- ___ ALARM HORN
- ___ POWER LAPSE INDICATOR
- ✓ LOW AIR PRESSURE ALARM SWITCH(ES)
- ✓ HIGH WATER LEVEL ALARM SWITCH
- ✓ DISCHARGE PUMP LEVEL SWITCH
- ___ WATER PRESSURE GAUGE(S)
- ✓ DIGITAL WATER FLOW INDICATOR
- ✓ AIR PRESSURE GAUGE
- ___ AIR FLOW METER
- ___ TEMPERATURE GAUGE(S)
- ___ LINE SAMPLING PORT(S)
- ___ AIR BLOWER SILENCER
- ✓ WASHER WAND
- ___ AUTO DIALER

NOTE: THIS DRAWING IS REPRESENTATIVE OF A STANDARD SHALLOWTRAY CONFIGURATION, AND IS NOT INTENDED FOR ENGINEERING DESIGN OR LAYOUT. ACTUAL ARRANGEMENT AND DIMENSIONS MAY VARY DEPENDING ON BLOWER SELECTION OR OTHER ACCESSORIES. PLEASE CONTACT NEEP FOR DETAILED DESIGN INFORMATION.

POWER: 3Ø, 230 Volt, 3 WIRE + GROUND 60 Hz

*CONSULT N.E.E.P. FOR OTHER AMPACITIES AND VOLTAGE OPTIONS

CONNECTION INFORMATION

ITEM	SIZE
GRAVITY DISCHARGE	4"Ø FLANGE, PVC80
DISCHARGE PUMP	2"Ø FNPT
WATER INLET	2"Ø FNPT
AIR EXHAUST NOZZLE	8"Ø STUB w/8" CPLG

STRIPPER CONSTRUCTION:
304L STAINLESS STEEL

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
7 COMMERCE AVENUE
WEST LEBANON, NEW HAMPSHIRE 03784
PHONE: 603-298-7061 FAX: 603-298-7063
http://www.neepsystems.com

TOLERANCES UNLESS OTHERWISE SPECIFIED: ± 1 INCH	DRAWING NAME: © 2002 NEEP® ShallowTray® Model 2631
	DRAWING #: Proposal #901902-1
DRAWN: DCS	CUSTOMER: Anson: Nassau Uniform, LI

DATE: 06/13/03	SCALE: NTS	SIZE: A	SHEET: 1 OF :1

ShallowTray®
low profile air strippers

System Performance Estimate

Client and Proposal Information:

Anson Environmental: John Tegins
e: jtegins@optonline.net
Nassau Uniform Services, Freeport, NY
#901902-1 40 GPM

Series chosen:	2600	
Water Flow Rate:	40.0 gpm	9.1 m3/hr
Air Flow Rate:	600 scfm	1020 m3/hr
Water Temp:	50 °F	10 °C
Air Temp:	40 °F	4 °C
A/W Ratio:	112	112
Safety Factor:	None	

		Model 2611		**Model 2621**		**Model 2631**		**Model 2641**		**Model 2651**	
	Untreated Influent	**Effluent**		**Effluent**		**Effluent**		**Effluent**		**Effluent**	
Contaminant	**Effluent Target**	**lbs/hr**	**PPMv**	**lbs/hr**	**PPMv**	**lbs/hr**	**PPMv**	**lbs/hr**	**PPMv**	**lbs/hr**	**PPMv**
		%removal		**%removal**		**%removal**		**%removal**		**%removal**	
Vinyl Chloride	1300 ppb	9 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 1100 ppm	2 ppb	0.03	4.4	0.03	4.4	0.03	4.4	0.03	4.4	0.03	4.4
Mwt 62.5		99.2832%		99.9949%		100.0000%		100.0000%		100.0000%	
1,1-Dichloroethylene	200 ppb	7 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 500 ppm	5 ppb	0.00	0.4	0.00	0.4	0.00	0.4	0.00	0.4	0.00	0.4
Mwt 96.94		96.7448%		99.8940%		99.9966%		99.9999%		100.0000%	
Methylene Chloride	200 ppb	42 ppb		9 ppb		2 ppb		<1 ppb		<1 ppb	
Solubility 20,000 ppm	5 ppb	0.00	0.4	0.00	0.5	0.00	0.5	0.00	0.5	0.00	0.5
Mwt 84.9		79.2324%		95.6870%		99.1043%		99.8140%		99.9614%	
Trichloroethylene	5900 ppb	242 ppb		10 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 1100 ppm	5 ppb	0.11	9.1	0.12	9.5	0.12	9.5	0.12	9.5	0.12	9.5
Mwt 131.5		95.8941%		99.8314%		99.9931%		99.9997%		100.0000%	
* **Tetrachloroethylene**	140000 ppb	4559 ppb		148 ppb		5 ppb		<1 ppb		<1 ppb	
Solubility 150 ppm	5 ppb	2.72	172.6	2.81	178.2	2.81	178.4	2.81	178.4	2.81	178.4
Mwt 165.83		96.7439%		99.8940%		99.9965%		99.9999%		100.0000%	
1,1,1-Trichloroethane	8 ppb	<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 4,400 ppm	5 ppb	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Mwt 133.41		94.5734%		99.7055%		99.9840%		99.9991%		100.0000%	
Total ppb	147608 ppb	4859		167		7		<1		<1	
Total VOC lbs/hr - PPMv		2.87	186.9	2.96	193.0	2.96	193.2	2.96	193.3	2.96	193.3
Total %removal		96.71%		99.89%		100.00%		100.00%		100.00%	

*** This influent concentration exceeds the solubility factor. Contact your ShallowTray® representative for details.**

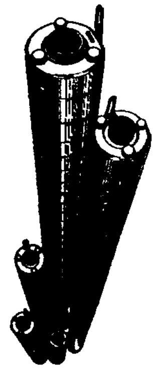
Report Generated: 8/13/03 **Modeler Ev2.3 ppmv**

GRUNDFOS®

Redi-Flo4 Environmental Submersible Pumps

10E

Submittal Data 3450 RPM 60 Hertz



JOB or CUSTOMER:

ENGINEER:

CONTRACTOR:

SUBMITTED BY: DATE:

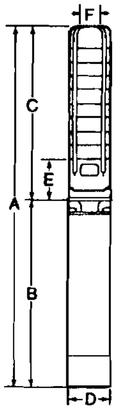
APPROVED BY: DATE:

ORDER NO.: DATE:

SPECIFICATION REF.:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Dimensions



Technical Data

FLOW RANGE: 5 to 14 US GPM

MOTORS: Grundfos MS402E Environmental Submersible Motor (Standard)
Maximum Operating Temperature: 104°F (40°C)
Maximum Operating Pressure: 220 PSI
Maximum Number of Starts Per Hour: 100
Minimum Recommended Flow Past Motor: 0.25 ft/sec
(NOTE: Franklin Pollution Recovery motor is optional.)

DISCHARGE SIZE: 1¼" NPT

PUMP END CONSTRUCTION MATERIALS: Stainless Steel and Teflon®

INSTALLATION: Unit to be installed vertically for submerged operation.

Electrical Data, Dimensions, and Weights ①

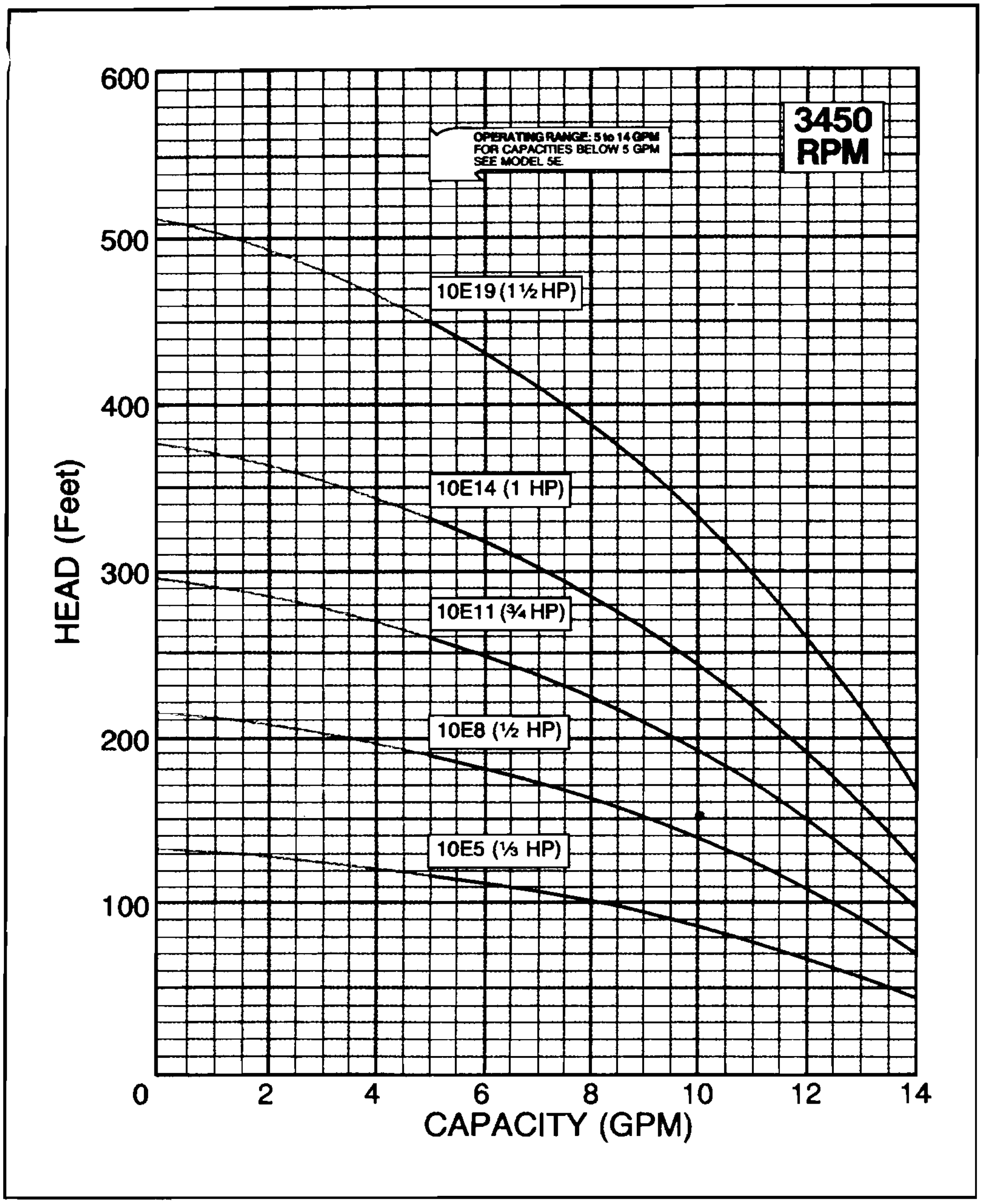
PUMP TYPE	MOTOR				DIMENSIONS (In Inches)						NET WEIGHT (LBS.)②	SHIP. WEIGHT (LBS.)②
	HP	SF	PH	VOLTS	OVERALL LENGTH A	MOTOR LENGTH B①	PUMP END LENGTH C	MAX. DIA. D	INLET E	DISCH. PIPE SIZE (NPT) F		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10E8	½	1.60	1	230	23 9/16	10 13/16	12¾	3 31/32	3 ¼	1 ¼	26	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10E14	1	1.40	1	230	29 11/16	12	17 11/16	3 31/32	3 ¼	1 ¼	31	32
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

