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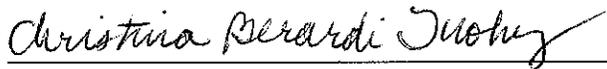
Appendix C

**Sampling and Analysis Plan
Operable Unit 3
Soil Gas Interim Remedial Measure**

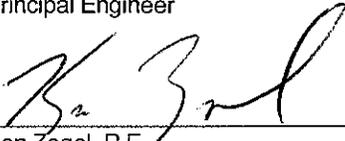
Former Grumman Settling Ponds,
Bethpage, New York
Site # 1-30-003A

February 8, 2008

ARCADIS



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**Appendix C
Sampling and Analysis Plan
Operable Unit 3
Soil Gas Interim Remedial
Measure**

Former Grumman Settling Ponds
Bethpage, New York
Site # 1-30-003A

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- Attachment C-1.2 December 31, 2007 Addendum, Quality Assurance Project Plan, Former Grumman Settling Ponds (Operable Unit 3-Bethpage Community Park), Bethpage, New York.
- Attachment C-2 System Startup Plan, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.
- Attachment C-3 System Long-Term Monitoring and Parameter Forms, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.
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**Appendix C
Sampling and Analysis
Plan**

Former Grumman Settling
Ponds,
Bethpage, New York
Site # 1-30-003A

Attachment C-4 Conditional Approval Letter for Discharge to Publicly Owned
Treatment Works, Grumman Operable Unit 3 Soil Gas Interim
Remedial Measure, Former Grumman Settling Ponds,
Bethpage, New York.

1. Introduction

This Operable Unit 3 (OU3) Soil Gas Interim Remedial Measure (soil gas IRM) Sampling and Analysis Plan (SAP) was prepared by ARCADIS of New York, Inc. (ARCADIS) on behalf of Northrop Grumman Systems Corporation (Northrop Grumman), and is being submitted pursuant to the Order On Consent (Consent Order or CO) Index # W1-0018-04-01 that was executed by the New York State Department of Environmental Conservation (NYSDEC) and Northrop Grumman, effective July 4, 2005 (NYSDEC 2005). The Park, which was termed the "Former Grumman Settling Ponds" and designated as Operable Unit 3 (OU3) by the NYSDEC, and the Former Grumman Plant 24 Access Road are collectively referred to in this Report as the Site.

This SAP, which is Appendix C of the 95% Design Report (ARCADIS 2007a) and will be a component of the Operation, Maintenance and Monitoring (OM&M) Manual to be prepared in accordance with NYSDEC DER-10 guidance (NYSDEC 2002), presents the methodologies to be employed during sampling and analysis activities associated with various soil gas IRM monitoring requirements presented in the OM&M Manual. Specifically, the SAP identifies the procedures to be used to implement operational monitoring and system performance and compliance monitoring, (including startup sampling activities) for the soil gas IRM. The procedures and protocols described herein shall be conducted in accordance with the requirements set forth in the Quality Assurance Project Plan (ARCADIS 2006)(QAPP) along with the December 31, 2007 Addendum, provided as Attachments C-1.1 and C-1.2 to this SAP, and the site-specific Health and Safety Plan (ARCADIS 2005), incorporated herein by reference.

This report is organized into the following sections:

- Section 1 provides an introduction.
- Section 2 provides a description of the sampling and analysis activities.
- Section 3 provides quality assurance procedures.
- Section 4 describes the field decontamination procedures.
- Section 5 provides a description of the waste disposal procedures.
- Section 6 summarizes the reporting activities.

2. Sampling and Analysis Activities

This section identifies the sampling and analysis activities to be used during operation of the soil gas IRM. The analytical data collected during system operation will be utilized to (1) evaluate the effectiveness and efficiency of the soil gas IRM system, (2) evaluate compliance with discharge air and water quality requirements, and (3) evaluate the need for maintenance activities. A description of the sampling and analysis activities is provided below.

2.1 System Startup Sampling Activities

The first 28 days of full-time system operation will be used for system startup performance monitoring. During this time period, system startup performance testing will be conducted at a greater frequency relative to the long-term OM&M requirements of the system. Testing will be used to confirm the proper operation of the system with respect to the performance objectives (i.e., the objectives described in the Soil Gas IRM Work Plan [ARCADIS 2007b]) and compliance requirements (i.e., air discharge limitations [NYSDEC 2003]). Startup performance testing will include the recording of system operating parameters and the collection of vapor and water samples for laboratory and/or field analysis. The System Startup Plan (Attachment C-2) provides a summary of the proposed startup sampling schedule and the field logs that will be completed during system startup. A drawing showing the proposed sampling locations is provided in Drawing 3 of the 95% Design Report (ARCADIS 2007a).

2.2 System Operation, Maintenance, and Monitoring Sampling Activities

The system OM&M phase will begin immediately following the system startup/shakedown period referenced in Section 2 of the System Startup Plan (see Attachment C-2). The goals of system OM&M are:

- Operate and maintain the soil gas IRM in accordance with equipment manufacturer recommendations.
- Inspect and evaluate system data periodically to confirm that the system continues to be effective for protection of human health and the environment.
- Monitor and report performance of the soil gas IRM by:
 - Assessing compliance with the air permit equivalent limits.

- Assessing achievement of the soil gas IRM design criteria; and,
 - Sampling and analysis of appropriate media.
- Inspect and evaluate site-wide data periodically to determine when operation of the soil gas IRM is no longer required for protection of human health and the environment.

The following subsections of this report identify the procedures to be used to implement performance (Subsection 2.2.1) and compliance (Subsection 2.2.2) monitoring associated with the soil gas IRM System. Performance and compliance monitoring includes air and/or water sampling and analysis activities.

2.2.1 System Performance Monitoring

This section identifies the procedures to be used to implement performance monitoring associated with the soil gas IRM System. Performance monitoring includes air sampling and analysis activities and operating parameter collection. As such, this section specifically summarizes the associated sampling locations and schedule to be used during operation of the soil gas IRM system. Sampling methodology is described in Section 2.3 of this report.

2.2.1.1 Operating Parameters

As referenced previously, the goal of the operational performance monitoring is to demonstrate that the soil gas IRM system is meeting the performance objectives (i.e., the objectives described in the Soil Gas IRM Work Plan [ARCADIS 2007b]) and compliance requirements (i.e., air discharge limitations [NYSDEC 2003]). A total of 47 vacuum monitoring wells (two of which will be used to monitor induced vacuum and perched water levels) and one groundwater monitoring well comprise the baseline well network for monitoring associated with the soil gas IRM system. In addition, the soil gas IRM system is equipped with numerous mechanical and electrical monitoring devices (i.e., vacuum gauges, pressure gauges, flow meters, sample ports, etc.) to allow observation and adjustment of system performance parameters to meet the design objectives in the most efficient manner. Drawing 3 of the 95% Design Report (ARCADIS 2007a) provides a summary of the available monitoring locations and their respective designations. To monitor and record these parameters, several forms have been prepared and provided in Attachment C-3 of this report. Table C-1 presents the schedule of the system long-term performance monitoring and testing.

Specifically, performance monitoring of operating parameters will include the following:

- The collection of induced vacuum readings and depth to water measurements from all applicable monitoring points (Attachment C-3.1).
- The collection of individual wellhead parameters from all monitoring points (Attachment C-3.2).
- The collection of general system operating parameters (Attachment C-3.3).

The frequency for collection and recording of system operating parameters specified in Attachment C-2 will be monthly for approximately three months and if deemed appropriate, a request will be submitted to NYSDEC to reduce the operating parameter collection frequency when the readings stabilize.

2.2.1.2 Vapor Sampling for Field and Laboratory Analysis

The goals of vapor sampling performance monitoring are to:

- Monitor influent vapor concentrations to evaluate if vapor treatment is necessary to reduce concentrations to below applicable discharge standards.
- Monitor influent vapor concentrations to document concentrations and general system operational performance over time.
- Monitor influent vapor concentrations to generate vapor phase carbon adsorption isotherms and estimate carbon usage rates; and,
- Monitor post-treatment vapor concentrations (if necessary) to determine when vapor phase carbon breakthrough occurs so that carbon changeouts can be scheduled accordingly.

The performance monitoring of system vapors will include:

- The collection of vapor performance samples for field analysis using a photoionization detector (PID) from individual depressurization wells (i.e., vapor sample ports VSP-101 through VSP-118), from the total effluent prior to treatment (i.e., VSP-601) and from the total effluent following treatment (i.e., VSP-602). Drawing 3 of the 95% Design Report (ARCADIS 2007a) provides

location of the vapor sampling ports. Field analysis vapor performance samples from individual depressurization wells will be collected on a quarterly basis

- In general, vapor sample ports VSP-601 and VSP-602 will be used to monitor the total effluent (prior to treatment) and total effluent (following treatment) vapor streams, respectively. Vapor performance samples will be collected monthly and submitted for laboratory analysis for the first three months, and if deemed appropriate, a request will be submitted to the NYSDEC to reduce the sampling frequency (Table C-1) when concentrations are generally stable to decreasing. Frequency of collection of the total effluent sample prior to treatment may be increased or decreased based on site-specific variables. This will include sampling the total effluent prior to treatment to determine vapor treatment media quality.
- Finally, samples from individual depressurization wells for laboratory analysis may be collected as a contingent activity if troubleshooting of the soil gas IRM system is required.

2.2.2 System Compliance Monitoring

This section identifies the procedures to be used for system compliance monitoring associated with the soil gas IRM system. Compliance monitoring includes vapor and water sampling and analysis activities and operational parameter collection. As such, this section specifically summarizes the associated sampling locations and schedule to be used during operation of the soil gas IRM system.

2.2.2.1 Operating Parameters

The collection of induced vacuum measurements from induced vacuum monitoring wells will be conducted to demonstrate the generation of negative pressure within the entire target zone of the subsurface depressurization system. Table C-1 and Attachment C-3 list the collection frequency and project specific analyte list respectively. Parameter collection will be conducted on a monthly basis for the first three months, and if deemed appropriate, a request will be submitted to the NYSDEC to reduce the sampling frequency.

2.2.2.2 Vapor Sampling

The goal of the vapor sampling compliance monitoring is to monitor the total effluent vapor concentration. Initially, the vapor compliance sample will be collected after emission control unit (ECU), from sampling port VSP-602. Frequency of collection of the total effluent sample following treatment represents the minimum sampling frequency that will be provided when air treatment is provided. Samples will initially be collected on a monthly basis for three months. After the initial three month period, a request will be made to the NYSDEC to reduce the sampling frequency based on steady to decreasing concentrations. Once it has been demonstrated that the ECU is no longer required to reduce emissions to below their respective NYSDEC DAR-1 guidelines (NYSDEC 2003), a request will be made to eliminate the ECU for treatment of soil gas IRM related emissions. Accordingly, the total effluent compliance sample will be collected from sampling port VSP-601. The vapor sample locations associated with the soil gas IRM system are shown on Drawing 3 of the 95% Design Report (ARCADIS 2007a). Tables C-1 and C-2 list the sample collection frequency and project specific analyte list respectively.

2.2.2.3 Condensate Water Sampling

The goal of condensate water quality compliance monitoring is to document and ensure that the waste profile (i.e., concentrations of VOCs) characteristics of the condensate are consistent with prior data (i.e., existing pilot test and system startup analytical data). Water quality will be monitored at WSP-510, the effluent of the collected condensate water storage tank. A condensate water sample will be collected monthly for the first three months and upon review of sample analysis, a long term sampling frequency will be established. Sampling frequency may be increased depending on the laboratory analytical results collected during the system startup period. However, based on existing analytical data, ARCADIS experience at similar sites, the high air to water ratio within the system, and the relatively low vapor concentrations, it is anticipated that the concentration of VOCs will be trace to non-detect. The water sample location associated with the soil gas IRM system is shown on Drawing 3 of the 95% Design Report (ARCADIS, 2007a). Table C-1 and C-3 list the sample collection frequency and project specific analyte list, respectively.

2.3 Sampling Methodology

This section describes the sampling locations and the protocols for collecting vapor and water samples during operation of the soil gas IRM system. Drawing 3 from the

95% Design Report (ARCADIS, 2007a) depicts the sample port locations described below.

2.3.1 Air Sampling Methodology

Vapor sampling locations associated with the soil gas IRM system that will be used for performance and compliance monitoring include the individual depressurization wells with sample ports located on the manifold in Treatment Building 2 (designated as VSP-101 through VSP-118), the ECU influent sampling port (designated VSP-601, and also referred to as vapor phase granular activated carbon (VPGAC) effluent (prior to treatment) in the 95% Design Report), and the ECU effluent sampling port (designated VSP-602).

Before the collection of each round of vapor samples, appropriate pre-cleaned sample containers will be provided by the laboratory in accordance with procedures and requirements described in the QAPP (Attachment C-1.1, Section 4.2 – Preparation and Preservation of Sample Containers), as applicable. The sample containers provided by the laboratory for vapor sampling will either be one-liter Tedlar bags or six-liter Summa canisters. The sample containers will be inventoried and inspected to make sure all the required containers are present and in good condition. Throughout the sample collection and handling process, the sampling technician will wear new disposable surgical gloves for each location sampled.