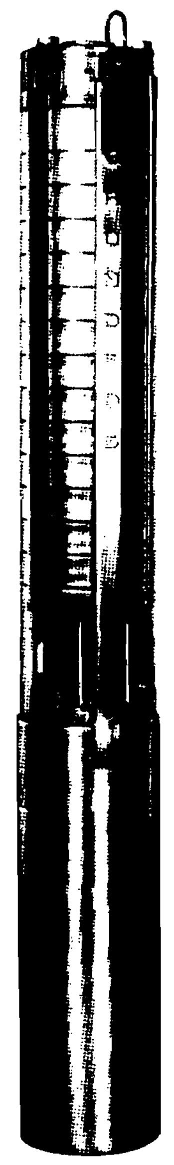
① Data for Grundfos MS402E motors. ② Does not include motor leads.

10E

Redi-Flo4 Environmental Pump

Performance Curves





Materials of Construction

REDI-FLO4 PUMP END	
Check Valve Housing	304 Stainless Steel
Check Valve	304 Stainless Steel
Check Valve Seat	304 Stainless Steel & Teflon®
Diffuser Chamber	304 Stainless Steel
Impeller Seal Ring	Teflon®
Impeller	304 Stainless Steel
Suction Interconnector	304 Stainless Steel
Inlet Screen	304 Stainless Steel
Pump Shaft	304 Stainless Steel
Coupling	329/420/431 Stainless Steel
Straps	304 Stainless Steel
Cable Guard	304 Stainless Steel
Priming Inducer	304 Stainless Steel
Intermediate Bearings	Teflon®

NOTE: Specifications are subject to change without notice.

GRUNDFOS ENVIRONMENTAL MOTOR	
Nema Top	304 Stainless Steel
Studs & Fasteners	304 Stainless Steel
Nuts	316 Stainless Steel
Sand Slinger	Viton®
Shaft Extension	431 Stainless Steel
Diaphragm	Viton®
Stator Housing	304 Stainless Steel
Fill Plug Screw	304 Stainless Steel
Fill Plug Washer	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR LEADS	
Connector Sleeve	304 Stainless Steel
Connector Potting	Scotch Cast #4® Epoxy w/Viton® Cap
Connector Plug	Viton®

Intermittent Operation

If continuous blower operation is a concern, ShallowTray low profile air stripper systems can be designed to run intermittently. When the feed water is flowing into the system, the blower will be in operation and the outlet pump (if provided) will maintain proper sump tank levels. When the feed water is shut down, the blower will run for an additional five minutes to treat the water already in the trays, then it will also shut down. When the feed water is restored, the blower will automatically start up to treat the new batch of water.

If there is an alarm condition that lasts longer than five minutes the blower will shut down and the alarm circuit light will remain on. Once the blower shuts off, the system will sense a low air pressure condition. To reset the alarm circuit or light once the blower has shut off, you must disconnect power at the main disconnect. Some systems may also have a "reset" push button on the control panel door.

System Shut Down

Shut feed water off.

Shut off the water feed to the system.

Wait 5 minutes, then shut off the blower.

Wait 5 minutes to allow the water in the stripper trays to be completely treated, then shut off the blower. Treated water in the trays will drain into the sump tank, so it is important to keep the outlet pump in "auto" to remove this extra water.

Shut main power off.

Shut off the power at the main disconnect switch if the shutdown is more than temporary.

Caution: If proper shut down procedures are not followed, contaminated water will drain into the sump tank. This will contaminate the water that has been collected in the tank. Therefore, always allow the blower to run an additional 5 minutes after the feed water is shut-off.

MAINTENANCE

Equipment Maintenance Instructions

Cleaning Instructions

Minerals dissolved in high concentrations tend to precipitate out of groundwate during air stripping processes. These minerals form insoluble deposits commor referred to as 'fouling.' Although the ShallowTray low profile air stripper system designed to be fouling resistant, proper steps must be taken when treating wate with high mineral concentrations. Deposits from iron-rich feed water can be reduced by pre-treating it with **sequestering agents.** For more information, please call Remede Products, Inc., 802-365-7200. The recommended cleaning procedure is pressure washing. Please follow the detailed instructions in this section.

Equipment Required

(a Kg)/cm^2

Pressure Washer

2 gpm minimum flow at 900 psig minimum. Equipment rental companies can usually supply such a unit on a daily rental basis.

Washer Wand

Washer wand with spray nozzle, (obtainable from North East Environmental Products as an option) and an adapter to connect the wand to the pressure washer hose end. All washer wand connections are ¼" (6mm) NPT.

Clean Water Supply

Clean water supply with a capacity of at least 2 gpm at 20 psig. Connect to the pressure washer using an ordinary garden hose.

Cleaning the Unit

Step 1

Turn off equipment.

Turn off the feed water to the stripper.

Step 2

Provide for waste disposal.

Make provisions for disposing of the sludge and waste generated during cleaning. A wet/dry vacuum may be required, or possibly the outlet pump (if provided) can pump out to a storage tank. Be aware that large pieces of debris might possibly clog the outlet pump or check valve.

Step 3

Remove cleanout port covers.

Remove all cleanout port covers.

Step 4

Turn on water and pressure washer.

Turn on the water supply to the pressure washer. Then, turn on the pressure washer. Wear protective goggles or face shield while spraying.

Step 5

Insert wand and start pressure washer water flow.

Insert the wand all the way into the 8" (20cm) cleanout port on the sump tank. Have the spray nozzle pointed up toward the bottom of the lowest tray. Holding the wand tightly, pull the trigger to start the pressurized water flow. Expect the wand to kick back as flow starts.

Step 6

Move wand side to side.

Move the wand side to side at a rate of about 1 inch (3cm) per second. Be s
to cover the entire tray bottom area. Recommended cleaning times for one s
of one tray are given below:

Model 1300	2 min
Model 2300	4 min
Model 2600	8 min
Model 3600	12 min
Model 31200	24 min
Model 41200	32 min

Step 7

Inspect cleaned area.

Periodically stop the cleaning operation and inspect the cleaned area by shi
a light into the unit. The area is clean when there are no deposits in or aroun
the stripper tray holes.

Caution: Check the water level in the sump tank periodically, and drain when necessary.

Step 8

Clean top side of tray.

When the bottom surface appears clean, move the wand to the top side of th
same tray by inserting it in the next highest cleanout port. Continue spraying
the nozzle pointed down onto the top surface of the tray. Remove all visible deposits from the tray baffles and the walls of the unit.

Step 9

Repeat for all trays.

Repeat the procedure for the bottom of the next higher tray, etc., working up
the top tray.

Step 10

Rinse.

After the cleaning operation is finished, rinse the trays, baffles, and walls with the pressure sprayer. Work down from the top tray to the sump tank. Make sure the surfaces are clean and the holes are not blocked by loosened debris.

Step 11

Remove the top cover, flip it over, and wash the bottom side. Inspect spray nozzle and the wire mesh mist eliminator pad for fouling.

Clean the spray nozzle.

If the spray nozzle shows evidence of deposits, it should be removed and cleaned with a wire brush. Some systems have more than one spray nozzle.

Check the mist eliminator pad.

Clean the mist eliminator pad.

Use the pressure sprayer to remove debris, deposits, and gummy residues on the mist eliminator pad.

Replace the mist eliminator pad.

Mist eliminator pads that are excessively plugged should be replaced. The old pad is removed by loosening the retainer plates on the corners of the pad. Reinstall the new pad in the same orientation as the old one.

NEEP Systems
RFQ
Contact Us
Technology
Modeler
Product Info
Patent Info

Integrated Systems
Air Strippers
Pumps
Controls/ SCADA
Home

Technology

ShallowTray®
low profile air strippers

Acenaphthene
Acenaphthylene
Acetone
Ammonia
Benzene
Bromodichloromethane
Butane
Butylbenzene
Carbon Dioxide
Carbon Tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
Chloropropane
Dibromochloromethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
c-1,2-Dichloroethylene (DCE)
t-1,2-Dichloroethylene
Dichlorofluoromethane
1,1-Dichloropropane
1,2-Dichloropropane
Diesel Fuel
Ethane
Ethylbenzene
Ethylene Dibromide
Fluorene
Fuel Oil
Gasoline
Hexane
Isopropylbenzene (Cumene)
Isopropylether
Jet Fuel
MEK
Methane
Methylene Chloride
MIBK
MTBE
n-Butanol
n-Propylbenzene
Naphthalene
Nonane
Phenanthrene

Radon
sec-Butylbenzene
Styrene
t-1,2-Dichloroethylene
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Tetrahydrofuran
Toluene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trifluoroethane
1,2,3-Trimethylbenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl Chloride
Xylenes

Top of Page

Appendix 2

Previous Environmental Investigations

GTI Information

Date: September 23, 1994

DRAFT

GROUNDWATER
TECHNOLOGY ®

Groundwater Technology, Ir
101-1 Colin Drive, Holbrook, NY 11741 US
Tel: (516) 472-4000 Fax: (516) 472-40

October 14, 1994

Mr. Michael E. White
Jaspan, Ginsberg, Schlesinger, et al
300 Garden City Plaza
Garden City, New York 11530-3324

Re: Summary Report for Additional Soil and Groundwater Investigation
Nassau Uniform Service, Inc.

Dear Michael:

On September 23, 1994, Groundwater Technology, Inc. supervised the installation of six geoprobe points for the collection of soil and groundwater samples. A site map illustrating the locations of the points is presented as Figure 1.

Initially, a core drill was utilized to drill through the concrete floor in the building warehouse. The concrete ranged from approximately 4" - 6" in thickness. A quad mounted geoprobe unit then set up at each location and sampling procedures began. A total of three samples, each consisting of a 4-foot length core of soil, were extracted from each location. The samples were collected from depths of 0-4', 4-8', and 8-12' below grade. An open borehole to 12 feet below grade was thus created. Each core sample was field screened with a flame ionization detector (FID) for the detection of volatile organic compounds (VOCs). A summary of the FID results and lithologic descriptions is presented as Table 1. One soil sample with the highest FID results from each boring was submitted to EcoTest Laboratories of North Babylon, New York for analysis of VOCs by EPA Method 8010. A summary of the soil analytical results is presented as Table 2.

Upon coring to a depth of 12 feet below grade, groundwater samples were then collected. A drill rod fitted with a two foot length of stainless steel screen was fitted within each borehole from a depth of 10'-12' below grade. New polyethylene tubing fitted with a ball check valve was installed inside the drilling rods and screen and oscillated up and down to push a column of water to the top of the tubing. Approximately one standing water well volume was purged from each location prior to collecting the groundwater sample. The samples were submitted to EcoTest Laboratories for analysis of VOCs by EPA Method 601, chloride and sodium. A summary of the groundwater analytical results is presented in Table 3.

Conclusions

The soil deposits at the site consist~~s~~ mainly of fine to medium sands with some clay and gravel, and marsh deposits located from five to eight feet below grade. Fill material was noted in GP-2 from grade to four feet. Groundwater was encountered at approximately seven feet below grade.

DRAFT

As specified in the Division Technical and Administrative Guidance Memorandum (TAGM: #HWR-94-4046) Determination of Soil Cleanup Objectives and Cleanup Levels dated January 24, 1994, a total of two locations (GP-2 and GP-3) exceeded the cleanup objective for 1,2-Dichloroethene, three locations (GP-2, GP-3, and GP-5) exceeded the cleanup objectives for trichloroethylene, two locations (GP-2 and GP-3) exceeded the cleanup objective for tetrachloroethene, and two locations (GP-2 and GP-3) exceeded the cleanup objective for total volatile organic compounds.

Groundwater samples GP-2 through GP-6 exceeded the Class GA standards for those volatile organic compounds listed in Table 3. Specifically, GP-2 exceeded the class GA standard for tetrachloroethene, GP-3 exceeded the Class GA standard for vinyl chloride, 1,2-Dichloroethene, trichloroethylene, and tetrachloroethene, GP-4 exceeded the Class GA standard for vinyl chloride, 1,2-Dichloroethene, trichloroethylene, tetrachloroethene, and chlorobenzene, GP-5 exceeded the Class GA standard for 1,1-Dichloroethane, 1,2-Dichloroethene, trichloroethylene, and tetrachloroethene, and GP-6 exceeded the Class GA standard for 1,2-Dichloroethene, 1,1,1-Trichloroethane, trichloroethylene, and tetrachloroethene. GP-1 did not exceed any Class GA standard for volatile organic compounds. The Class GA standard for chloride was exceeded in GP-5 and sodium was exceeded in GP-1 through GP-6.

The results of the laboratory analysis indicates that VOC contamination in groundwater extends to the perimeter of the garage area. There were no VOCs detected in the apparent upgradient groundwater sample. Results of the sodium analysis were above the Class GA standards in all water samples and chloride concentrations were above Class GA standards in one sample, GP-5. These results could be used to argue with the NYSDEC for a different classification, and therefore less stringent cleanup requirements.

Please contact this office if you have any questions or comments regarding this report.

Sincerely,

GROUNDWATER TECHNOLOGY, INC.

Albert M. Tonn
Project Manager

Enclosures

NassauUniform/sumrpt1.094

TABLE 1
SUMMARY OF SOIL BORING LOGS
NASSAU UNIFORM SERVICES
525 RAY STREET
FREEPORT, NEW YORK

DRAFT

SEPTEMBER 23, 1994

GEOPROBE [illegible]	DEPTH [illegible]	PID RESULT (ppm)	LITHOLOGIC DESCRIPTION
GP-1	0-4	0	Brown sand, fine grained,.poorly sorted, some gravel, clayey sand at 2-4'.
	4-8	0	Orange brown sand, fine to medium grain, wet at 7', fairly well sorted.
	8-12	3	Same as above, trace coarse sand.
GP-2	0-4	90	Brown sand, poorly sorted, some concrete and brick
	4-8	400	Black marsh deposits, wet.
	8-12	400	Black sand, then gray, then brown, fine to medium grained, fairly well sorted.
GP-3	-0-4	15	Brown sand, fine to medium grained, trace small grav fairly well sorted.
	4-8	100	Brown clayey sand to 4.5', then black marsh deposits, then grey sand, fine grained, fairly well sorte
	8-12	>1000	Grey sand, fine grianed, fairly well sorted, then sand becomes brown at 10', sheen detected on water.
GP-4	0-4	0	Brown sand, fine to medium grain, fairly well sorted, trace gravel, dark brown clayey sand at 3.7'.
	4-8	4	Brown sand with black marsh deposits and some brown and grey clay, wet.
	8-12	400	Grey sand, fine to medium grained, trace coarse sanc and gravel, trace black marsh deposits.
GP-5	0-4	0	Tan, brown and dark brown sand, fine to medium grained, fairly well sorted, trace gravel.
	4-8	90	Brown sand to 5', then black organic marsh, then brown sand, fine to medium grained, fairly well sorted trace soarse sand, wet.
	8-12	90	Brown sand, fine to medium grained, fairly well sortec trace coarse sand and gravel, becomes orange at 11
GP-6	0-4	30	Brown sand, fine to medium grained, fairly well sortec then black clayey sand deposits, marsh.
	4-8	>1000	Black organic marsh deposits to 7', then grey sand, f to medium grain, fairly well sorted, trace gravel.
	8-12	200	Grey sand, fine to medium grained, fairly well sorted to 10', then sand becomes orange.