To collect a vapor sample from the desired sample location, the appropriate container (either one-liter Tedlar bag or one, six-liter Summa canister) will be filled from the sample port. Heavy walled disposable Teflon tubing will be used to connect the sample container, the sampling vacuum pump (as applicable), and the sample port. If a Tedlar bag is used, it will be filled completely based on visual observations. If a Summa canister is used, the laboratory will provide the canister under vacuum. The Summa canister will be filled completely until the canister has a vacuum of 5 inches of mercury.

Depending on the actual location of the individual vapor sample port, as well as the actual sample container used, the sample may be collected using a sampling vacuum pump. Sample collection under negative pressure may require the use of a sampling vacuum pump to provide positive pressure in order draw the vapor sample into the sample container. Logistical considerations (i.e., sample collection time) for stack sampling may warrant the use of a dedicated sampling vacuum pump at the ECU effluent sampling port (VSP-602) if a Tedlar bag is utilized, even though VSP-602 is

under atmospheric, or positive, pressure. As mentioned previously, the Summa canister, if used, will be under vacuum. Therefore, a sampling vacuum pump will not be needed to collect vapor samples during short-term and long-term operation from ECU sample ports if Summa canisters are utilized.

All samples (including quality control checks and quality assurance auditing processes (QA/QC) samples specified in the attached QAPP) will be properly labeled and identified, and information on the Field Sampling Log and chain-of-custody form will be completed. The system pressure and temperature at the location and time of sample collection will also be recorded on the Field Sampling Log. The attached QAPP provides additional details regarding Field Records and QA/QC samples, frequency and protocols (Section 4.1 – Field QA/QC), sample labeling (Section 4.2 – Preparation and Preservation of Sample Containers), and sample custody (Section 4.4 – Sample Custody). All sample containers will be checked for proper identification/labeling and compared to the chain-of-custody form for accuracy prior to packaging any sample for shipment. The chain-of-custody form will be placed in a sealed plastic bag and accompany sample containers. The samples may then be wrapped with a cushioning material, as needed, to preclude damage during shipment and placed in a package. The vapor samples will remain at ambient temperature throughout transport until arrival at the laboratory. When the package is ready, it will be sealed with packing tape, and custody seals will be placed in such a manner that any opening of the package prior to arrival at the laboratory can be detected.

Samples will be delivered by overnight carrier to the analytical laboratory following sample custody requirements specified in the attached QAPP. The laboratory will be prepared to receive the samples and perform preliminary extractions or analyses within the analytical method recommended holding times. During the start-up period, compliance vapor samples will be submitted to the laboratory for 24-hour turnaround of analytical results. All vapor samples will be submitted to a NYSDOH-approved laboratory for analysis for VOCs (including Freon 113) by USEPA Method TO-15 (modified list including tentatively identified compound, Freon 22), as further described in the QAPP (Attachment C-1.1 and C-1.2). The list of compounds to be analyzed for is included as Table C-2.

2.3.2 Water Sampling Methodology

Before the collection of each condensate water sample, appropriate pre-cleaned sample containers (bottles) will be provided by the laboratory in accordance with procedures and requirements described in the QAPP (Attachment C-1.1). The sample

bottles will be inventoried and inspected to make sure all the required bottles are present, unbroken, and have been adequately prepared by the laboratory (i.e., sample preservation requirements, as applicable). Throughout the sample collection and handling process, the sampling technician will wear new disposable surgical gloves.

All condensate water samples will be collected from the storage tank sampling port, WSP-510, into laboratory supplied sample bottles. Special care will be taken in filling and capping the Volatile Organic Analysis (VOA) vials, so that no headspace or air bubbles are present in the condensate water samples collected for VOC analysis. In addition, overflowing bottles will be avoided to prevent the loss of floating substances or preservatives that may have already been added to the bottle. All sample bottle caps will be secured snugly, but not over-tightened.

All samples (including QA/QC samples specified in the QAPP) will be properly labeled and identified. The QAPP provides additional details regarding Field Records and QA/QC samples, frequency and protocols (Section 4.1 – Field QA/QC), sample labeling (Section 4.2 – Preparation and Preservation of Sample Containers), and sample custody (Section 4. System Startup Plan 4 – Sample Custody). All sample containers will be checked for proper identification/labeling and compared to the chain-of-custody form for accuracy prior to packaging any sample for shipment. The chain-of-custody form will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The samples may then be wrapped with a cushioning material, as needed, to preclude breakage during shipment and placed in a cooler. Sufficient amounts of bagged ice or ice packs will be placed in the cooler to keep the samples at 4 degrees Celsius until arrival at the laboratory. When the cooler is ready, it will be sealed with packing tape, and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be detected.

Samples will be delivered by overnight carrier to the analytical laboratory following sample custody requirements specified in the QAPP. The laboratory will be prepared to receive the samples and perform preliminary extractions or analyses within the analytical method recommended holding times. All condensate water samples (including QA/QC samples) will be analyzed for VOCs, plus Freon 113 (trichlorotrifluoromethane) using USEPA Method 8260 as described in the QAPP Addendum (Attachment C-1.2) and Columbia Analytical Services Inc. Quality Assurance Manual (CAS 2006). The condensate sampling analyte list is presented in Table C-3.

2.3.3 Operating Parameter Collection Methodology

Induced vacuum measurements will be collected from the vapor monitoring well network using the following procedures. Induced vacuum measurements will be collected by measuring the vacuum at each well listed in Attachment C-3.1. The induced vacuum measurements will be made to the nearest hundredth with a digital manometer or Magnehelic type mechanical manometer. Various gauge calibration ranges will be available and the most appropriate manometer range will be used at each individual monitoring point to ensure an accurate reading. All gauges will be calibrated/zeroed prior to use, as appropriate. Induced vacuum measurements and other pertinent information (i.e., Barometric Pressure) will be recorded as outlined in Attachment C-3 System Long-Term Monitoring and Parameter Forms. Ultimately, baseline induced vacuum measurements collected prior to startup will be compared to the induced vacuum measurements to demonstrate that negative pressure is being maintained within the targeted capture zone.

3. Quality Assurance Procedures

Quality assurance procedures will be implemented to ensure that data produced as a result of sampling and monitoring include the condensate water and the vapor samples and analytical results is of highest quality. The QAPP, Attachments C-1.1 and C-1.2, provides a summary of the quality assurance procedures and the QA/QC protocols related to field sampling and analysis activities that will be completed during system operation.

4. Field Decontamination Procedures

Proper decontamination of non-dedicated field equipment associated with sampling activities will ensure that the data collected in support of the sampling and analysis activities for the soil gas IRM System will meet the precision, accuracy, representativeness, completeness and comparability (PARCC) requirements, as presented in the QAPP.

5. Waste Disposal

All condensate water generated during system operation will be containerized in drums, carboys, or other suitable containers for eventual disposal. Each container shall be properly labeled and staged in a designated secure area(s) on McKay Field. Containerized water will be disposed of at the predetermined and pre-approved

discharge point, on Northrop Grumman Property, which ultimately terminates at the local publicly owned treatment works (POTW). Condensate water will be sampled as described in Section 2.2.2 and its subsections of this SAP to comply with applicable POTW requirements. A copy of the conditional approval for discharge to the local POTW is provided in Attachment C-4.

6. Record Keeping and Reporting

Records documenting the operation and maintenance of the soil gas IRM System will be maintained. Electronic and system inspection and maintenance logs will be retained a minimum of 10 years after data collection and submission of logs.

Interim System operation maintenance and monitoring reports summarizing the system operation and performance and monitoring sampling will be prepared monthly for three months. Similar to the parameter collection and sampling frequency, a request will be submitted to the NYSDEC to reduce the reporting frequency from monthly based on the results of the first three months. In addition, an annual report summarizing data with comments and conclusions will be submitted (NYSDEC 2002).

In addition, for the first three months, a monthly letter report summarizing the condensate water quality and volume will be submitted to the POTW. Reporting frequency may change based on volumes generated, review of first three months of sampling data and POTW requirements.

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Appendix C Sampling and Analysis Plan

Former Grumman Settling
Ponds,
Bethpage, New York
Site # 1-30-003A

7. References

ARCADIS of New York, Inc. 2007a. 95% Design Report, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A. September 7, 2007.

ARCADIS of New York, Inc. 2007b. Operable Unit 3 – Soil Gas Interim Remedial Measure Work Plan, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A February 16, 2007.

ARCADIS G&M, Inc. 2006. Quality Assurance Project Plan, Former Grumman Settling Ponds (Operable Unit 3 -- Bethpage Community Park), Bethpage, New York. NYSDEC Site # 1-30-003A. Revised: March 8, 2006.

ARCADIS G&M, Inc. 2005. Northrop Grumman Systems Corporation, Health and Safety Plan, Bethpage, New York. August 15, 2005.

Columbia Analytical Services Inc. Quality Assurance Manual, Revision Number 15, Revision Date: March 29, 2006.

New York State Department of Environmental Conservation, 2005, Order on Consent Index #WI-0018-04-01, Site # 1-30-003A, July 4, 2005.

New York State Department of Environmental Conservation, AGC/SGC Tables December 2003, Division of Air Resources-1 (DAR-1) Guidelines for the Control of Toxic Ambient Air Contaminants, December 22, 2003.

New York State Department of Environmental Conservation (NYSDEC), December 2002, Draft DER-10 Technical Guidance for Site Investigation and Remediation.

Table C-1. System Long-Term Performance Monitoring and Testing Schedule, Northrop Grumman Operable Unit 3
Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Sample Location/Description	Parameter/Measurement	Frequency
<u>Parameters for Field Analysis</u>¹		
<u>Field Parameters</u>		
Induced Vacuum and Water Level Readings	All Parameters Listed on Attachment C-3.1	Monthly
Individual Wellhead Operating Parameters	All Parameters Listed on Attachment C-3.2	Monthly
General System Operating Parameters	All Parameters Listed on Attachment C-3.3	Monthly
<u>Vapor Samples</u>		
<u>Individual Depressurization Wells</u>		
VSP-101 Through VSP-118	Photoionization Detector	Quarterly
<u>Total Effluent Prior to Treatment</u>³		
VSP-601	Photoionization Detector	Monthly
<u>Total Effluent Following Treatment</u>⁴		
VSP-602	Photoionization Detector	Monthly
<u>Samples for Laboratory Analysis</u>		
<u>Vapor Samples</u>		
<u>Total Effluent Prior to Treatment</u>³		
VSP-601	VOCs (USEPA Method TO-15+) ⁵	Monthly
<u>Total Effluent Following Treatment</u>^{4,6}		
VSP-602	VOCs (USEPA Method TO-15+) ⁵	Monthly
Condensate Water Samples		
<u>Water Storage Tank Effluent</u>⁷		
WSP-501	VOCs(USEPA Method 8260)	Monthly ⁸

Notes on next page.

Table C-1. System Long-Term Performance Monitoring and Testing Schedule, Northrop Grumman Operable Unit 3
Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bathpage, New York.

Notes:

1. All parameters for field analysis will be measured using dedicated system mechanical gauges, handheld portable field gauges, and a portable photoionization detector (PID). All portable field equipment shall be calibrated prior to use.
2. Parameters or samples to be collected monthly for the first 3 months, and if deemed to be appropriate a request will be submitted to the NYSDEC to reduce the sampling frequency.
3. Frequency of total effluent sampling prior to treatment may be increased or decreased based on site-specific variables. Example variables include whether or not vapor treatment is necessary to reduce emissions to below NYSDEC DAR-1 guidance values, reaching asymptotic conditions, and/or a change in system operational parameters or configuration. Any proposed changes will be provided to the NYSDEC for approval prior to implementation.
4. Frequency of total effluent compliance sampling following treatment represents the minimum sampling frequency that will be provided when air treatment is required.
Additional performance samples will be collected, as necessary, to monitor breakthrough of the vapor phase carbon.
5. All vapor samples to be submitted for laboratory analysis using USEPA Method TO-15 with a project modified analyte list plus the top 15 tentatively identified compounds (TICs) including the TIC Freon 22. Complete analyte list is provided in Table C-2 of the Sampling and Analysis Plan.
6. Routine total effluent compliance samples will be submitted to the laboratory with a standard 2-week turnaround time. Performance total effluent samples (e.g., vapor phase carbon breakthrough monitoring) will be submitted with a rush turnaround time, if necessary, to obtain results promptly for decision-making.
7. Condensate water samples will be collected on an annual basis to confirm that the waste profile of the condensate water is consistent with prior data. Complete analyte list is provided in Table C-3 of the Sampling and Analysis Plan. Sampling frequency may be increased depending on the laboratory analytical results collected during the system startup period and/or local treatment work requirements.
8. As required by a letter to Northrop Grumman from Nassau County Department of Public Works, dated October 23, 2007, a condensate water sample will be collected monthly for the first three months and upon review of sample analysis, a long term sampling frequency will be established by the publicly owned treatment works.