Nassau Uniform/tidsum.wk3

TABLE 2
SOIL ANALYTICAL RESULTS
NASSAU UNIFORM SERVICES
525 RAY STREET
FREEPORT, NEW YORK

DRAFT

SEPTEMBER 23, 1994

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
GP-1 (0'-4')	ND	ND	160	ND	160
GP-2 (0'-4')	7,400	12,000	11,000	280	30,680
GP-3 (0'-4')	800	7,400	2,200	70	10,470
GP-4 (0'-4')	55	400	1,000	ND	1,455
GP-5 (0'-4')	230	1,400	1,400	ND	3,030
GP-6 (4'-8')	5	5	ND	ND	10
RECOMMENDED CLEANUP OBJECTIVE*	300	700	1,400	7,900	10,000

Results reported in ug/kg (ppb)
Samples analyzed by EPA Method 8010

* – Based upon NYSDEC TAGM#HWR-94-4046, January 24, 1994, Determination of Soil Cleanup Objectives and Cleanup Levels

Nassau Uniform/soilana.wk3

DRAFT

TABLE 3
GROUNDWATER ANALYTICAL RESULTS
NASSAU UNIFORM SERVICES
525 RAY STREET
FREEPORT, NEW YORK

SEPTEMBER 23, 1994

COMPOUND	LOCATION						CLASS GA
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STANDARD
Vinyl Chloride	ND	ND	280	180	ND	ND	2
1,1 Dichloroethane	ND	ND	ND	ND	10	ND	5
1,2 Dichloroethene	ND	ND	150	4,100	5,600	24	5
1,1,1 Trichloroethane	ND	ND	ND	ND	ND	26	5
Trichloroethylene	ND	10	34	2,300	630	39	5
Tetrachloroethene	ND	6,400	1,100	91,000	2,800	600	5
Chlorobenzene	ND	ND	ND	150	ND	ND	5
Total VOCs	ND	6,410	[illegible]	97,730	9,040	689	NA
Chloride	77,000	250,000	210,000	140,000	610,000	190,000	250,000
Sodium	120,000	190,000	150,000	140,000	380,000	140,000	20,000

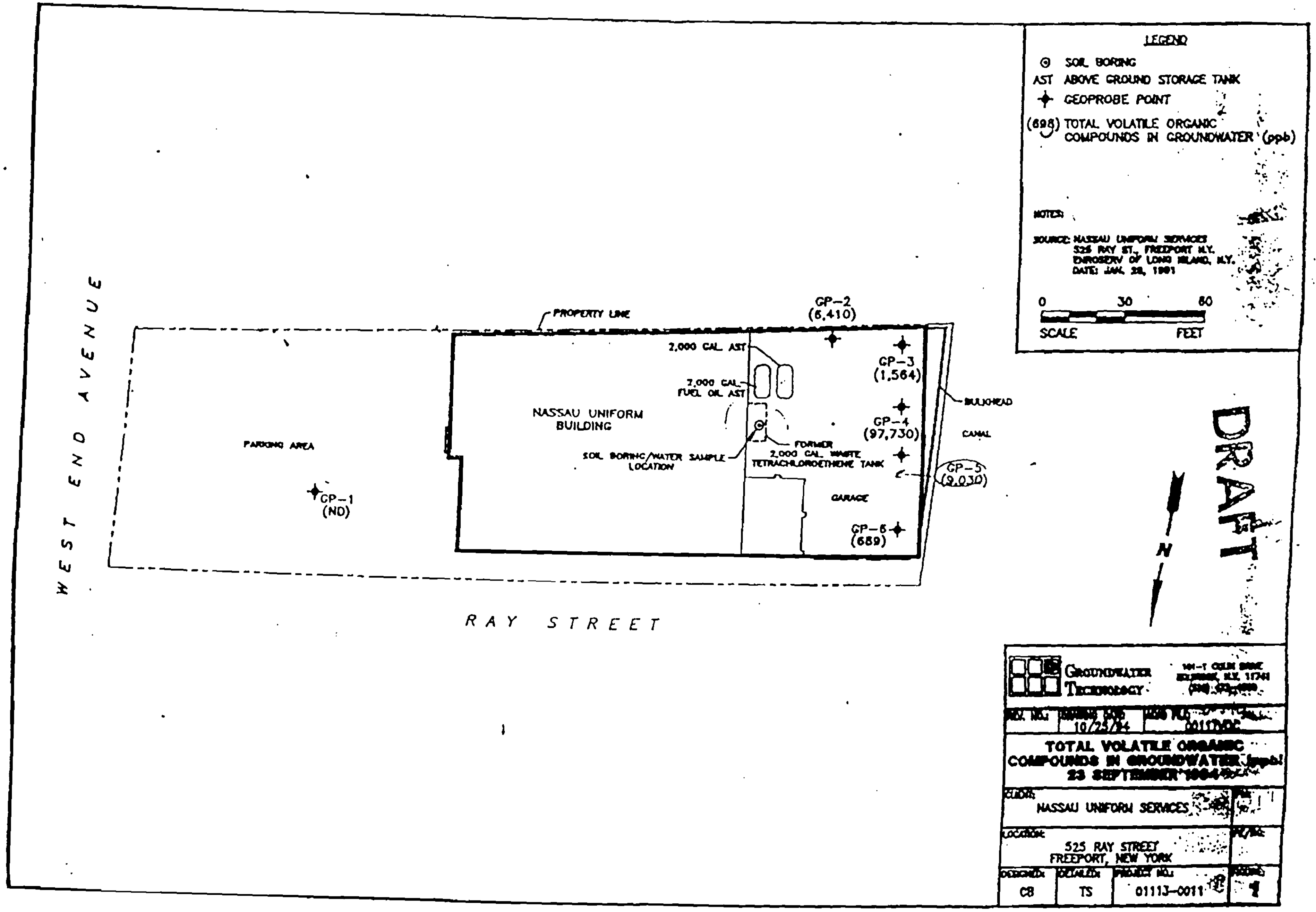
All results reported in ug/l (ppb)

Samples analyzed for Volatile Organic Compounds by EPA Method 601, Chlorides by 4500CL–B and Sodium by EPA Method 3500 NA–C.

ND – Not Detected

NA – Not Applicable

nassau uniform/gwana


DRAFT
N
LEGEND
SOIL BORING
AST ABOVE GROUND STORAGE TANK
GEOPROBE POINT
(698) TOTAL VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (ppb)
NOTES:
SOURCE: NASSAU UNIFORM SERVICES 525 RAY ST., FREEPORT N.Y. ENVIROSERV OF LONG ISLAND, N.Y. DATE: JAN. 28, 1991
0
30
60
SCALE
FEET
WEST END AVENUE
RAY STREET
PROPERTY LINE
PARKING AREA
GP-1 (ND)
NASSAU UNIFORM BUILDING
SOIL BORING/WATER SAMPLE LOCATION
2,000 GAL. AST
2,000 GAL. FUEL OIL AST
FORMER 2,000 GAL. WASTE TETRACHLOROETHENE TANK
GARAGE
GP-2 (6,410)
GP-3 (1,564)
GP-4 (97,730)
GP-5 (9,030)
GP-6 (689)
BULKHEAD
CANAL
GROUNDWATER TECHNOLOGY
HOLBROOK, N.Y. 11741
REV. NO.:
DRAWING DATE: 10/25/94
FILE NO.:
TOTAL VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (ppb)
23 SEPTEMBER 1994
CLIENT: NASSAU UNIFORM SERVICES
LOCATION: 525 RAY STREET FREEPORT, NEW YORK
DESIGNED: CB
DETAILED: TS
PROJECT NO.: 01113-0011
FIGURE: 1

Appendix 3

H2M Labs, Inc. Standard Operating Procedure

Sample Preparation and Analysis of Volatile Organics by GC/MS in Air

Date: April 24, 2002

H2M LABS, INC.

STANDARD OPERATING PROCEDURE

METHOD 18 AND METHOD 106

SAMPLE PREPARATION AND ANALYSIS OF VOLATILE ORGANICS BY GC/MS IN AIR

Prepared by: Ursula Middel Date: 4/24/02

Approved by: ______________________ Date: ______
Quality Assurance Manager

Approved by: ______________________ Date: ______
Laboratory Manager

SOP No.	
Revision No.:	
Revision Date	
Page	

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INTRODUCTION

The procedure described is based on Method 18 in Appendix A of 40 CFR, Part 60 for stationary sources and Method 106 in Appendix B of 40 CFR, Part 61 for emission testing.

The work can only be performed by analysts trained in the procedure who are qualified according to the standards set forth in ASP CLP analyses.
In addition to the requirements of this SOP, the guidelines in the H2M "Quality Assurance, Quality Control Manual" have to be observed:

- "Training"
- "Instrument Maintenance"
- "Health and Safety"
- "Waste Generation, Storage, Disposal"
- "Progression of Samples"
- "Validation and Reporting"

For data assessment and acceptance criteria for QC measures and corrective action for out of control data and handling of unacceptable data. refer to section 7 in this SOP and section "Analytical Methodology- Organic" in the QC manual.

Refer to "Waste Generation, Storage, Disposal" for pollution prevention, and to "Health and Safety" for lab policy in safety precautions.

Definitions of specific terminology utilized in this SOP and method references are summarized in the separate document "Definitions of SOP Terminology and References of Official Protocols", which applies to all SOPs.

1.0 SCOPE AND APPLICATION

This protocol covers analysis of medium to high levels of volatile compound collected as "whole air" in Tedlar bags or on sorbent tubes according to NIOSH methods

1.1 Applicable Methods

1.1.1 Method 18, which incorporates both sampling procedures, is intended for the measurement of gaseous organic compound emissions by gas chromatography. GC/MS analysis is recommended, if compounds cannot be identified with certainty. To avoid duplicate analysis and due to frequently encountered interferences, analysis by this SOP are performed by GC/MS.

1.1.2 Vinyl chloride by the stack gas method 106 is collected in Tedlar bags.

1.1.3 In method 18, the Tedlar bag analysis is performed for presurvey sampling. In general, the Tedlar bag method is suitable for prescreening, and if high levels of compounds are expected. The injection size can be varied to keep compound concentration in the linear range.

1.1.4 Instead of Tedlar bags gas sampling bottles (or "valves") are suitable if only small sample volumes need to be injected due to high concentrations.

1.1.5 For analysis, method 18 specifies "direct sampling" for in-situ analysis for the analysis, which requires portable instrumentation. As an alternative, method 18 provides for testing by NIOSH methods, covered by this protocol.

1.2 List of Analytes

1.2.1 Compounds that can be analyzed with the Tedlar bag procedure comprise compounds with boiling points below 200°C that are not or only slightly soluble in water and can be analyzed by the purge and trap procedure.

1.2.2 **Tables 1A/B** represent a list of targeted analytes (TCL), which can be included in this scan. The list can be expanded to other volatile analytes.

1.2.3 The NIOSH methods are generally specific for one analyte or a small group of analytes. If only a selected number of compounds are targeted, these methods are suitable. However, if a broad spectrum of analytes are to be tested, either the Tedlar bag method should be used, or for lower concentration ranges heat-desorption tubes need to be employed. (Refer to 1.3.3 below.)

1.2.4 The following NIOSH methods include the targeted compounds in Table 1B:

Analyte	NIOSH Method .	Category
1,2,4-Trichlorobenzene	5517	Polychlorobenzenes
Naphthalene	1501	Aromatic Hydrocarbons
Hexachloroethane	1003	Halogenated Hydrocarbons
Hexachlorobutadiene	2543	(Only Targeted Analyte)
Benzyl Chloride	1003	Halogenated Hydrocarbons

1.2.5 The protocol described below for the NISHO methods applies to method numbers 1501 and 1003. Separate protocols apply for the analysis by method 2543 and 5517 for hexachlorobutadiene and 1,2,4-trichlorobenzene. If analyses for all compound are to be performed, the Tedlar bag method should be used.

1.3 Reporting Limits

1.3.1 In **Table 1A** the practical quantification limits (PQL) are listed for an injection volume of 50 mL of air for the Tedlar bag method and **Table 1B** lists the amount quantified per volume collected for the NIOSH methods. Note that the concentrations are given as weight per volume. If ppm concentrations as v/v are required, conversion factors, using the molecular weight per 22.4 L, are used.

1.3.2 Even though the volume collected for the NIOSH method is much larger than the injection size for the "whole air" method with Tedlar bags, the sensitivity for the NIOSH method is also only in the parts per million range (v/v), because the tubes are extracted with solvent, and only a small aliquot of the extract is injected.

1.3.3 If parts per billion sensitivities are required, either the VOST method or method TO-17 for ambient air need to be used, where the tubes are heat desorbed and the entire amount of volatiles collected is analyzed. (If samples were collected in Tedlar bags, it is possible to transfer the content of the bag in the laboratory to TO-17 tubes for analysis to achieve high sensitivities.)

2.0 SUMMARY OF PROCEDURE

2.1 Tedlar Bag Preparation

2.1.1 For "whole air" collection, an air sample is brought to the laboratory in Tedlar bags.

2.1.2 A volume up to 50 mL of the bag is withdrawn with a syringe and injected into the purge vessel of a purge and trap (P&T) autosampler..

2.1.3 The compounds are concentrated on the trap of the P&T concentrator collected and consequently back flushed at elevated trap temperature onto the analytical column.

2.2 NIOSH Tube Collection and Preparation

2.2.1 For sorbent tube collection by NIOSH method, a predetermined volume of air is pulled through sorbent tubes, and the analytes are concentrated on the sorbent..

2.2.2 The tubes are leached with carbon disulfide, and an aliquot of the extract is injected onto the instrument for analysis.

2.3 GC/MS Analysis

2.3.1 The compounds are eluted from the column with a temperature program to achieve separation.

2.3.2 The eluting compounds are detected on a electron impact mass spectrometer and integrated on a data system capable of collecting spectral data.

2.3.3 The targeted compounds are evaluated and reported.

3.0 SAMPLE PRESERVATION, STORAGE AND HOLDING TIMES

3.1 The samples have to be held at 4°C± 2°C from time of collection until delivered to the laboratory.

3.2 At arrival at the lab, the samples are stored refrigerated at 4°C ± 2°C protected from light. The refrigerator has to be located in an area free of volatile contaminants in the atmosphere and cannot be used for storage of standards or extracts. Samples suspected to contain medium or high concentration levels are sealed in cans or bags containing carbon granules to prevent cross contamination.

3.3 Tedlar bag samples should be analyzed within a few days due to some permeability of the bags. Sorbent tubes can be stored for several weeks but should be analyzed within 1-2 weeks.

4.0 INTERFERENCES AND SAFTY

4.1 Interferences

4.1.1 Interferences can be compounds in the sample "interfering" with the analysis or secondary contaminations from the instrument or introduced during sample storage.

4.1.2 If other analytes are interfering, (coeluting), identification of the targeted analytes is generally still possible, by comparison with the standard spectra

4.1.3 To avoid secondary contaminations, the samples have to be stored in an area free of volatile contaminants, which might permeate through the septa, namely freons and methylene chloride, which might be present in the lab atmosphere. Vials containing Nanopure water are stored together with the samples to serve as holding blanks.

4.1.4 After analyzing highly concentrated samples, instrument blanks need to be interspersed to demonstrate that no contamination is carried over into the next run. If samples were run with the autosampler, any positives, above the quantification level that are also present, in the sample are reanalyzed. The position of the autosampler needs to be determined (note in runbook), in which a high sample was run and the sample subsequently analyzed in that position also needs to be examined for potential false positives.

4.1.5 Even though the purge efficiency is poor for contaminants with higher molecular weights than the targeted analytes, enough may be purged out to cause interferences in the next run. To elute higher boiling compounds from the column, hold the GC at least for 3 min. at the highest temperature of the program after the retention time of the last analyte. For oily samples, extended baking times may be required to clean the instrument between runs.

4.1.6 Method blanks are required before samples are analyzed in each 12 h period to demonstrate that the instrument is free from interferences.

4.2 Safety

4.2.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest level possible.

4.2.2 The reference file of material safety data sheets (MSDS) should be consulted for properties of the chemicals used, to determine handling precautions.

5.0 SAMPLE PREPARATION

5.1 Equipment and Supplies

- ORBO tubes, specified for the particular NIOSH method in the vendors catalog from SKC, Supelco or equivalent
- Tedlar bags, 1 L, 500 mL or
- Gas sampling valves, 250 or 500 mL, optional
- Syringe - 10 mL, gastight with Luerlok tip
- Syringe - 50 mL, gastight with Luerlok tip
- Microsyringes
- Syringe valve - with male and female Luerlok connections
- Balance - capable of weighing 100 g ± 0.001 g

- Volumetric flasks - 10 mL, 50 mL
- Vial - 15 mL with Teflon lined cap
- Spatula - narrow, stainless steel.
- Vial - 2 mL or larger
- Weighing pan - aluminum
- Oven - capable of maintaining 105°C
- Autosampler - 16 positions with purge vessels for five mL sample volumes programmable in conjunction with concentrator, ALS 2016 from Tekmar or equivalent.
- Sample Concentrator - programmable with trap heater, gas controls, and multipoint valve for directing purge and desorb flows, with moisture control module. LSC - 2000 from Tekmar or equivalent.

5.2 Reagents and Standards

- Reagent water - water free from contaminants from Nanopure or equivalent systems
- Methanol - pesticide grade
- System monitoring compounds solution in methanol

Analyte	ug/mL
Toluene-d8	25
4-Bromofluorobenzene	25
1,2-Dichloroethane-d4	25

- QC spiking solution

  All targeted analytes in methanol at a concentration of 25μg/mL

- Internal standard solution in methanol

Analyte	ug/mL
Bromochloromethane	25
Chlorobenzene-d5	25
1,4-Difluorobenzene	25

5.2.1 Purchase intermediate solutions for each mix at higher concentrations. Prepare the working standards at the required levels by diluting with methanol. Retain the certification of the purchased solution.

5.2.2 As long as ampules are not opened, they can be kept in the freezer up to two years or until the expiration date.

5.2.3 After opening, unused portions of the intermediate solutions should be transferred to small vials with minimal headspace, closed with Teflon lined caps and sealed with Teflon tape. These are stored at -10°C to 20°C and checked for integrity before being used again for standard preparation.

5.2.4 The working standards are opened frequently and therefore should be replaced after one week. To prolong stability, distribute the solution into several smaller vials with minimal headspace and seal and store as in 5.2.3.

5.2.5 All solutions have to be properly labeled and entered into the standard log book.

5.2.6 Before it can be used, each new solution has to be tested for composition.

5.2.7 Equilibrate the spiking solution at room temperature for one hour before using.

5.3 Preparation of Tedlar Bag Samples

5.3.1 Fill clean 10 mL syringes with Nanopure water, without including bubbles. Adjust the volume to 5 mL.

5.3.2 Spike all syringes with 10 uL of surrogate solution and additionally spike one syringe for a lab fortified blank with 10 uL of the QC spiking solution. Also add 10 uL of internal standard spiking solution into all syringes.

5.3.2 For calibrations, spike appropriate volume of calibration solution as indicated in 6.4.2 and 6.4.4.

5.3.3 Load the purge vessel of the autosampler with the 5-mL solutions through the Hamilton valves in runorder, loading clean water with internal and surrogate for each sample.

5.3.4 Start autosampler sequence.

5.3.5 Just before the first "sample" starts the purge process, withdraw 50 mL of air from the first sample Tedlar bag.

5.3.6 As soon as the nitrogen flow commences, gradually introduce the 50 mL through the Hamilton valve, carful not to apply too much pressure, which will cause leakage. Any compounds contained in the air will be collected on the trap together with purged internal and surrogate standards.

5.4 Preparation of NIOSH Tubes

5.4.1 Crack ORBO tubes and empty contents into 12 mL vials.

5.4.2 Add 9 mL of toluene. (If the extract requires further concentration, replace toluene with hexane, because of quicker evaporation rates.)