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Table C-2. System Performance and Compliance Vapor Sampling Analyte List, Northrop Grumman, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Analyte	CAS No.
Acetone	67-64-1
Benzene	71-43-2
Bromodichloromethane	75-27-4
Bromoform (Tribromomethane)	75-25-2
Bromomethane (Methyl bromide)	74-83-9
1,3-Butadiene	106-99-0
2-Butanone(MEK)	78-93-3
Methyl tert-Butyl Ether	1634-04-4
Carbon disulfide	75-15-0
Carbon tetrachloride	56-23-5
Chlorobenzene	108-90-7
Chloroethane	75-00-3
Chloroform	67-66-3
Chloromethane (Methyl chloride)	74-87-3
Dichlorodifluoromethane (Freon 12)	75-71-8
Dibromochloromethane (CDBM)	124-48-1
1,1-Dichloroethane	75-34-3
1,2-Dichloroethane	107-06-2
1,1-Dichloroethene	75-35-4
trans-1,2-Dichloroethene	156-60-5
cis-1,2-Dichloroethene	156-59-2
1,2-Dichloropropane	78-87-5
cis-1,3-Dichloropropene	10061-01-5
trans-1,3-Dichloropropene	10061-02-6
Ethylbenzene	100-41-4
2-Hexanone (Methyl n-Butyl Ketone)	591-78-6
Methylene chloride (Dichloromethane)	75-09-2
4-Methyl-2-pentanone (MIBK)	108-10-1
Styrene	100-42-5
1,1,2,2-Tetrachloroethane	79-34-5
Tetrachloroethene	127-18-4
Toluene (Methylbenzene)	108-88-3
1,1,1-Trichloroethane	71-55-6
1,1,2-Trichloroethane	79-00-5
Trichloroethene	79-01-6
Trichlorofluoromethane (Freon 11)	75-69-4
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	76-13-1
Vinyl chloride	75-01-4
o-Xylene	95-47-6
m&p-Xylenes	NA

CAS No. - Chemical Abstracts Service list Number.

Note:

- Analytical Method TO-15 with Project Modified Analyte List plus top 15 tentatively identified compounds (TICs) including the TIC Freon 22.

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Table C-3. System Compliance Condensate Sampling Analyte List, Northrop Grumman Operable Unit 3
Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Analyte	CAS No.
Acetone	67-64-1
Benzene	71-43-2
Bromodichloromethane	75-27-4
Bromoform (Tribromomethane)	75-25-2
Bromomethane (Methyl bromide)	74-83-9
2-Butanone (MEK)	78-93-3
Carbon Disulfide	75-15-0
Carbon Tetrachloride	56-23-5
Chlorobenzene	108-90-7
Chlorodifluoromethane (Freon 22)	75-45-6
Chloroethane	75-00-3
Chloroform	67-66-3
Chloromethane (Methyl chloride)	74-87-3
Dibromochloromethane (CDBM)	124-48-1
Dichlorodifluoromethane (Freon 12)	75-71-8
1,1-Dichloroethane	75-34-3
1,2-Dichloroethane	107-06-2
1,1-Dichloroethene	75-35-4
trans-1,2-Dichloroethene	156-60-5
cis-1,2-Dichloroethene	156-59-2
1,2-Dichloropropane	78-87-5
trans-1,3-Dichloropropene	10061-02-6
cis-1,3-Dichloropropene	10061-01-5
Ethylbenzene	100-41-4
2 - Hexanone (Methyl n-Butyl Ketone)	591-78-6
Methylene Chloride (Dichloromethane)	75-09-2
4-Methyl-2-Pentanone (MIBK)	108-10-1
Styrene	100-42-5
1,1,2,2-Tetrachloroethane	79-34-5
Tetrachloroethene	127-18-4
Toluene (Methylbenzene)	108-88-3
1,1,1-Trichloroethane	71-55-6
1,1,2-Trichloroethane	79-00-5
Trichloroethene	79-01-6
1,1,2-Trichloro-1,2,2-Trifluoroeth (Freon 113)	76-13-1
Vinyl Chloride	75-01-4
o-Xylene	95-47-6
m+p-Xylene	NA

CAS No. - Chemical Abstracts Service list Number.

Note:

1. Analytical Method USEPA 8260

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Attachment C-1.1

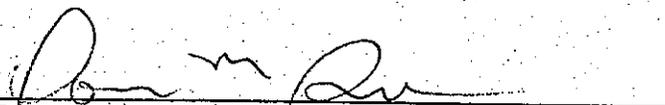
Quality Assurance Project Plan

Appendix B

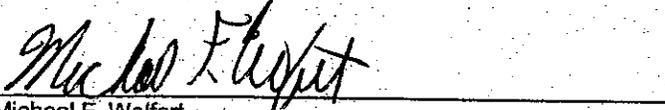
Quality Assurance Project Plan

**Former Grumman Settling Ponds (Operable
Unit 3 – Bethpage Community Park),
Bethpage, New York.
NYSDEC Site # 1-30-003A**

Revised: March 8, 2006


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Appendix B
Quality Assurance Project
Plan, Former
Grumman Settling Ponds
(Operable Unit 3 – Bethpage
Community Park),
Bethpage, New York
NYSDEC Site # 1-30-003A.
Revised: March 8, 2006

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- B-2 Summary of Sample Containers, Analytical Methods, Preservation, and Holding Times, Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.
- B-3A Analyte List for Solid and Aqueous Sample Analysis (VOCs and TOC), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.
- B-3B Analyte List for Solid and Aqueous Sample Analysis (SVOCs), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.
- B-3C Analyte List for Analysis of Aqueous Samples (Metals, Perchlorate, and Biogeochemical/Wet Chemistry Parameters), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.
- B-4 Analyte List for Analysis of Soil Gas and Air Samples (VOCs), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Attachments

- B-1 Field Forms
- B-2 Chain-of-Custody Forms
- B-3 Laboratory Quality Assurance Plans (QAP)

1. Introduction

This Quality Assurance Project Plan (QAPP) has been prepared by ARCADIS with input from Dvirka & Bartilucci Consulting Engineers (D&B) on behalf of Northrop Grumman Systems Corporation (NGSC), as a component of the Remedial Investigation (RI)/Feasibility Study (FS) Work Plan for the Former Grumman Settling Ponds site (Operable Unit 3 – Bethpage Community Park) in Bethpage, New York (NYSDEC Sites Number 1-30-003A) to address specific quality control (QC) checks and quality assurance (QA) auditing processes.

The overall QAPP objective is to ensure that data produced as a result of the various sampling and monitoring, including soil, groundwater, and soil gas is of the highest quality. This QAPP has been prepared in accordance with the United States Environmental Protection Agency (USEPA) guidance, “Guidance for Quality Assurance Project Plans,” (USEPA 2002), The New York State Department of Environmental Conservation (NYSDEC) Draft DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC 2002), and considering requirements of the July 4, 2005 Operable Unit 3 Order on Consent (NYSDEC 2005). This QAPP presents project organization and responsibilities, and QA/QC protocols related to field sampling and analysis activities associated with various sampling and monitoring requirements. The procedures in this QAPP will be implemented to ensure that precision, accuracy, representativeness, completeness, and comparability (PARCC parameters) of the data can be documented, as applicable.

This QAPP is part of the Sampling and Analysis Plan (SAP) which is the umbrella document that consists of Appendices A through D of the RI/FS Work Plan. The SAP includes the following required elements:

- The FSP (Appendix A) defines sampling and data gathering methods consistent with NYSDEC DER-10 and the “Field Methods Compendium,” OSWER Directive 9285.2-11 (draft June 1993).
- This QAPP (Appendix B) describes the quality assurance and quality control protocols necessary to achieve the initial data quality objectives.
- The HASP (Appendix C) protects persons at and near the site during performance of the RI/FS (in accordance with 29 CFR 1910).

- The CPP (Appendix D) was developed in accordance with New York Environmental Conservation Law, hazardous waste site regulations (6 NYCRR Part 375) and Citizens Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook (NYSDEC1998).

In addition to the above, the components of the SAP are also consistent with the requirements of NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC 2002). Various cross-references to other portions of the SAP are included, as appropriate in the following Sections.

2. Site Description and Background

The Former Grumman Settling Ponds Site (Operable Unit 3 – Bethpage Community Park) is located on Stewart Avenue in Bethpage, Nassau County, New York and is situated adjacent to the northeastern portion of the NGSC Bethpage Facility site. The Park property was donated by NGSC to the Town of Oyster Bay in 1962. Soon afterwards, the current park structures were constructed by the Town, without Grumman involvement. Former activities are described in the December 2003 report prepared by Dvirka & Bartilucci (Dvirka & Bartilucci, 2003). The Park is approximately 18 acres in size and is currently owned by the Town of Oyster Bay and operated as the Bethpage Community Park (Park). The Park is bordered by the Cherry Avenue Extension and a Robert Plan Company building to the north, Stewart Avenue to the east, the NGSC Plant 24 access road to the south, and another Robert Plan Company building (former NGSC Plant 24) and the McKay Field property (owned by NGSC) to the west. The north campus of the NGSC property and the Naval Weapons Industrial Plant (NWIRP) sites are located west of the Site. The Former Occidental Chemical Corporation (OCC) RUCO Polymer Corporation (RUCO) site is located further west (RI/FS Work Plan Figure 1).

Activities planned for OU3 consist of the RI of groundwater, soil, and soil gas contaminants of potential concern (COPCs), at and near the former Grumman Settling Ponds Site, planning and preparation for evaluation of Interim Remedial Measure (IRM) remedial technologies. The following techniques will be used to collect data to determine the nature and extent of groundwater, soil, and soil gas impacts associated with former site operations, as well as to obtain preliminary information toward design of a potential IRM.

- Soil borings and soil sampling,
- Geophysical surveys,

- Test Pits and soil sampling (if needed),
- Soil gas and ambient air sampling,
- Temporary wells groundwater sampling,
- Hydropunch groundwater sampling,
- Permanent well groundwater sampling, and
- Piezometers perched water sampling.

In addition to the above, cone penetrometer testing (CPT)/membrane interface probe (MIP) methodologies may also be used, depending on field conditions.

3. Project Organization and Responsibilities

The responsibilities of the key project personnel are detailed below.

- The Project Director is responsible for overseeing the implementation of the project tasks. The Project Director will review all documents and other correspondence concerning the activities performed pursuant to the NYSDEC Superfund project (i.e., all activities associated with Operable Unit 3). The Project Director is also responsible for the overall QA including technical adequacy of the project activities and reports and conformance to the scope of work.
- The Project Manager is responsible for the following: overall project coordination; adherence to the project schedules; directing, reviewing, and assessing the adequacy of the performance of the Task Managers assigned to the project; implementing corrective action, if warranted; interacting with the Project Director; reviewing reports; and maintaining full and orderly project documentation.
- Task Manager(s) is responsible for the following: field activity QA/QC; task coordination; adherence to the project schedules; directing, reviewing, and assessing the adequacy of the performance of the technical staff and subcontractors assigned to the project; if warranted; interacting with the Project Manager; preparing reports; and maintaining full and orderly project documentation.
- The project team members include the task managers, field hydrogeologists, sampling team/field technicians, engineers, risk assessors, support staff (e.g., data

processors, secretaries, and in-house experts in engineering, etc.) who are qualified to oversee/perform the Work, as appropriate, and will be responsible for work in their respective specialty areas. Project team members will be on-site to supervise all activities specified in this Work Plan.

- The Project QA/QC Officer is responsible for performing systems auditing and for providing independent data quality review of project documents and reports.
- The Site Health and Safety Officer is responsible for implementing the site-specific health and safety directives in the Health and Safety Plan (HASp – see RI/FS Work Plan Appendix C) and for contingency response.
- The Data Validator is responsible for review of laboratory data for compliance with the QA objectives for the PARCC parameters (i.e., precision, accuracy, reproducibility, comparativeness, and completeness), and notifications to the project manager of any QC deficiencies.

4. Quality Assurance/Quality Control – Field Sampling and Analysis Activities

The overall QA objective for this aspect of the project is to develop and implement procedures for field measurements, sampling, and analytical testing that will provide data of known quality that is consistent with the intended use of the information. Generally, the specific field sampling and analysis activities to be conducted during this project which require QA/QC protocols include OU3 RI soil and groundwater sampling (i.e., soil sampling, temporary and permanent well groundwater sampling, perched water sampling, and liquid and solid waste characterization sampling), and soil gas and ambient air sampling.

Quality assurance/quality control (QA/QC) protocols will be used to ensure the PARCC parameters of data collected during these field activities meets the objectives of the overall project. Specifically, data will be gathered or developed using procedures appropriate for the intended use of the data. The field measurements and laboratory analyses will be used to support one or more steps in the monitoring described above.

The QA/QC protocols for this aspect of the project will include laboratory analysis and validation procedures, field decontamination procedures, calibration and maintenance

of field instruments, tracer gas analysis, and QA/QC sampling procedures. The following sections outline the QA/QC protocols for each of these issues.