5.4.3 Soak for 30 minutes and occasionally agitate.

5.4.4 Leach blank cartridge in the same manner as samples for method blank.

5.4.5 Directly inject 2 µL of the extracts into the GC/MS.

6.0 INSTRUMENT ANALYSIS

6.1 Equipment and Supplies

-
- Trap - to be used in LSC-2000 or PTA-30 W/S, Type K Vocarb 3000 or equivalent.
- Gas Chromatograph - with programmable temperature control, carrier gas control.
- Widebore capillary column - fused silica 105 m x 0.53 mm, 3.0 micron film thickness, RTX-502.2 from Restek or equivalent
- Quadropole mass spectrometer - benchtop, with electron impact ionization and electron multiplier, scanning from 35 to 300 amu
- Data system
- Computer
- Graphics display terminal
- Printer
- Chemstation/Enviroquant software from HP, Target from Thruput, Omega from Khemia or equivalent
- Mass Spectral library - NIST/EPA/MSDC

6.2 Reagents and Standards

- Performance check solution - 4-bromofluorobenzene at 25 ug/mL
- Calibration spiking solution (intermediate)- mix containing all targeted analytes in **Table 1** and the system monitoring compounds at a recommended concentration of 100 ug/mL in methanol.
- Internal standard solution - in methanol as in 5.2.
- Matrix spike solution – in methanol as in 5.2
- System monitoring compounds - in methanol as in 5.2.
- Initial and continuing calibration standards (working) - water solutions prepared with the above methanol solutions to contain 50 ng/mL of internal standard and the system monitoring

compounds, and targeted analytes at the following concentrations: 10, 20, 50, 100, and 200 ug/L.

6.2.1 Intermediate Solution - For preparation and storage of the methanol solutions refer to 5.2.1 to 5.2.5.

6.2.2 Working Solution - The aqueous calibration solutions can be prepared in volumetric flasks or directly in the loading syringe for a volume of 5 mL. Water solutions can only be kept for one hour, unless refrigerated at 4°C ± 2°C and protected from light.

6.3 Setup and Parameters

6.3.1 Typical operating parameters of the analytical system are presented in **Table 2**.

6.3.2 Carrier flow velocities and temperature programs depend on the individual column used and have to be optimized for the specific column. Equally, the parameters for the mass spectrometer have to be adjusted depending on the particular conditions.

6.3.3 Parameters have to be optimized to achieve sharp peaks for the gases that have to be separated from the solvent peak and are resolved from each other at 90% or greater.

6.4 Calibration

6.4.1 Tuning and Performance Check

6.4.1.1 After major changes of paramcters or instrument maintenance that effects the source of the MS, the source has to be tuned. Adjust all voltages, obtain ion ratios for the tuning compound FC43, as established for the specific instrument, to achieve the required BFB ion ratios.

6.4.1.2 Before running calibrations or analyses, check the correct mass calibration with the analysis of 50 ng of the performance check compound BFB.

6.4.1.3 Compare ion ratios found against the DEC acceptance criteria, which are listed in Table 6. If the abundances do not meet the criteria, retune or adjust voltages based on experience before repeating the BFB check.

6.4.1.4 Documentation of acceptable mass calibration must be provided by the mass listing and bar graph plot for the BFB spectrum.

6.4.2 Initial Calibration

In the calibration, the relative response is determined for the major ion of each analyte relative to the major ion of an internal standard. The primary and secondary ions of the analytes are listed in **Table 3.**

6.4.2.1 Perform a multipoint calibration to establish linearity for all targeted analytes and system monitoring compounds at the following levels: 50, 100, 250, 500 and 1000 ng.For an injection volume of 50 mL of air this translates into air concentrations of 1, 2, 5,10, and 20 µg/L.

6.4.2.2 These amounts are entered with the 5 mL of calibration solutions in water as prepared in 5.3.2. The water concentrations are listed in 5.2.

6.4.2.2 Since relative responses by internal standard method are to be determined, each calibration mix must also contain the internal standards at 50 ug/L.

6.4.2.3 Equally, all sample extracts are to be spiked with 10 uL of the internal standard mix to achieve the same concentration of 50 ug/L.

6.4.2.4 Calculate relative response factors for all analytes utilizing the appropriate internal standard as found in the grouping in Table 5.

6.4.2.5 Compute the responses with the following formula:

Relative Response Factor (RRF)

RRF =

Where:

A_x = Area of characteristic ion for compound measured
C_{is} = Concentration of internal standard (ug/mL)
A_{is} = Area of the characteristic ion for the specific internal standard

C_x = Concentration of compound to be measured (ug/uL) 6.4.2.6 Determine the average response factor by summing factors and from all five concentration levels dividing the sum by the number of results. Since m- and p- xylene coelute, utilize the response factor of o-xylene for all xylenes.

6.4.2.7 Evaluate the multipoint calibration for relative standard deviation with the following computation:

Relative Standard Deviation (RSD)

% RSD

Where:

RF_i = Response factor from the ith calibration run

RF_{avg} = Average response factor for the analyte

n = Number of calibration points for the analyte

6.4.2.8 Compare the factors and RSDs with the acceptance criteria for minimum average response factors and maximum acceptable standard deviations summarized in Table 7.

Allowance is made for two analytes which however must meet the minimum requirement for the RRF of 0.01 with an RSD of less than or equal to 40%.

6.4.2.9 If a particular injection appears to be an outlier, reinject that level. If the criteria still cannot be met, determine the cause and take remedial action in regard to instrument maintenance or replacement of standard solutions.

6.4.2.10 Perform a new multipoint calibration.

6.4.3 Verification of Mass Calibration

6.4.3.1 To check that the tune parameters provide ion ratios that are comparable, make an injection of the performance check substance BFB at the beginning of every 12 hour period of analyses.

6.4.3.2 Check that the obtained ratios meet the acceptance criteria of Table 6. If the ion ratios are outside the limits, adjust the tune parameters until satisfactory ratios are obtained.

6.4.4 Continuous Calibration

6.4.4.1 Once correct tuning is verified, instrument calibration for relative response factors is checked with an injection of a calibration standard containing 50 ug/L of each analyte, system monitoring compound and internal standard.

6.4.4.2 Calculate the RRF (compare 6.4.2.5) and compute the relative percent difference with the following equation:

<u>Percent Difference (% D)</u>

% D =

Where:

RRF_{avg} = Average RRF of initial calibration

RRF_c = RRF of continuous calibration

6.4.4.3 Compare the RRFs and %Ds with the requirements tabulated in Table 7. Allowance is made for two analytes, which must meet the minimum requirements (greater than 0.01 and less than 40%), however.

6.4.4.4 If the results are acceptable, proceed with the analyses. Otherwise repeat the analysis, either with a different continuous calibration standard if a problem with the solution is suspected, or after minor remedial action is performed.

6.4.4.5 If the instrument performance and the initial calibration cannot meet criteria, a new multipoint calibration needs to be analyzed.

6.4.5 Internal Standard Area Checks

6.4.5.1 To assure stability of instrument performance and injections, the internal standard (IS) areas of all injections are monitored.

6.4.5.2 Tabulate all IS areas for a 12 hour period starting with the continuous calibration.

6.4.5.3 Compare areas and retention times with those of the continuous calibration (or medium level standard in a multipoint calibration). Areas must be between -50 and +100 percent and retention times within 0.5 minutes.

6.4.5.4 Samples with noncompliant areas must be reanalyzed to demonstrate matrix interference.

6.5 Sample Analysis

6.5.1 The method blank, QC extracts and samples are sequentially processed with the autosampler with the same instrument parameters (see 6.3) as the calibration standard(s).

6.5.2 Data of all injections are collected on the data system with the the Chemstation and processed with the Enviroquant software or Target.

6.6 Evaluation of Analyses

6.6.1 Identification of Targeted Analytes

6.6.1.1 Compound identification is performed by “reverse library search” based on the computer algorithms for matching of the sample spectra with the library spectra developed in-house from standard injections.

6.6.1.2 All ions in the standard mass spectrum of a relative intensity greater than 10 percent of the most abundant ion must be present, and the relative intensities of the ions must agree within ± 20 percent. The ions greater than 10 percent in the sample but not in the standard spectrum must be accounted for.

6.6.1.3 Another means of identifying compounds is by comparison of the relative retention time of the sample peak with that in the standard analysis. The relative retention times (RRT) should not deviate by more than ± 0.06 RRT units. This serves as a confirmation of the spectra identification and provides a means to distinguish compounds with the same spectra but with different elution times

6.6.2 Quantification of Targeted Analytes

6.6.2.1 If the computer search establishes a positive, the concentration of the analyte is computed by the software program with the RRFs of the calibration established by internal standard method and reported in the "quant report".

6.6.2.2 The RRF used is either from the mid level of the multipoint calibration for those samples analyzed subsequently, or the daily RRF of the continuous calibration for samples analyzed on other days.

6.6.2.3 The data system is capable of computing the reportable sample concentration, if the appropriate parameters are entered according to the following computation:

<u>Sample Concentration - Conc. (water), Conc. (soil)</u>

Conc. water =

Conc. soil =

Where:

Conc. (water) = Concentration of analyte in water (ug/L)

Conc. (soil) = Concentration of analyte in soil (ug/kg)

A_x = Area of characteristic ion of analyte
A_{is} = Area of characteristic ion of internal standard

IS = Amount of internal standard (ng)

RRF = Relative response factor of analyte

V_o = Volume of sample purged (mL)

DF = Dilution factor

W_s = Weight of sample purged (g)

D = factor for solids content =

6.6.2.4 The total xylene is reported for the summed area of the two peaks utilizing the response factor o-xylene. The values for the cis- and trans- isomers of 1,2-dichloroethene are also summed and reported as total.

7.0 QUALITY CONTROL

7.1 System Monitoring Compound

7.1.1 To monitor method efficiency, add a mix of surrogate standards ("system monitoring compounds") to all samples, blanks and QC samples as described in 5.3.

7.1.2 Calculate the recovery for all surrogates as:

Percent Recovery (% Rec)

% Rec = x 100%

Where: X = Concentration found (ug/L or ug/kg)
T = "Targeted" concentration spiked (ug/L or ug/kg)

7.1.3 Compare the recoveries with the QC limits in Table 8. Investigate noncompliant recoveries and take corrective action as e.g.:

- Recalculate data
- Reanalyze sample
- Verify volume or concentration of spike
- Perform instrument maintenance

7.1.4 Reanalyze samples after corrective action.

7.1.5 If the reanalysis meet the acceptance criteria, only report the second analysis, otherwise present both sets of data.

7.2 Accuracy

7.2.1 One lab fortified blank (LFB) is spiked with the targeted analytes and prepared and analyzed with the sample batch to monitor accuracy. (Compare 5.2, 5.3.2)

7.2.2 Calculate the accuracy (% recovery) and reproducibility (relative percent difference) according to the following equations:

Recovery (% Rec)

% Rec = x 100%

Where:

% Rec = Recovery of spike in percent

X = Measured result (ug/L or ug/kg)

B = "Background" concentration of unspiked sample (ug/L or ug/kg). This value is 0 for surrogate recovery calculations.

T = Targeted value of concentration spiked (ug/L or ug/kg)

Relative Percent Difference (RPD)

RPD =
Where:
RPD = Relative percent difference (%)
MSR = Matrix spike recovery (%)
MSDR = Matrix spike duplicate recovery (%)

7.3 Blanks

7.3.1 Method Blank

7.3.1.1 A method blank is five mL of Nanopure water or equivalent or five g of a purified solid matrix spiked with the system monitoring compounds and internal standards that is analyzed prior to samples to ensure the analytical system is free of interferences. The blank must be analyzed immediately following the standard to ensure that there is no carryover. A method blank is analyzed for each 12 hours of analysis at the same conditions as the standard and samples.

7.3.1.2 The interferences seen in the method blank must be less than the PQL except for methylene chloride, acetone, and 2-butanone. These compounds must be less than five times the PQL.

7.3.1.3 If the method blank exceeds the above criteria, the source of the contamination must be found and the problem eliminated prior to continuing with analysis. All samples analyzed with a blank, that do not meet the above criteria, must be reanalyzed.

7.3.2 Instrument Blank

7.3.3.2 7.3.2.1 After analyzing highly concentrated samples, instrument blanks need to be interspersed to demonstrate that no contamination is carried over into the next run. If samples were run with the autosampler, any positive results, above the PQL that are also present, in the sample are reanalyzed. The <u>position</u> of the autosampler needs to be determined (note in runbook), in which a high sample was run and the sample subsequently analyzed in that position also needs to be examined for potential false positives.

7.4 Method Detection Limit (MDL)

7.4.1 The MDLs define the lowest levels, where positives will be found with 99 percent confidence with the particular analytical method in clean media. An example of a detection limit study for this procedure is presented in **Table 9**. Updated MDLs can be found in the Laboratory Information Management System (LIMS).

7.4.2 Determine the method detection limit by analyzing seven replicate lab fortified blanks containing each targeted analyte at or under the practical quantification limit.

7.4.3 Calculate the standard deviation according to the equation:

Standard Deviation (S)

S =

Where:

X_i= Individual result

n = Number of replicates

= Average results

7.4.4 From the obtained S calculate the MDL as follows:

Method Detection Limit (MDL)

MDL = $t_{n-1} \times S$

Where:

S = Standard deviation

t_{n-1} = Students t-test value (for seven replicates $t_{n-1} = 3.14$)

7.4.5 The MDL studies are submitted in the data package

7.4.6 Update the MDLs in the testcode of the LIMS annually. This is done by entering the MDLs into an excel spread sheet and transferring the data into the method "testcode".

8.0 REPORTING

8.1 Evaluation of Analytical Data

8.1.1 Check that acceptance criteria are met for QC data, BFB, calibrations and internal standards.

8.1.2 Make sure that the correct RRFs are used for positive targeted compounds.

8.1.3 Examine whether the internal standard coelutes with interferences causing incorrect TIC computations. To assess whether the internal standard areas are reasonable, compare them with the standard and blank. Areas should not deviate more than about -50% or +100%. Manually correct data as necessary, using the nearest internal standard free of interferences.

8.1.4 Visually compare the spectra of positives with the standard spectra to verify the identifications.

8.1.5 Confirm correct peak integration and edit as necessary. Manual integrations have to be signed. Provide an extracted ion profile for the major mass of the reintegrated peak.

8.1.6 Perform final quantifications with appropriate dilution factors.

8.1.7 The finalized data are entered into the LIMS software and reported as described in the Quality Assurance Manual.

8.2 Generating of the Data Package

8.2.1 After evaluating the analyses, compile all analytical data in "data packages" in the reporting format and with all deliverables of 95-1 of the NYSDEC ASP.

8.2.2 Arrange data in five report sections:

QC Summary

Sample Data

Standard Data

Raw QC Data

Documentation

8.2.3 The package includes report forms I - VIII from the ASP for summarizing sample results, calibrations and QC data. With the exception of certain sample information data in the headers, all results calculated by the data system are automatically entered by the software into the form templates.

8.2.4 Print all completed ASP forms and add printouts of all chromatograms, quant reports, library searches and spectra and arrange them in the sequence specified in the protocol.

8.2.5 Sign the H$_2$M report release form and include at the end of the package.

8.3 Review

8.3.1 The package is submitted for review by the supervisor, QA Manager or equivalent.

8.3.2 If needed, the package is returned to the analyst for clarifications or corrections

8.3.3 Uncorrectable deviations or non-compliances are noted in the SDG narrative upon review.

TABLE 1A

PRACTICAL QUANTIFICATION LIMITS (PQL) FOR TARGETED VOLATILE ORGANICS BY TEDLAR METHOD

Analyte	CAS No.	PQL (ug/L)
Chloromethane	74-87-2	1
Vinyl chloride	75-01-4	1
Bromomethane	74-83-9	1
Chloroethane	75-00-3	1
2-Butanone	78-93-3	1
Carbon disulfide	75-15-0	1
1,1-Dichloroethene	75-35-3	1
Methylene chloride	75-09-2	1
1,2-Dichloroethene (total)	540-59-0	1
1,1-Dichloroethane	75-34-4	1
Chloroform	67-66-3	1
1,2-Dichloroethane	107-06-2	1
2-Butanone	78-93-3	1
1,1,1-Trichloroethane	71-55-6	1
Carbon tetrachloride	56-23-5	1
Benzene	71-43-2	1
Trichloroethene	79-01-6	1
1,2-Dichloropropane	78-87-5	1
Bromodichloromethane	75-27-4	1
cis-1,3-Dichloropropene	10061-01-5	1
Toluene	108-88-3	1
trans-1,3-Dichloropropene	10061-02-6	1
1,1,2-Trichloroethane	79-00-5	1
4-Methyl-2-pentanone	108-10-1	1
Chlorobenzene	108-90-7	1
Tetrachloroethene	127-18-4	1
Dibromochloromethane	124-48-1	1
2-Hexanone	591-78-6	1
Ethylbenzene	100-41-4	1
Xylenes(total)	1330-20-7	1
Styrene	100-42-5	1
Bromoform	75-25-2	1
1,1,2,2-Tetrachloroethane	79-34-5	1
1,2,4-Trichlorobenzene	120-82-1	1
Naphthalene	91-20-3	1
Hexachloroethane	67-72-1	1
Hexachlorobutadiene	87-68-3	1
Benzyl Chloride	100-44-7	1

TABLE 1B

PRACTICAL QUANTIFICATION LIMITS (PQL) FOR TARGETED VOLATILE ORGANICS BY NIOSH METHODS

Analyte	CAS No.	PQL 1) µg/Volume sampled
1,2,4-Trichlorobenzene	120-82-1	250
Naphthalene	91-20-3	250
Hexachloroethane	67-72-1	250
Hexachlorobutadiene	87-68-3	250
Benzyl Chloride	100-44-7	250

1) These values are based on an extract volume of 10 mL and an injection size of 2µL.