4.1 Field QA/QC

To ensure that data collected in the field is consistent, accurate and complete, forms will be utilized for repetitive data collection, such as depth to water in wells, groundwater sampling etc. These field forms include a Soil Sample/Core Log; Vertical Profile Boring Groundwater Screening Form; Test Pit Log Form; Monitoring Well Construction Log; Daily Log; Water-Level Measurement Log; a Water Sampling Log, and Soil Gas Sampling Logs, as applicable to a specific field task. Forms are provided in Attachment B-1.

QA/QC samples will be collected to assure quality control of soil and groundwater samples. Analyses of QA/QC samples will enable data evaluation for accuracy and integrity. A QA/QC sample set includes one or more of the following: field (equipment rinsate) blank, trip blank, blind (field) duplicate, and site-specific matrix spike/matrix spike duplicate (MS/MSD), as applicable. The QA/QC sample set will vary depending on the objective of the collected sample as well as the parameter or group of parameters specified for analysis. A summary of the QA/QC samples is provided in Table B-1. In general, blanks and duplicate samples will be used to verify the quality of the sampling results. Demonstrated analyte-free water will be supplied by the laboratory for the preparation of equipment and trip blank QA/QC samples; documentation for the analysis of QA/QC blank water will be provided if contamination is detected in the blanks. A brief description of these QA/QC samples follows.

4.1.1 Field (Equipment Rinsate) Blank

A field (equipment rinsate) blank is a water sample that consists of laboratory-supplied analyte-free water that is poured through or over a decontaminated segment of sampling or other down-hole equipment to assess or document the thoroughness of the decontamination process. A rinsate blank will be collected from the decontaminated down-hole equipment by pouring analyte-free water over the equipment and into sample containers before using the equipment in sampling. Field blanks will be collected as specified in Table B-1. These QA/QC samples will only be collected in connection with the collection of aqueous-phase and soil samples and submitted for the appropriate chemical analysis (see Table B-1).

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4.1.2 Trip Blank

A trip blank will contain laboratory supplied analyte-free water and will be transported to the site and returned to the laboratory without opening. This will serve as a check for contamination originating from sample transport, shipping, and from site conditions. One trip blank per day per sampling team will be utilized during groundwater sampling. The maximum number of samples per trip blank is 20. These QA/QC samples will only be collected in connection with the collection of aqueous samples (associated with groundwater sampling) for VOC analysis and submitted for the appropriate chemical analysis (see Table B-1).

4.1.3 Blind (Field) Duplicate

The relative difference in analytical results between samples and their blind duplicates will be used to determine if the data reported by the laboratory meet PARCC requirements. The blind duplicate samples will be assigned fictitious identifications; the correct sample identification number will be recorded on the water sampling log. One blind duplicate sample per 20 groundwater samples will be collected during groundwater sampling activities. These QA/QC samples will be collected in connection with the collection of aqueous and soil gas samples (associated with groundwater sampling) and submitted for the appropriate chemical analysis (see Table B-1). These QA/QC samples will also be collected in connection with the collection of and submitted for the appropriate chemical analysis (see Table B-1).

4.1.4 MS/MSD Sample

Site-specific MS and MSD samples will be collected and submitted to the laboratory as separate samples to provide site-specific matrix-interference data. Upon arrival at the laboratory, the MS/MSD samples will be spiked with appropriate analytes and analyzed by the appropriate method. The purpose of spiking and analyzing the samples is to evaluate any site-specific matrix interference on the analytical results. One MS/MSD sample set will be collected for every 20 samples collected during groundwater and soil sampling activities. These QA/QC samples will only be collected in connection with the collection of aqueous and soil samples for VOC analysis and submitted for the appropriate chemical analysis (see Table B-1).

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4.1.5 Field Records

Proper documentation will consist of all field personnel maintaining records of all work accomplished including the items listed below (in addition to the information required on the forms provided in Attachment B-1):

- Date and time of work events;
- Purpose of work;
- Description of methods;
- Description of samples;
- Number and size of samples;
- Description of sampling point;
- Date and time of collection of sample;
- Measurement or Sample collector's first initial and last name;
- Field observations; and
- Field measurements with portable instruments.

In addition, for soil gas sampling, the following information will be collected:

- Sample depth;
- Soil gas purge volumes;
- Volume of soil gas extracted;
- Vacuum of canisters before and after samples collected; and
- Apparent moisture content of the sampling zone

All information pertinent to field sampling activities will be recorded on the logs provided in Attachment B-1. Duplicates of field notes/forms will be prepared and kept in a secure place away from the Site.

4.2 Preparation and Preservation of Sample Containers

Laboratory pre-cleaned sample containers will be provided by the laboratory. Each sample container will be provided with a label for sample identification purposes. The information on the label will include a sample identification number, time, date and initials of the sample collector. All sample containers will be accompanied by a full chain-of-custody (see Attachment B-2).

Sample containers will be thoroughly cleaned at the laboratory prior to sampling and as appropriate, sample preservatives will be added to the bottles, prior to sample bottle shipment to the client. It is laboratory practice to preserve sample containers to minimize potential contaminants in the field and to reduce unnecessary sample handling in the field (see laboratory Quality Assurance Plans in Attachment B-3 for additional information). Table B-2 provides a summary of sample analytical methods, sample containers, holding times and preservation procedures to be used.

4.3 Decontamination

Proper decontamination of all sampling equipment will help ensure that the data collected will meet the PARCC requirements. Field decontamination procedures are provided in the FSP, Section 8.

4.4 Sample Custody

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 in the field; the chain-of-custody form is provided in Attachment B-2.

A sample is under custody if it is:

1. In one's actual possession; or
2. In one's view, after being in your physical possession; or

3. Was in one's physical possession and then was locked up or sealed to prevent tampering; or
4. It is in a designated secure place restricted to authorized personnel.

Each person involved with the samples will know chain-of-custody procedures. A detailed discussion of the stages of possession (i.e., field collection, transfer, and laboratory custody) is presented below in the following sections.

4.4.1 Environmental Samples Chain-of-Custody

The laboratory begins the chain-of-custody procedure with the preparation of the sample bottles. The field sampler continues the chain-of-custody procedure in the field and is the first to sign the form upon collection of samples. The field sampler is personally responsible for the care and custody of the samples until they are transferred and properly dispatched. Each sample will have sample labels completed (using waterproof ink), have proper preservation, and be packaged to preclude breakage during shipment. Every sample will be assigned a unique identification number that is entered on the chain-of-custody form. Samples can be grouped for shipment using a single form.

4.4.2 Transfer of Custody and Shipments

All samples will be accompanied by a chain-of-custody record. When transferring the possession of samples, the individual(s) relinquishing and receiving will sign, date, and note the time of transfer on the chain-of-custody form. This record documents transfer of custody of samples from the sampler to another person to the analytical laboratory.

Samples will be properly packed for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample cooler. All chemical analytical samples will be delivered to the laboratory within 48 hours of collection or earlier, as needed, to meet analyte holding times.

Whenever samples are split with a facility or government agency, a separate chain-of-custody record will be prepared for those samples and marked to indicate with whom the samples were split.

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4.4.3 Laboratory Sample Custody

The laboratory utilized for chemical analysis will have standard operating procedures for documenting receipt and tracking of samples and compilation of sample data. Sample custody, related to sampling procedures and sample transfer, is described below:

- (1) Shipping or pickup of cooler by sampling personnel.
- (2) Cooler packed at the laboratory after contact with sampling personnel.
- (3) Cooler wrapped with evidence tape.

4.4.4 Field Chain of Custody

- (1) Chain-of-Custody form filled out by field sampling personnel.
- (2) Field sampling personnel supply evidence tape and seal cooler prior to shipment back to the laboratory.

4.4.5 Laboratory Sample Custody

- (1) Samplers check for any external damage (such as leaking).
- (2) Samplers sign the waybill for sending cooler to the laboratory.
- (3) The laboratory receives cooler and completes chain of custody.

The samples will be stored at the proper temperature prior to analysis. It is the responsibility of the laboratory to properly dispose of samples beyond the holding period.

4.5 Laboratory Analyses

All soil, soil gas/air and groundwater samples will be analyzed by a NYSDOH-approved laboratory.

Soil samples will be analyzed by a NYSDOH-approved laboratory. Soil samples will be selectively analyzed for TCL VOCs, SVOCs, cadmium (Cd)/chromium (Cr),

polychlorinated biphenyls (PCBs), and TOC using the methods specified in Table B-2. Analytes are provided in Tables B-3A to B-3C.

Groundwater samples will be analyzed for Target Compound List (TCL) VOCs (including Freon 113 under NYSDEC Analytical Services Protocol (ASP) 2000 Method OLM 4.2. The analytical laboratory will also conduct a library search of up to 10 tentatively identified compounds (TICs). Selected samples may be analyzed for semi-volatile organic compounds (SVOCs) (NYSDEC ASP Method OLM 4.2), Total Organic Carbon (TOC) (USEPA Method 9060), perchlorate (USEPA Method 314.0), Target Analyte List (TAL) Metals (NYSDEC ASP Method ILM 4.0), and biogeochemical/wet chemistry parameters (i.e., ethane, ethene, methane, alkalinity, nitrate, nitrite, sulfate, chloride, total iron, total manganese, dissolved iron, dissolved manganese, ammonia, orthophosphate, hardness, and total dissolved solids) using the methods specified in Table B-2. Analytes are provided in Tables B-3A to B-3C.

Soil gas samples will be analyzed for a selected list of site-related VOCs by a NYSDOH-approved laboratory using USEPA Method TO-15 (see Tables B-2 and B-4).

Tables B-3A, B-3B, B-3C, and B-4 summarize the list of parameters to be analyzed for in soil/solid, soil gas/air, and aqueous samples (i.e., perched water groundwater) along with the respective required quantitation limits for the following groups of analytes: VOCs, SVOCs, TOC, perchlorate, metals, and biogeochemical parameters. Geotechnical parameters will be determined during the course of RI activities and samples will be analyzed using the appropriate method under the American Society for Testing and Materials (ASTM).

The internal laboratory Standard Operating Procedures (SOPs) and QA/QC procedures are described in the individual laboratory facility Quality Assurance Plans (QAPs), independent plans provided by the analytical laboratory. Laboratory QAPs are provided in Attachment B-3.

4.6 Laboratory Reporting

The laboratory will provide a NYSDEC Category B deliverable (unless otherwise unavailable or specified) for the sampling effort within two weeks of receipt of samples. Additional documentation may be required from the laboratory based on the results of the data evaluation.

4.7 Data Validation

Data validation is the process in which analytical data generated by the laboratory are evaluated against a specific set of requirements and specifications, and determinations of data usability and limitations are made. The Data Validator examines the criteria pertaining to analytical data generated in accordance with Contract Laboratory Program (CLP) protocols from four perspectives, as follows:

- Technical requirements.
- Contractual requirements.
- Determination of compliance.
- Determination and action of how to define the usability or qualify the data.

Validation of the organic data will be performed on 5 percent of the data (20 percent of the Phase 2A soil RI data) following the QA/QC criteria set forth in the NYSDEC ASP, June 2000 and DER-10, and the USEPA CLP National Functional Guidelines for Organic Data Review, (USEPA 2001;2003). Validation of the inorganic data will be performed on 5 percent of the data (20 percent of the Phase 2A soil RI data) following the QA/QC criteria set forth in the NYSDEC ASP, June 2000 and DER-10 (NYSDEC 2002), and the USEPA CLP National Functional Guidelines for Inorganic Data Review, (USEPA 2004).

Groundwater and soil samples associated with sampling of monitoring wells and VPBs, soil samples associated with soil borings, waste characterization samples (liquid or solid-phase), and soil gas samples associated with sampling of soil gas points (SVPs) will require a NYSDEC Category B deliverable.

The NYSDEC Category B deliverable data review will include checking the following:

- Chain-of-custody forms.
- Holding times.
- GC/MS Instrument Performance checks.
- Instrument calibration.

- Trip and/or laboratory (method) blank-detected constituents.
- Surrogate spike recoveries.
- Matrix spike/spike duplicate precision and accuracy.
- Internal standards.
- Check for transcriptions between quantitation reports and Form I's.
- Blind duplicate precision.

Final validation of data obtained during the field sampling and analysis activities will be performed by the Data Validator. The laboratory deliverables will be reviewed for accuracy, precision, completeness, and overall quality of data. All laboratory data will be reviewed for adherence to method-specific QA/QC guidelines and to the data validation guidelines that are described above. If specific data quality issues arise based on the data validation and review guidelines described above, the data validation and review process may be expanded, as warranted, in order to address the specific data quality issue. Any additional validation performed will continue to be performed until the specific data quality issue is resolved.

4.8 Data Usability

The Data Validator for the project will review the analytical data for usability including determining if the data are accurate, precise, representative, complete, and comparable. The review of the analytical results will include checking chain-of-custody forms, sample holding times, blank contamination, spike recoveries, surrogate recoveries, internal standard, and precision of duplicate sample analysis, and laboratory control samples (as appropriate). This review will be used to classify the data as valid, usable, or unusable. Valid data will indicate that all QA/QC review criteria have been met and are acceptable (as per details outlined in the preceding section). Data will be characterized as usable when QA/QC parameters are marginally outside acceptable limits (example: sample holding times were slightly exceeded) where the data may be questionable, but still usable within limitation. Unusable data will be data that are observed to have gross errors or analytical interference that would render the data invalid for any purpose.