TABLE 2

EXAMPLE OF
INSTRUMENT OPERATING PARAMETERS FOR VOLATILE ORGANICS

Purge Process

Sample Size	5 mL
Purge Time	11 min
Purge Flow	40 mL/min
Purge Temp.	Ambient for water and medium level soil, 40°C for low level soil
Desorption Flow	15 mL/min
Desorption Time	2.0 ± 0.1 min
Desorption Temp.	180°C

GC Conditions

Column	105 m long x 0.53 mm ID, 3.0 um film thickness, fused silica widebore capillary column, RTX-502.2 Restek or equivalent
Carrier	Helium
Flow Rate	15 mL/min
Temperature Program:	Initial temp: 45°C Initial hold: 0 min Ramp 1: 70°C/min to 30°C Hold 1: 5.5 min Ramp 2: 70°C/min to 120°C Hold 2: 7.5 min Ramp 3: 40°C/min to 220°C Final Hold: 8 min

TABLE 2 (Continued)
INSTRUMENT OPERATING PARAMETERS FOR VOLATILE ORGANICS
MS Conditions (Hewlett Packard 5890)

Separator Temp:	220°C
Manifold Temp:	250°C
Mass Range:	35 to 300
Scan Time:	0.38 sec
Number of scans:	3220
Threshold:	50
Minimum peak area:	500

TABLE 3

CHARACTERISTIC IONS FOR VOLATILE TARGETED COMPOUNDS

Parameter	Primary Ion*	Secondary Ions
chloromethane	50	52
vinyl chloride	62	64
bromomethane	94	96
chloroethane	64	66
acetone	43	58
2-butanone	43***	72
carbon disulfide	76	78
1,1-dichloroethene	96	61, 63
methylene chloride	84	49, 86
1,2-dichloroethene	96	61, 98
1,1-dichloroethane	63	65, 83
chloroform	83	85, 47
1,2-dichloroethane	62	98, 64
1,1,1-trichloroethane	97	61, 99
1,2-dichloroethane-d_4	65	102
carbon tetrachloride	117	119
benzene	78	77
trichloroethene	95	130, 132
bromodichloromethane	83	85, 127
cis-1,3-dichloropropene	75	77, 110
toluene	91	92***
trans-1,3-dichloropropene	75	77, 110
1,1,2-trichloroethane	83	85, 97
4-methyl-2-pentanone	43	57, 58
toluene-d_8	98	100
4-bromofluorobenzene	95	176
chlorobenzene	112	77, 114
1,3-dichloropropane	76	41, 78
tetrachloroethene	164	129, 166
dibromochloromethane	129	127, 131

TABLE 3 (Continued)

CHARACTERISTIC IONS FOR VOLATILE TARGETED COMPOUNDS

Parameter	Primary Ion*	Secondary Ions
2-hexanone	43	58, 57
ethylbenzene	106	91, 105
xylenes (ortho)	106	91, 105
styrene	104	78, 103
bromoform	173	175, 254
1,1,2,2-tetrachloroethane	83	85, 131, 133, 166
m\p-xylenes	106	91, 105
1,2,4-trichlorobenzene	180	182, 145
naphthalene	128	
hexachloroethane	117	223, 227
hexachlorobutadiene	225	223,227
benzyl Chloride	91	126

* The primary ion should be used unless interferences are present, in which case, a second ion may be used.

** m/z 43 is used for quantification of 2-Butanone, but m/z 72 must be present for positive identification.

*** Quantitation ion differs from primary ion.

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TABLE 4

CHARACTERISTIC IONS FOR SYSTEM MONITORINGCOMPOUNDS AND INTERNAL STANDARDS FOR VOLATILE ORGANIC COMPOUNDS

Compound	Primary Ion	Secondary Ion(s)	CAS No.:
	System Monitoring Compounds		
4-Bromofluorobenzene	95	174, 176	460-00-4
1,2-Dichloroethane-d_8	65	102	17060-07-0
Toluene-d_8	98	70, 100	2037-26-5
	Internal Standards		
1,4-Difluorobenzene	114	63, 88	540-36-3
Chlorobenzene-d_5	117	82***, 119	3114-55-4
Bromochloromethane	128	49,130,51	74-97-5

*** Quantitation ion differs from primary ion.

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TABLE 5

VOLATILE INTERNAL STANDARDS ASSIGNED FOR QUANTITATION OF TARGETED COMPOUNDS AND SYSTEM MONITORING COMPOUNDS

Bromochloromethane (IS)	1,4-difluorobenzene (IS)	Chlorobenzene-d5 (IS)
chloromethane	1,1,1 trichloroethane	2 hexanone
bromomethane	carbon tetrachloride	4 methyl 2 pentanone
vinyl chloride	bromodichloromethane	tetrachloroethene
chloroethane	1,2 dichloropropane	1,1,2,2

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TABLE 5

VOLATILE INTERNAL STANDARDS ASSIGNED FOR QUANTITATION OF TARGETED COMPOUNDS AND SYSTEM MONITORING COMPOUNDS

Bromochloromethane (IS)	1,4-difluorobenzene (IS)	Chlorobenzene-d5 (IS)
chloromethane	1,1,1 trichloroethane	2 hexanone
bromomethane	carbon tetrachloride	4 methyl 2 pentanone
vinyl chloride	bromodichloromethane	tetrachloroethene
chloroethane	1,2 dichloropropane	1,1,2,2 tetrachloroethane
methylene chloride	trans 1,3 dichloropropene	toluene
acetone	trichloroethene	chlorobenzene
carbon disulfide	dibromochloromethane	ethylbenzene
1,1 dichloroethene	1,1,2 trichloroethane	xylenes(total)
1,1 dichloroethane	benzene	styrene
1,2 dichloroethane	cis 1,3 dichloropropene	bromofluorobenzene
2 butanone	bromoform	toluened8
1,2 dichloroethane-d-4		1,2-dibromoethane
chloroform		1,4-dichlorobenzene
1,2 dichloroethene total		1,2,4-trichlorobenzene
benzyl chloride		naphthalene
		hexachloroethane
		hexachlorobutadiene

TABLE 6

BFB KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
50	15 - 40 percent of mass 95
75	30 - 60 percent of mass 95
95	Base peak, 100 percent relative abundance
96	5.0 - 9.0 percent of mass 95
173	Less than 2.0 percent of mass 174
174	50 - 120 percent of mass 95
175	5.0 - 9.0 percent of 174
176	95 - 101 percent of 174
177	5.0 - 9.0 percent of 176

NOTE: All ion abundances must be normalized to m/z 95, the nominal base peak, even though the ion abundance of m/z 174 may be up to 120 percent that of m/z 95.

TABLE 7

RELATIVE RESPONSE FACTOR CRITERIA FOR INITIAL AND CONTINUING CALIBRATION OF VOLATILE ORGANIC COMPOUNDS

Volatile Compound	Minimum RRF	Maximum % RSD	Maximum % Diff
chloromethane	0.010	100	±100
vinyl chloride	0.100	20.5	±25.0
bromomethane	0.100	20.5	±25.0
chloroethane	0.010	100	±100
acetone	0.010	100	±100
2-butanone	0.010	100	±100
carbon disulfide	0.010	100	±100
1,1-dichloroethene	0.100	20.5	±25.0
methylene chloride	0.010	100	±100
total-1,2-dichloroethene	0.010	100	±100
1,1-dichloroethane	0.200	20.5	±25.0
Chloroform	0.200	20.5	±25.0
1,2-dichloroethane	0.100	20.5	±25.0
1,1,1-trichloroethane	0.100	20.5	±25.0
1,2-dichloroethane-d_4	0.010	100	±100
1,1-dichloropropene	0.010	100	±100
carbon tetrachloride	0.100	20.5	±25.0
benzene	0.500	20.5	±25.0
trichloroethene	0.300	20.5	±25.0
1,2-dichloropropane	0.010	100	±100
bromodichloromethane	0.200	20.5	±25.0
cis-1,3-dichloropropene	0.200	20.5	±25.0
toluene	0.400	20.5	±25.0

TABLE 7 (Continued)

RELATIVE RESPONSE FACTOR CRITERIA FOR INITIAL AND CONTINUING CALIBRATION
OF VOLATILE ORGANIC COMPOUNDS

Volatile Compound	Minimum RRF	Maximum % RSD	Maximum % Diff
trans-1,3-dichloropropene	0.100	20.5	±25.0
1,1,2-trichloroethane	0.100	20.5	±25.0
4-methyl-2-pentanone	0.010	100	±100
toluene-d_8	0.010	100	±100
bromofluorobenzene	0.200	20.5	±25.0
chlorobenzene	0.500	20.5	±25.0
1,3-dichloropropane	0.010	100	±100
tetrachloroethene	0.200	20.5	±25.0
dibromochloromethane	0.100	20.5	±25.0
2-hexanone	0.010	100	±100
ethylbenzene	0.100	20.5	±25.0
xylenes(total)	0.300	20.5	±25.0
styrene	0.300	20.5	±25.0
bromoform	0.100	20.5	±25.0
trans-1,4-dichloro-2-butene	0.010	100	±100
1,1,2,2-tetrachloroethane	0.300	20.5	±25.0
1,2,4-trichlorobenzene	0.010	100	±100
naphthalene	0.010	100	±100
hexachloroethane	0.010	100	±100
hexachlorobutadiene	0.010	100	±100
benzyl Chloride	0.010	100	±100

TABLE 7 (Continued)

RELATIVE RESPONSE FACTOR CRITERIA FOR INITIAL AND CONTINUING CALIBRATION

OF VOLATILE ORGANIC COMPOUNDS

SYSTEM MONITORING COMPOUNDS

Bromofluorobenzene	0.200	20.5	±25.0
Toluene-d_8	0.010	100.	±100.
1,2-Dichloroethane-d_4	0.010	100.	±100.

TABLE 8

SYSTEM MONITORING COMPOUND RECOVERY LIMITS

Compound	% Recovery
Toluene-d_8	60-140
Bromofluorobenzene	60-140
1,2-Dichloroethane-d_4	60-140

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TABLE 9

METHOD DETECTION LIMITS

(NOT DETERMINED)