The data usability summary report (DUSR) will be prepared at the conclusion of validation.

4.9 Performance and System Audits

Performance and system audits will be performed on a periodic basis, as appropriate, to ensure that the work is implemented in accordance with the approved project SOPs and in an overall satisfactory manner. Examples of audits that will be performed during the project activities are as follows:

- The field personnel will supervise and check, on a daily basis during sampling activities, that monitoring well integrity is intact; that field measurements are made accurately; that equipment is thoroughly decontaminated; that samples are collected and handled properly; and that all field work is accurately and neatly documented.
- On a timely basis, the data packages submitted by the laboratory will be checked for the following information: that all requested analyses were performed; that sample holding times were met; that the data were generated through the approved methodology with the appropriate level of QC effort and reporting; and that the analytical results are in conformance with the prescribed acceptance criteria. The quality and limitations of the data will be evaluated based on these factors.
- The project manager will oversee the field personnel and check that the management of the acquired data proceeds in an organized and expeditious manner.
- Audits of the laboratory are performed on a regular basis by regulatory agencies. Audits are discussed in the laboratory Quality Assurance Plan. (Attachment B-3).

4.10 Preventive Maintenance

ARCADIS has established a program for the maintenance of field equipment to ensure the availability of equipment in good working order when and where it is needed, as indicated, in the following examples:

- An inventory of equipment, including model and serial number, quantity, and condition will be maintained. Each item will be tagged and signed out when in use and, its operating condition and cleanliness will be checked upon return. Routine checks will be made on the status of equipment, and spare parts will be stocked. An equipment manual library will also be maintained.

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Quality Assurance Project Plan

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- The field personnel are responsible for making sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the field.

The laboratory also follows a well-defined program to prevent the failure of laboratory equipment and instrumentation. This preventive maintenance program is described in the laboratory Quality Assurance Plan. (Attachment B-3).

5. References

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Attachment B-1

Field Forms

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Attachment B-2

Chain-of-Custody Forms

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Attachment B-3

Laboratory Quality Assurance Plans
(QAP)

Table B-1. Quality Assurance/Quality Control Sample Summary, Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Matrix	Sampling Event	Sample Location/ Sample Point	Parameters ⁽¹⁾	Frequency	Estimated Sample Quantity per Event ⁽⁴⁾	Estimated Field Blanks per Event (*)	Estimated Trip Blanks per Event ⁽³⁾	Estimated Field Duplicates per Event (**)	Estimated MS/MSD ⁽²⁾ per Event
Phase 1 Remedial Investigation (completed by ARCADIS)									
Aqueous	Vertical Profile Borings	Phase 1 / VP-1 to VP-12	VOCs	Remedial Investigation	60	20	22	3	3
Aqueous	Vertical Profile Borings	Phase 1A / VP13 to VP-20	VOCs	Remedial Investigation	41	16	18	2	2
Aqueous	Vertical Profile Borings	Phase 1B / VP-21 to VP-33 (excluding VP-31)	VOCs SVOCs	Remedial Investigation	59 36	11 6	12 0	3 1	3 0
Soil	Vertical Profile Borings	Phase 1 / VP-2 to VP-8	TOC	Remedial Investigation	7	0	0	0	0
Soil	Vertical Profile Borings	Phase 1A / VP14 and VP-16	TOC	Remedial Investigation	6	0	0	0	0
Soil	Vertical Profile Borings	Phase 1B / VP-21 to VP-33 (excluding VP-31)	VOCs SVOCs TOC	Remedial Investigation	26 16 17	0 0 0	0 0 0	0 0 0	2 0 1
Phase 2 Remedial Investigation (Proposed - ARCADIS and Dvirka & Bartilucci)									
Soil***	Soil Borings	Phase 2A (see RI/FS Workplan Tables 3, 4, and 5)	VOCs ⁽⁷⁾ SVOCs ⁽⁷⁾ Cd/Cr PCBs	Remedial Investigation	178 196 3 274	TBD TBD TBD TBD	TBD 0 0 0	9 10 0 0	9 10 0 0
Soil*****	Soil Borings	Phase 2B / CL-1 through CL-14 (See RI/FS Work Plan Table 1 and 5)	VOCs TOC Physical Parameters ⁽⁸⁾	Remedial Investigation	28 28 7	TBD 0 0	TBD 0 0	2 0 0	2 0 0
Aqueous (groundwater)	Groundwater Quality Sampling of Monitoring Wells	Phase 2 CAMW-1 through CAMW-4/ B30MW-1, BCPMW-2 and BCPMW-3 (on-site); HN-40S, HN-40I, HN-42S, and HN-42I (off-site)	VOC Metals ClO ₄ ⁻ BioGeo ⁽⁶⁾ SVOCs	Remedial Investigation/IRM Pre-Design (Per Event)	11 7 11 7 6	3 0 0 0 0	TBD 0 0 0 0	1 0 0 0 0	1 0 0 0 0
Aqueous (perched water)	Perched Water Quality Sampling from Piezometers	Phase 2 On-site Piezometers PZ-1 through PZ-5	VOC Metals ClO ₄ ⁻ BioGeo ⁽⁶⁾	Remedial Investigation (Per Event)	1 1 1 1	1 1 1 1	TBD 0 0 0	1 1 1 1	1 0 0 0
Aqueous (groundwater)	Vertical Profile Borings	Phase 2 On-site VPBs VP-3A, VP-19A, VP-27A, VP-3B, and VP-3C	VOC TOC Metals ClO ₄ ⁻ BioGeo ⁽⁶⁾	Remedial Investigation****	13 13 13 13 13	TBD TBD TBD TBD TBD	TBD 0 0 0 0	1 1 1 1 1	1 0 0 0 0
Aqueous (groundwater)	Vertical Profile Borings	Phase 2 Off-site VPBs / VP-100 through VP-108 (VP-102 to VP-104 are contingency VPBs)	VOC ClO ₄ ⁻	Remedial Investigation****	TBD TBD	TBD TBD	TBD TBD	TBD TBD	TBD TBD
Soil Gas	Soil Gas/Ambient Air	Phase 2 On-site/ SVP-5 through SVP-10, Ambient Air	VOCs	Remedial Investigation	19	0	0	1	0
Soil Gas	Soil Gas/Ambient Air	Phase 2 Off-site/ SVP-100 through SVP-107, Ambient Air	VOCs	Remedial Investigation	13	0	0	1	0
Non-Aqueous Phase Liquid ⁽⁹⁾	IF Encountered	Phase 2 Piezometers	TBD	Remedial Investigation	TBD	TBD	TBD	TBD	TBD
Solid/Aqueous (soil/water)	Waste Characterization	Grab	Varies ⁽⁵⁾	Remedial Investigation	TBD	TBD	TBD	TBD	TBD

See next page for footnotes.

Table B-1. Quality Assurance/Quality Control Sample Summary, Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

(1)	Analyses will be performed in accordance with NYSOEC Analytical Services Protocol (ASP), or USEPA methods by a CLP-certified NYSDOH-approved laboratory, with the exception of physical properties, which will conform to ASTM Standards.
(2)	Matrix spike/matrix spike duplicate (MS/MSD) analysis is performed on a site sample and therefore is not counted as separate samples. For MS/MSDs, triple sample volume will be provided. MS/MSD sample sets collected at a frequency of one per 20 samples of the same matrix and will accompany the associated site sample during shipment.
(3)	Trip blanks will be provided by the analytical laboratory and will accompany VOC samples as they are collected and during shipment. Trip blanks collected at a frequency of one per day. A trip blank will accompany the other samples collected the same day. The maximum number of samples per trip blank is 20.
(4)	Sample count will depend on number of locations and number of samples collected per location.
(5)	Waste characterization sample analysis will depend on generator knowledge and the requirements of the receiving facility.
(6)	BioGeoChemical (BioGeo) sampling includes collection of field parameters (pH, specific conductance, temperature and sulfide) and the following laboratory analyses: dissolved gases: (ethane and ethene and methane), alkalinity, nitrate, nitrite, sulfate, chloride, total iron, total manganese, dissolved iron and dissolved manganese. Selected wells will also be sampled for ammonia, hardness (as CaCO ₃), orthophosphate, TDS, and TOC. Samples will be submitted to Microseeps of Pittsburgh, Pennsylvania (dissolved gases only) and Severn Trent of Shelton, Connecticut.
(7)	Additional samples will be taken if PID readings above background concentrations are detected. The soil sample exhibiting the highest PID reading, as well as the deepest soil sample collected from that boring, will be analyzed for VOC's and SVOC's. In addition, any soil sample exhibiting a PID reading of 50ppm or greater above background concentrations will also be analyzed for VOC's and SVOC's.
(8)	Samples collected via Shelby Tube and submitted for analysis for porosity, bulk density, vertical permeability, moisture content, and fraction organic carbon by TetraTech/Woodward Clyde Consultants, Totowa, New Jersey.
(9)	If non-aqueous phase liquid is encountered, a sample will be collected for fingerprinting and physical property analyses, to be determined.
*	One field blank collected per day every time non-dedicated (i.e., disposable or reusable) sampling equipment (i.e., split-spoons, pumps and/or bailers) is used.
**	A field (blind) duplicate will be collected at a frequency of one per 20 samples of the same matrix.
***	Soil boring Quality Assurance/Quality Control Summary obtained from Dvirka & Bartilucci.
****	Event for the purpose of sample collection - an event is considered one vertical profile boring.
*****	If the CPT/MIP methodology is selected, then the actual number of borings drilled, samples collected, and analytical parameters selected will be modified, as appropriate.
MS/MSD	Matrix spike/matrix spike duplicate
VOCs	Volatile organic compounds
SVOCs	Semi volatile organic compounds
Cd/Cr	cadmium/chromium
TOC	Total Organic Carbon
TAL	Target Analyte List of Metals
USEPA	U.S. Environmental Protection Agency
NYSDEC	New York State Department of Environmental Conservation
TBD	To be determined
ASTM	American Society for Testing and Materials
CPT	Cone Penetrometer Testing
MIP	Membrane Interface Probe
IRM	Interim Remedial Measure
TDS	Total Dissolved Solids

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Table B-2. Summary of Sample Containers, Analytical Methods, Preservation, and Holding Times, Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Matrix	Monitoring Program	Parameters (1)	Analytical Laboratory Methodology	Sample Containers	Preservation	Holding Time
Aqueous (groundwater)	VPB / Groundwater Quality Samples / Perched Water Samples	VOCs	NYSDEC ASP 2000 Method OLM 4.2	Two (2) 40 mL glass with Teflon-lined septa	Cool 4 degrees C, HCl to pH<2	10 days VTSR
		SVOCs	NYSDEC ASP 2000 Method OLM 4.2	Two (2) 1-L amber	Cool 4 degrees C	5 days to extract, then 40 days VTSR to analyze
		TAL Metals	NYSDEC ASP 2000 Method ILM 4.0	One (1) 500 mL plastic	HNO ₃ to pH <2	28 Days; Hg 180 days - ICAP
		Ethane and Ethene	AM20GAX	Two (2) 40 mL glass with Teflon-lined septa	None	14 days
		Methane (CH ₄)	AM20GAX	Two (2) 40 mL glass with Teflon-lined septa	None	14 days
		Alkalinity	USEPA Method 310.1	(1) 500 mL, plastic	Cool 4 degrees C	14 days
		Ammonia	USEPA Method 350.1	(1) 500 mL, plastic	Cool 4 degrees C, H ₂ SO ₄ to pH<2	28 days
		Hardness (As CaCO ₃)	USEPA Method 130.2	(1) 500 mL, plastic	Cool 4 degrees C, HNO ₃ to pH<2	6 months
		Orthophosphate	USEPA Method 365.2	(1) 500 mL, plastic	Cool 4 degrees C	48 hours
		TDS	USEPA Method 160.1	(1) 500 mL, plastic	Cool 4 degrees C	7 days
		Nitrate (NO ₃)	USEPA Method 300.0	(1) 1,000 mL, plastic	Cool 4 degrees C	48 hours
		Nitrite (NO ₂)	USEPA Method 300.0	(1) 1,000 mL, plastic	Cool 4 degrees C	48 hours
		Sulfate (SO ₄)	USEPA Method 300.0	(1) 1,000 mL, plastic	Cool 4 degrees C	28 days
		Chloride (Cl)	USEPA Method 300.0	(1) 1,000 mL, plastic	Cool 4 degrees C	28 days
		Total Iron	NYSDEC ASP 2000 Method ILM 4.0	(1) 500 mL, plastic	HNO ₃ to pH <2	28 days
		Total Manganese	NYSDEC ASP 2000 Method ILM 4.0	(1) 500 mL, plastic	HNO ₃ to pH <2	28 days
Dissolved Iron	NYSDEC ASP 2000 Method ILM 4.0	(1) 500 mL, plastic	HNO ₃ to pH <2	28 days		

See last page for footnotes.

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Table B-2. Summary of Sample Containers, Analytical Methods, Preservation, and Holding Times, Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Matrix	Monitoring Program	Parameters (1)	Analytical Laboratory Methodology	Sample Containers	Preservation	Holding Time
		Dissolved Manganese	NYSDEC ASP 2000 Method ILM 4.0	(1) 500 mL, plastic	HNO ₃ to pH <2	28 days
		TOC	USEPA Method 9060	Two (2) 40 mL glass with Teflon-lined septa	Cool 4 degrees C, H ₂ SO ₄ to pH <2	28 days
		Perchlorate	USEPA Method 314.0	(1) 500 mL, Plastic	Cool 4 degrees C	28 days
Soil	VPB / Soil Borings*** / Shallow Soil Borings	VOCs	NYSDEC ASP 2000 Method OLM 4.2	One (1) 2 oz. glass	Cool 4 degrees C	10 days VTSR
		SVOCs	NYSDEC ASP 2000 Method OLM 4.2	One (1) 4 oz. glass	Cool 4 degrees C	10 days to extract, then 40 days VTSR to analyze
		Cd/Cr	NYSDEC ASP 2000 Method ILM 4.0	One (1) 4 oz. Glass	Cool 4 degrees C	6 months
		PCBs	NYSDEC ASP 2000 Method OLM 4.2	One (1) 4 oz. Glass	Cool 4 degrees C	10 days to extract, then 40 days VTSR to analyze
		TOC	USEPA Method 9060	One (1) 8 oz Glass	Cool 4 degrees C	28 days
Soil Gas	Soil Gas/Ambient Air	VOCs	USEPA Method TO-15	6L SUMMA, one (1) cannister	NA	28 days
Soil/Water	Waste Characterization (2)	Varies	Varies	Varies	Varies	Varies
Soil	Geotechnical	Varies	Varies	Varies	Varies	Varies

See last page for footnotes.

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Table B-2. Summary of Sample Containers, Analytical Methods, Preservation, and Holding Times, Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

(1)	Refer to Tables B-3 and B-4 for specific analyte lists for analyses of aqueous and soil vapor samples, respectively.
(2)	Waste characterization sample analysis will depend on generator knowledge and the requirements of the receiving facility.
USEPA	U.S. Environmental Protection Agency
NYSDEC	New York State Department of Environmental Conservation
ASP	Analytical Services Protocol
C	Celsius
L	Liter
HNO ₃	Nitric Acid
mL	Milli-liter
NA	Not applicable
VOCs	Volatile organic compounds (including Freon 113)
Cd/Cr	Total cadmium/chromium
SVOCs	Semivolatile organic compounds
VTSR	Verified Time of Sample Receipt at lab.
TOC	Total Organic Carbon
***	Soil boring Quality Assurance/Quality Control Summary obtained from Dvirka & Bartilucci (2005).

Table B-3A. Analyte List for Solid and Aqueous Sample Analysis (VOCs and TOC), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Method:	NYSDEC ASP 2000 OLM 4.2	NYSDEC ASP 2000 OLM 4.2
Matrix/Sample Type:	Aqueous/Groundwater & Water	Soil/Solid
Constituent ⁽¹⁾	Contract-Required Quantitation Limits (ug/L)	Contract-Required Quantitation Limits (ug/kg)
VOCs:		
Chloromethane	5	10
Bromomethane	5	10
Vinyl Chloride	2	10
Chloroethane	5	10
Methylene chloride	5	10
Acetone	50	10
Carbon disulfide	50	10
1,1-Dichloroethene	5	10
1,1-Dichloroethane	5	10
cis-1,2-Dichloroethene	5	10
trans-1,2-Dichloroethene	5	10
2-Butanone	50	10
Chloroform	7	10
1,2-Dichloroethane	5	10
1,1,1-Trichloroethane	5	10
Carbon tetrachloride	5	10
Bromodichloromethane	50	10
1,2-Dichloropropane	5	10
cis-1,3-Dichloropropene	5	10
Trichloroethene	5	10
Benzene	0.7	10
Dibromochloromethane	5	10
trans-1,3-Dichloropropene	5	10
1,1,2-Trichloroethane	5	10
Bromoform	50	10
4-Methyl-2-pentanone	50	10
2-Hexanone	50	10
Tetrachloroethene	5	10
1,1,2,2-Tetrachloroethane	5	10
Toluene	5	10
Chlorobenzene	5	10
Ethylbenzene	5	10
Styrene	5	10
Xylene (total)	5	10
Freon 113	5	10

See next page for Notes and Abbreviations.

Table B-3A. Analyte List for Solid and Aqueous Sample Analysis (VOCs and TOC), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

	Groundwater Sampling	Soil Sampling
Method:	USEPA 9060	USEPA 9060
Matrix/Sample Type:	Aqueous/Groundwater & Water	Soil/Solid
	Contract-Required	Contract-Required
	Quantitation Limits	Quantitation Limits
Constituent ⁽¹⁾	(ug/L)	(ug/kg)
Total Organic Carbon	1	100

Notes and Abbreviations:

* CRQLs/RQLs are the same for groundwater samples (environmental monitoring) and for water samples (waste characterization sampling).

(1) Listed constituents represent Target Compound List (TCL) volatile organic compounds (VOCs), plus Freon 113 (also known as trichlorotrifluoroethane or 1,1,2-trichloro-1,2,2-trifluoroethane).

VOCs Volatile organic compounds

TOC Total Organic Carbon

USEPA U.S. Environmental Protection Agency

NYSDEC New York State Department of Environmental Conservation

ASP Analytical Services Protocol

CRQLs Contract-Required Quantitation Limits

RQLs Required Quantitation Limits

ug/L micrograms per liter

ug/kg micrograms per kilogram

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Table B-3B. Analyte List for Solid and Aqueous Sample Analysis (SVOCs), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Method:	NYSDEC ASP 2000 QLM 4.2	NYSDEC ASP 2000 QLM 4.2
Matrix/Sample Type:	Aqueous/Groundwater	Soil/Solid
Constituent ⁽¹⁾	Required Quantitation Limits (ug/L)	Required Quantitation Limits (ug/kg)
SVOCs:		
Phenol	10	330
Bis(2-chloroethyl)ether	10	330
2-Chlorophenol	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
1,2-Dichlorobenzene	10	330
2-Methylphenol	10	330
4-Methylphenol	10	330
N-Nitroso-di-n-propylamine	10	330
Hexachloroethane	10	330
Nitrobenzene	10	330
Isophorone	10	330
2-Nitrophenol	10	330
2,4-Dimethylphenol	10	330
Bis(2-chloroethoxy)methane	10	330
2,4-Dichlorophenol	10	330
1,2,4-Trichlorobenzene	10	330
Naphthalene	10	330
4-Chloroaniline	10	330
Hexachlorobutadiene	10	330
4-Chloro-3-methylphenol	10	330
2-Methylnaphthalene	10	330
Hexachlorocyclopentadiene	10	330
2,4,6-Trichlorophenol	10	330
2,4,5-Trichlorophenol	25	800
2-Chloronaphthalene	10	330
2-Nitroaniline	25	800
Dimethylphthalate	10	330
Acenaphthylene	10	330
2,6-Dinitrotoluene	10	330
3-Nitroaniline	25	800
Acenaphthene	10	330
2,4-Dinitrophenol	25	800
4-Nitrophenol	25	800
Dibenzofuran	10	330
2,4-Dinitrotoluene	10	330
Diethylphthalate	10	330
4-chlorophenyl(phenyl) ether	10	330
Fluorene	10	330
4-Nitroaniline	25	800
4,6-Dinitro-2-methylphenol	25	800
N-Nitrosodiphenylamine (1)	10	330

See next page for Notes and Abbreviations.

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Table B-3B. Analyte List for Solid and Aqueous Sample Analysis (SVOCs), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Method:	NYSDEC ASP 2000 OLM 4.2	NYSDEC ASP 2000 OLM 4.2
Matrix/Sample Type:	Aqueous/Groundwater	Soil/Solid
Constituent ⁽¹⁾	Required Quantitation Limits (ug/L)	Required Quantitation Limits (ug/kg)
SVOCs (continued):		
Hexachlorobenzene	10	330
Pentachlorophenol	25	800
Phenanthrene	10	330
Anthracene	10	330
Carbazole	10	330
Di-n-butylphthalate	10	330
Fluoranthene	10	330
Pyrene	10	330
Butylbenzylphthalate	10	330
3,3'-Dichlorobenzidine	10	330
Benzo(a)anthracene	10	330
Chrysene	10	330
Bis(2-ethylhexyl)phthalate (BEHP)	10	330
Di-n-octylphthalate	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(a)pyrene	10	330
Indeno(1,2,3-cd)pyrene	10	330
Dibenz(a,h)anthracene	10	330
Benzo(g,h,i)perylene	10	330
4-bromophenyl-phenylether	10	330
Benzoic acid	10	330
Benzyl alcohol	10	330
Bis(2-chloroisopropyl)ether	10	330

Notes and Abbreviations:

- SVOCs Semivolatile organic compounds
- USEPA U.S. Environmental Protection Agency
- RQLs Required Quantitation Limits
- ug/L micrograms per liter
- ug/kg micrograms per kilogram

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Table B-3C. Analyte List for Analysis of Aqueous Samples (Metals Perchlorate, Biogeochemical/Wet Chemistry Parameters),
Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Matrix/Sample Type:	Aqueous/Groundwater	Aqueous/Groundwater	Soil/Solid	Soil/Solid
Constituent	Method	Contract Required Detection Limits (ug/L)	Method	Contract Required Detection Limits (mg/kg)
Inorganics (Metals):				
Aluminum	NYSDEC ILM4.0	200**	Same	258
Antimony	NYSDEC ILM4.0	60	Same	11.7
Arsenic	NYSDEC ILM4.0	10**	Same	8
Barium	NYSDEC ILM4.0	200	Same	2
Beryllium	NYSDEC ILM4.0	5	Same	2
Cadmium	NYSDEC ILM4.0	5**	Same	3
Calcium	NYSDEC ILM4.0	5000	Same	85
Chromium	NYSDEC ILM4.0	10	Same	3
Cobalt	NYSDEC ILM4.0	50	Same	2
Copper	NYSDEC ILM4.0	25	Same	5
Iron	NYSDEC ILM4.0	100	Same	145
Lead	NYSDEC ILM4.0	3**	Same	9
Magnesium	NYSDEC ILM4.0	5000	Same	35
Manganese	NYSDEC ILM4.0	15	Same	2.5
Mercury	NYSDEC ILM4.0	0.2**	Same	0.05
Nickel	NYSDEC ILM4.0	40	Same	5
Potassium	NYSDEC ILM4.0	5000	Same	200
Selenium	NYSDEC ILM4.0	5**	Same	16
Silver	NYSDEC ILM4.0	10	Same	3
Sodium	NYSDEC ILM4.0	5000	Same	94
Thallium	NYSDEC ILM4.0	10**	Same	20
Vanadium	NYSDEC ILM4.0	50	Same	4
Zinc	NYSDEC ILM4.0	20**	Same	20
BioGeochemical/Wet Chemistry:				
Ethane	AM20GAX	5 ng/L*	--	--
Ethene	AM20GAX	5 ng/L*	--	--
Methane (CH ₄)	AM20GAX	15 ng/L*	--	--
Alkalinity	USEPA 310.1	0.594 mg/L	--	--
Nitrate (NO ₃)	USEPA 300.0	0.002 mg/L	--	--
Nitrite (NO ₂)	USEPA 300.0	0.003 mg/L	--	--
Sulfate (SO ₄)	USEPA 300.0	0.012 mg/L	--	--
Chloride (Cl)	USEPA 300.0	0.147 mg/L	--	--
Total Iron	USEPA 6010	0.1 mg/L	--	--
Total Manganese	USEPA 6010	0.1 mg/L	--	--
Dissolved Iron	USEPA 6010	0.1 mg/L	--	--
Dissolved Manganese	USEPA 6010	0.1 mg/L	--	--
Ammonia	USEPA 350.1	40	--	--
Hardness (as CaCO ₃)	USEPA 130.2	1000	--	--
Orthophosphate	USEPA 365.2	100	--	--
TDS	USEPA 160.1	10,000	--	--
Perchlorate:				
Perchlorate	USEPA 314.0	4	--	--

Notes and Abbreviations:

USEPA	U.S. Environmental Protection Agency
RQLs	Required Quantitation Limits
ug/L	micrograms per liter
mg/L	Milligrams per liter
ng/L	Nanograms per liter
ug/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
*	Method quantitation limits reported by Microseeps, Inc., Pittsburgh, PA.
**	MDL Reported in this instance.
--	Not Applicable

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Table B-4. Analyte List for Analysis of Soil Gas and Air Samples (VOCs), Quality Assurance Project Plan (QAPP), RI/FS Work Plan, Former Grumman Settling Ponds, Bethpage, New York.

Constituent ⁽¹⁾	Method: USEPA Method TO-15
	Matrix: Gas/Air
	Contract-Required Detection Limits ($\mu\text{g}/\text{m}^3$)
VOCs:	
1,1,1-Trichloroethane	1
1,1,2,2-Tetrachloroethane	1
1,1,2-Trichloroethane	1
1,1-Dichloroethane	1
1,1-Dichloroethene	1
1,2-Dichloroethane	1
1,2-Dichloropropane	1
1,3-Butadiene	1
Acetone	1
Benzene	1
Bromodichloromethane	1
Bromoform	1
Bromomethane	1
Carbon Disulfide	1
Carbon Tetrachloride	1
Chlorobenzene	1
Chloroethane	1
Chloroform	1
Chloromethane	1
cis-1,2-Dichloroethene	1
cis-1,3-Dichloropropene	1
Dibromochloromethane	1
Dichlorodifluoromethane (Freon 112)	1
Ethylbenzene	1
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	1
Methyl Butyl Ketone (2-hexanone)	1
2-Butanone (MEK)	1
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)	1
Methylene Chloride	1
Styrene	1
Tetrachloroethene	1
Toluene	1
trans-1,2-Dichloroethene	1
trans-1,3-Dichloropropene	1
Trichloroethene	1
Vinyl Chloride	1
Xylene (m,p) [a]	1
Xylene (o)	1

Notes and Abbreviations:

(1) Listed constituents based on Target Compound List (TCL) volatile organic compounds (VOCs), plus Freon 113 (also known as trichlorotrifluoroethane or 1,1,2-trichloro-1,2,2-trifluoroethane), except for acetone, 2-butanone, 4-methyl-2-pentanone, and 2-hexanone.

USEPA U.S. Environmental Protection Agency

$\mu\text{g}/\text{m}^3$ Milligrams per cubic meter

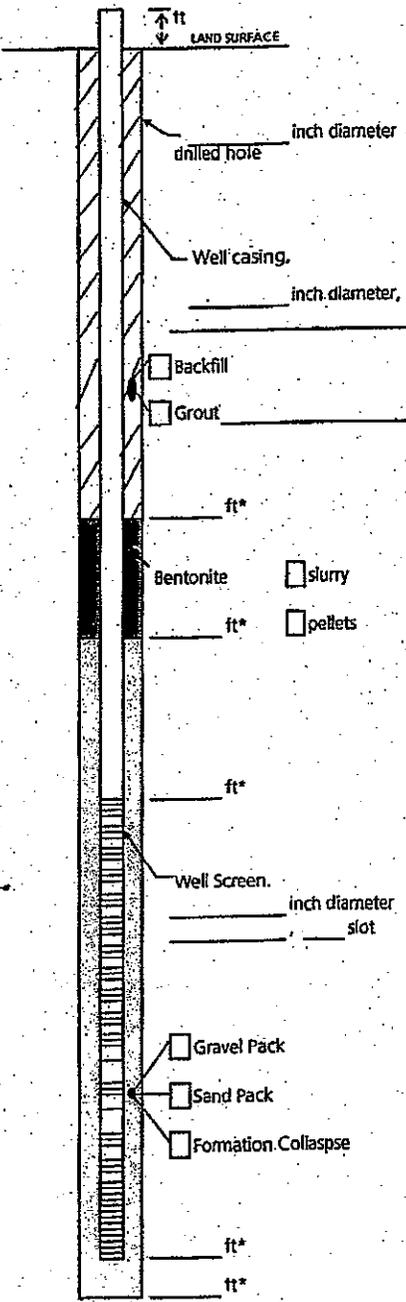
ARCADIS

Attachment B-1

Field Forms

Well Construction Log

(Unconsolidated)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.
* Depth Below Land Surface

Project _____ Well _____

Town/City _____

County _____ State _____

Permit No. _____

Land-Surface Elevation and Datum:
_____ feet Surveyed
 Estimated

Installation Date(s) _____

Drilling Method _____

Drilling Contractor _____

Drilling Fluid _____

Development Technique(s) and Date(s)

Fluid Loss During Drilling _____ gallons

Water Removed During Development _____ gallons

Static Depth to Water _____ feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration _____ hours

Yield: _____ gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose _____

Remarks _____

Prepared by _____

Water Sampling Log

Project _____ Project No. _____ Page 1 of _____
 Site Location _____ Date _____
 Site/Well No. _____ Replicate No. _____ Code No. _____
 Weather _____ Sampling Time: Begin _____ End _____

Evacuation Data

Measuring Point _____
 MP Elevation (ft) _____
 Land Surface Elevation (ft) _____
 Sounded Well Depth (ft bmp) _____
 Depth to Water (ft bmp) _____
 Water-Level Elevation (ft) _____
 Water Column in Well (ft) _____
 Casing Diameter/Type _____
 Gallons in Well _____
 Gallons Pumped/Bailed Prior to Sampling _____
 Sample Pump Intake Setting (ft bmp) _____
 Purge Time begin _____ end _____
 Pumping Rate (gpm) _____
 Evacuation Method _____

Field Parameters

Color _____
 Odor _____
 Appearance _____
 pH (s.u.) _____
 Conductivity (mS/cm) _____
 (µmhos/cm) _____
 Turbidity (NTU) _____
 Temperature (°C) _____
 Dissolved Oxygen (mg/L) _____
 Salinity (%) _____
 Sampling Method _____
 Remarks _____

Constituents Sampled	Container Description	Number	Preservative
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Sampling Personnel

Gal./Ft.	Well Casing Volumes				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65	
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47		

- bmp below measuring point
- °C Degrees Celsius
- ft feet
- gpm Gallons per minute
- mg/L Milligrams per liter
- ml milliliter
- mS/cm Milisiemens per centimeter
- msl mean sea-level
- N/A Not Applicable
- NR Not Recorded
- NTU Nephelometric Turbidity Units
- PVC Polyvinyl chloride
- s.u. Standard units
- µmhos/cm Micromhos per centimeter
- VOC Volatile Organic Compounds



ARCADIS Soil Gas Sample Log

Sample ID _____
 Date _____
 Time _____
 Weather _____
 Atmos. Pressure _____

Project/No. _____
 Sampling Personnel _____

 Wind Speed: _____
 Precipitation?: _____

DESCRIPTION OF SAMPLE LOCATION:

Outdoor
Location _____
Est. depth to water (ft): _____
Soil type: _____
Odor: _____
Color: _____

Indoor
Location _____
Basement: yes / no _____
Room size ft x ft: _____
Floor material: cement / wood / dirt _____
Slab Thickness (ft): _____
Visible cracks?: yes / no _____
Sub-slab material: dirt / gravel _____

PROBE INSTALLATION:

Date: _____
 Method: _____
 Diameter: _____
 Depth: _____
 Packing material: _____

PURGE:

Date: _____
 Time: _____
 Rate: _____
 Volume: _____

SAMPLE COLLECTION:

Sample Time: _____
 Sample Rate: _____
 Sample Volume: _____
 Sample Start Time: _____
 Sample End Time: _____

CONTAINER VACUUM:

Initial Canister Vacuum: _____
 Final Canister Vacuum: _____

CONTAINER DESCRIPTION:

Canister: 6-L Summa _____
 Canister Serial Number: _____

ANALYTICAL METHOD:

Location Sketch:



**Dvirka
and
Bartilucci**
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. CORLUCH ASSOCIATES, P.C.

Project No.:
Project Name:

Boring No.:
Sheet ___ of ___
By:

Drilling Contractor:

Driller:

Drill Rig:

Date Started:

Geologist:

Drilling Method:

Drive Hammer Weight:

Date Completed:

Boring Completion Depth: "

Ground Surface Elevation:

Boring Diameter:

Depth (ft.)	Soil Sample				Headspace Analysis			Sample Description	USCS
	No.	Type	Blows Per 6"	Rec	FID ppm	PID ppm	CH4 ppm		
-0-									
-1.5'									
-2-									
-3-									
-4-									
-5-									
-6-									
-7-									
-8-									
-9-									
-10-									

Sample Types:

SS =

ST =

D&M =

UC = Undisturbed Core (Dennison Type)

NOTES:



**Dvirka
and
Bartilucci**
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Project No.:
Project Name:

Test Pit No.:
Sheet of
By:

Contractor:

Geologist:
Test Pit Method:

Test Pit Completion Depth:
Ground Surface Elevation:
Test Pit Dimension(s):

Operator:
Equipment:

Date Started:
Date Completed:

Weather Conditions:

Depth (ft.)	OVA (ppm)	PID (ppm)	Description of Materials	Remarks
-0-				
-1-				
-2-				
-3-				
-4-				
-5-				
-6-				
-7-				
-8-				
-9-				
-10-				

NOTES:

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Attachment B-2

Chain-of-Custody Forms

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Attachment B-3

Laboratory Quality Assurance Plans
(QAP)

**Laboratory Quality Assurance Plans
have been removed and do not apply to Soil Gas IRM activities**

they are replaced by:

**Columbia Analytical Services Inc. (CAS)
Quality Assurance Manual (QAM)
&
Standard Operating Procedures (SOPs)**

**CAS QAM & SOPs are included with the
December 31, 2007 Addendum to this Quality Assurance Project Plan,
Attachment C-1.2 of the
Sampling and Analysis Plan,
Operable Unit-3 Soil Gas Interim Remedial Measure,
Former Grumman Settling Ponds,
Bethpage, New York
Site # 1-30-003A**

Dated: January 2008

ARCADIS

Attachment C-1.2

Quality Assurance Project Plan
Addendum

Attachment C-1.2: Addendum to Quality Assurance Project Plan (QAPP), Former Grumman Settling Ponds (Operable Unit 3-Bethpage Community Park), Bethpage, New York (March 8, 2006):

The following items are revisions to the QAPP, originally submitted as Appendix B of the Sampling and Analysis Plan (SAP) (ARCADIS March 2006), for the Grumman Remedial Investigation/Feasibility Study (RI/FS) Work Plan prepared for the Former Grumman Settling Ponds, Bethpage, New York. This addendum to the QAPP was prepared to include samples collected for the interim remedial measure (IRM) soil gas system, as specified in the Sampling and Analysis Plan (SAP) (ARCADIS 2008).

Items:

1. Throughout the QAPP document wherever “groundwater” sampling and monitoring are mentioned it is to be understood as “groundwater and condensate water” sampling and monitoring.
2. Throughout the QAPP document wherever “soil gas” sampling and monitoring are mentioned it is to be understood as “soil gas and system vapor” sampling and monitoring.
3. Throughout the QAPP document wherever “laboratory Quality Assurance Plan” is mentioned it is to be understood as Columbia Analytical Services Inc’s. “laboratory Quality Assurance Manual”. This Manual and relevant Standard Operating Procedures for the analytical methods to be used during the OU-3 Soil Gas IRM activities are attached to this addendum.
4. Section 4.1-Field QA/QC: This section, inclusive of subsections: 4.1.1-Field (Equipment Rinsate) Blank; 4.1.2-Trip Blank; 4.1.3-Blind (Field) Duplicates; 4.1.4-MS/MSD Sample; and, 4.1.5-Field records, defines and discusses the collection of QA/QC samples. It is to be understood to include (when applicable) condensate water and system vapor QA/QC sample collection.

These sections reference Table B-1 for information on analytical methods, sample collection quantity, and QA/QC sample collection quantity. This table is not inclusive of the condensate water and system vapor samples. In regards to the condensate water and system vapor samples, please refer to the SAP, Operable Unit 3, Soil Gas Interim Remedial Measure (ARCADIS February 2008).

5. Section 4.2-Preparation and Preservation of Samples Containers: This section references Table B-2, which summarizes analytical methods, sample containers, holding times, and preservation procedures to be used. This table is not inclusive of the condensate water

and system vapor samples. In regard to the condensate water sample collection; sample collection guidelines should be followed. In regard to system vapor sample collection; "Soil Gas" sample collection guidelines should be followed.

6. Section 4.5-Laboratory Analysis: Columbia Analytical Services, Rochester, New York (NYSDOH certified laboratory, ID#: 10145) will be performing the condensate water sample analysis and the system vapor sample analysis.
 - System Vapor Sample analytical method: USEPA Method TO-15 (modified list plus the top 15 tentatively identified compounds (TICs) including the TIC Freon 22). For analyte list, please refer to Table C-2 of the SAP, Operable Unit 3, Soil Gas Interim Remedial Measure (ARCADIS February 2008).
 - Condensate Water Sample analytical method:USEPA 8260. For analyte list, please refer to Table C-3 of the SAP, Operable Unit 3, Soil Gas Interim Remedial Measure (ARCADIS February 2008).
7. Section 4-7-Data Validation: Analytical data for water condensate and system vapor samples collected during this event will receive an ARCADIS Level 1 data validation review. A Level 1 review includes checking the following: chain-of-custody; case narrative, holding time, trip/field/method blanks, and blind duplicate precision. The data validation will be performed by an experienced ARCADIS data validator. A data validation memo, delineating any comments, notes and/or applied qualification to the data, will be prepared for each sample delivery group (SDG) or data package received by the laboratory for such samples.



QUALITY ASSURANCE MANUAL

©Columbia Analytical Services, Inc.

1 Mustard St. Suite 250
Rochester, NY 14609

Phone: (585) 288-5380

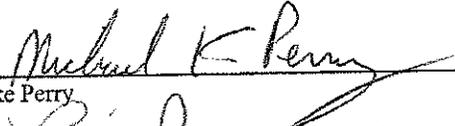
Fax: (585) 288-8475

Revision Date: March 29, 2006

Effective Date: April 10, 2006

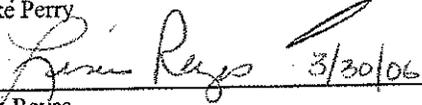
Approved by:

Laboratory Director:



Mike Perry

Quality Assurance Program Manager:



Lisa Reyes

Annual review of this QAM has been performed
and the QAM still reflects current practice.

Initials: JMC Date: 5/11/07

Initials: _____ Date: _____

Initials: _____ Date: _____

DOCUMENT CONTROL

NUMBER: QAM-002

Initials: LR Date: 4/10/06

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3.0 INTRODUCTION AND COMPANY QUALITY ASSURANCE POLICY

Columbia Analytical Services, Inc. (CAS) is a professional consulting laboratory which performs chemical and microbiological analyses on a wide variety of sample matrices, including drinking water, groundwater, surface water, wastewater, soil, sediment, sludge, tissue, industrial and hazardous waste, and other material. CAS/Rochester is a part of a multi Lab Network operating throughout the USA. See Corporate Organization Chart (Appendix B) for locations.

It is a policy at CAS that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. This goal is achieved by ensuring that adequate Quality Control (QC) procedures are used throughout the monitoring process, and by establishing a means to assess performance of these Quality Control and other QA activities. Under the authority of the owner of CAS, a quality policy statement is available under separate cover and is posted on the employee bulletin board.

We recognize that quality assurance requires a commitment to quality and ethics by everyone in the organization - individually, within each operating unit, and throughout the entire laboratory. All employees of CAS undergo lengthy data integrity training and are encouraged to participate in CAS open door policy to ensure a quality product and protect employees from any undue pressures. CAS also has stringent requirements and signed statements from employees to protect client confidentiality and ethical agreements. All personnel must familiarize themselves with the quality documentation and implement the policies and procedures in their work.

The information in this document has been organized according to the format described in *National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Standards*, July 2003 in order to meet the compliance requirements of this standard. This document is controlled under policies required by CAS Document Control SOP (ADM-DOCCTRL). Each CAS network laboratory maintains its own lab specific Quality Assurance Manual.

4.0 QUALITY SYSTEM PROGRAM DESCRIPTION

The purpose of the QA program at CAS is to ensure that our clients are provided with analytical data that is scientifically sound, legally defensible, and of known and documented quality. The concept of Quality Assurance can be extended, and is expressed in the Vision of CAS:

"CAS Holdings, Inc. applies creative thinking and strategic integration of our talents to be the best in all business endeavors we pursue. The Company is a leader in our industry demonstrated by:

- Unprecedented customer satisfaction
- Sustained profitability
- Exceptional technical excellence
- Superior Quality Systems

We value our company's most valuable asset, our employee-owners. We are committed to make CAS Holdings Inc the preferred place to work and grow as individuals and professionals."

In support of this vision, our QA program addresses all aspects of laboratory operations, including laboratory organization and personnel, standard operating procedures, sample management, sample and quality control data, calibration data, standards traceability data, equipment maintenance records, method proficiency data (such as method detection limit studies and control charts), document storage and staff training records.

4.1 Facilities and Equipment

CAS features over 17,000 square feet of laboratory and administrative workspace at its Rochester, NY location. The facility is secured to the rest of the building using a swipe card entry system. Upon hire, each employee is assigned an access card and security code that must be used with their card. This employee-specific card provides access to the lab. SOP's are in place to protect the integrity of samples throughout the laboratory process (SMO-ICOC). A company software Quality Assurance plan exists to provide standard procedures to protect the integrity of electronic data. The laboratory has been designed and constructed to provide safeguards against cross-contamination of samples and is arranged according to work function, which enhances the efficiency of analytical operations.

Specialized areas include:

- Shipping and Receiving/Purchasing

- Sample Management Office (including a separate, controlled-access sample storage area)
- Inorganic/Metals Sample Preparation Laboratories (2)
- ICP and ICP/MS Laboratory
- AA Laboratory
- Water Chemistry & General Chemistry Laboratories
- Gas Chromatography Laboratory (including a separate sample preparation laboratory)
- Gas Chromatography/Mass Spectrometry Laboratory (including a separate sample preparation laboratory)
- Volatile Organics Laboratory (including a separate standard preparation laboratory)
- HPLC and Petroleum Laboratory (including GC and GC/MS)
- Microbiology Laboratory
- Laboratory Deionized Water System
- Laboratory Management, Client Service, Report Generation and Administration
- Data Archive
- Information Technology (IT) and LIMS
- Hazardous Waste Storage Area

In addition, segregated laboratory areas were designed for efficient and safe handling of a variety of sample types. Figures 4-1, 4-2, and 4-3 shows the facility location and layout of our Rochester, NY location. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. Appendix A lists the major equipment at the Rochester facility, illustrating the laboratory's depth and overall capabilities. All analytical instrumentation must be verified for each test prior to reporting data to ensure documented quality (see analytical SOPs and/or ADM-TRANDOC).

Good housekeeping is an essential practice at CAS. Each department is responsible for their own area, keeping isles clear, counters free of debris and chemicals that may cause contamination during analysis. A contracted cleaning service removes all garbage and recyclables, mops the floors, and vacuums each working day.

4.2 Technical Elements of the Quality Assurance (QA) Program

4.2.1 Quality Assurance Manual.

This document describes in detail the company's quality assurance program as well as provides information about test methods available, personnel, equipment, and facilities. The contents of the manual are reviewed annually by the Quality Assurance Program Manager (QAPM) and revised as needed to ensure that it continuously reflects current policies and practices. Personnel information is also updated annually as needed. The QAPM and the Lab Manager must approve all revisions before they are put into effect.

4.2.2 Standard Operating Procedures (SOPs) and Laboratory Notebooks.

CAS maintains SOPs for use in both technical and administrative functions. Included in the list of available SOPs are procedures for the preparation of an SOP document, and for enforcing the control of documents through the laboratory

(ADM-SOP & ADM-DOCCTRL, respectively). Each SOP is implemented as written and has been reviewed and approved by the Laboratory Director, the Quality Assurance Program Manager. In most cases, the SOP has also been approved by the appropriate laboratory supervisor. The SOPs are reviewed annually and are revised as necessary to reflect actual objectives, flow of tasks, and staff responsibilities. The document control process associated with an SOP ensures that only the most currently prepared version of an SOP is being used for guidance and instruction. In addition to SOPs, each laboratory supervisor maintains a current file of all the promulgated methodology used to perform analyses. This file is accessible to all laboratory staff regardless of discipline. Laboratory notebook entries have been standardized following the guidelines in the *Making Entries into Logbooks and onto Benchsheets* SOP (SOP No. ADM-DATANTRY). The entries made into laboratory notebooks are reviewed and approved by the appropriate supervisor at a regular interval (e.g. monthly, quarterly, etc...)

4.2.3 Standard Reference Materials

All analytical measurements generated at CAS are performed using materials and/or processes that are traceable to a Standard Reference Material (SRM). Metrology equipment (analytical balances, thermometers, etc...) is calibrated using SRMs traceable to the National Institute of Standards and Technology (NIST). Consumable SRMs routinely purchased by the laboratories (e.g. primary stock standards) are purchased from nationally-recognized, reputable vendors. Most vendors have fulfilled the requirements for ISO 9001 certification and/or are accredited by A₂LA. Traceability throughout the laboratory is accomplished by following the guidelines set in the SOP, *Making Entries Into Logbooks and Onto Benchsheets* (ADM-DATANTRY).

All sampling containers provided to the client by the laboratory are purchased as precleaned (Level 1) containers, with certificates of analysis available for each bottle type. Certifications of Analysis provided by the vendors of reference materials and bottles are reviewed prior to use and kept on file by the laboratory.

4.2.4 Operational Assessments

There are a number of methods used to assess the laboratory and its daily operations. In addition to the routine quality control (QC) measurements used by a laboratory to measure quality, the senior laboratory management staff at CAS examine a number of other performance indicators to assess the overall ability of the laboratory to successfully perform analyses for its clients. On-time performance, Analytical Report defect rate and Customer Invoice defect rate are a few of the measurements performed at CAS that are used to assess performance from an external perspective (i.e. client satisfaction). A frequent, routine assessment must also be made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload. CAS utilizes a number of different methods to insure that adequate resources are available in

anticipation of the demand for service. Regularly scheduled senior staff meetings, tracking of outstanding proposals and an accurate, current synopsis of incoming work all assist the senior staff in properly allocating resources to achieve the required results.

4.2.5 Additional Quality Records

Quality Reports to Management, Internal and External Audits, and NCAR Forms discuss quality assurance program issues, continuous process improvements, and corrective actions throughout the program and are the responsibility of the QAPM.

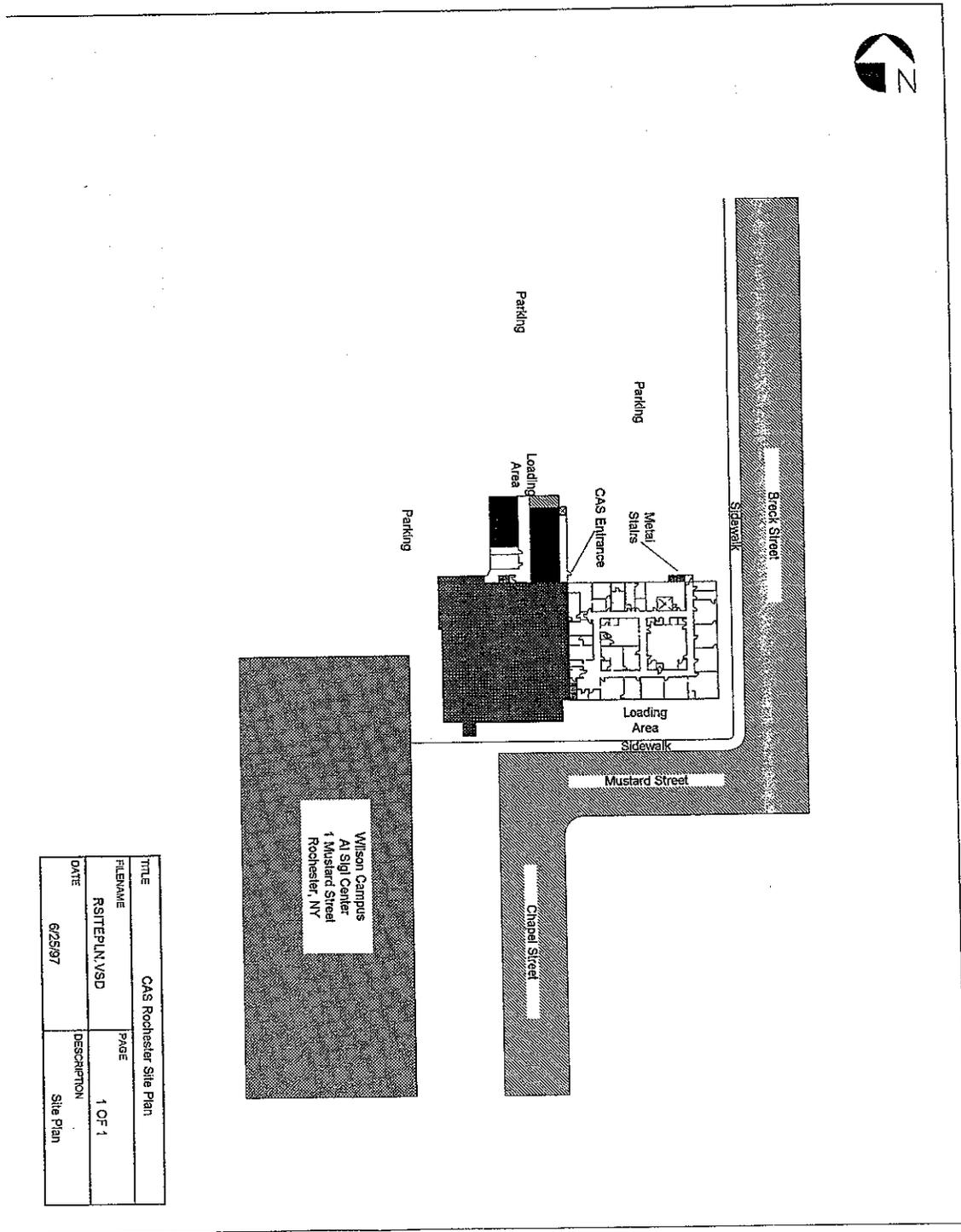
4.2.6 Deviation from Standard Operating Procedures, Policies, or Standard Specifications

When a customer requests a modification to an SOP, policy, or standard specification the Project Manager handling that project must discuss the proposed deviation with the lab director, departmental manager, or QA to obtain approval for the deviation. It is recommended that all project-specific requirements must be on-file and with the service request upon logging in the samples. A Project-Specific Communication Form is available to document such deviations.

4.3 Subcontracting

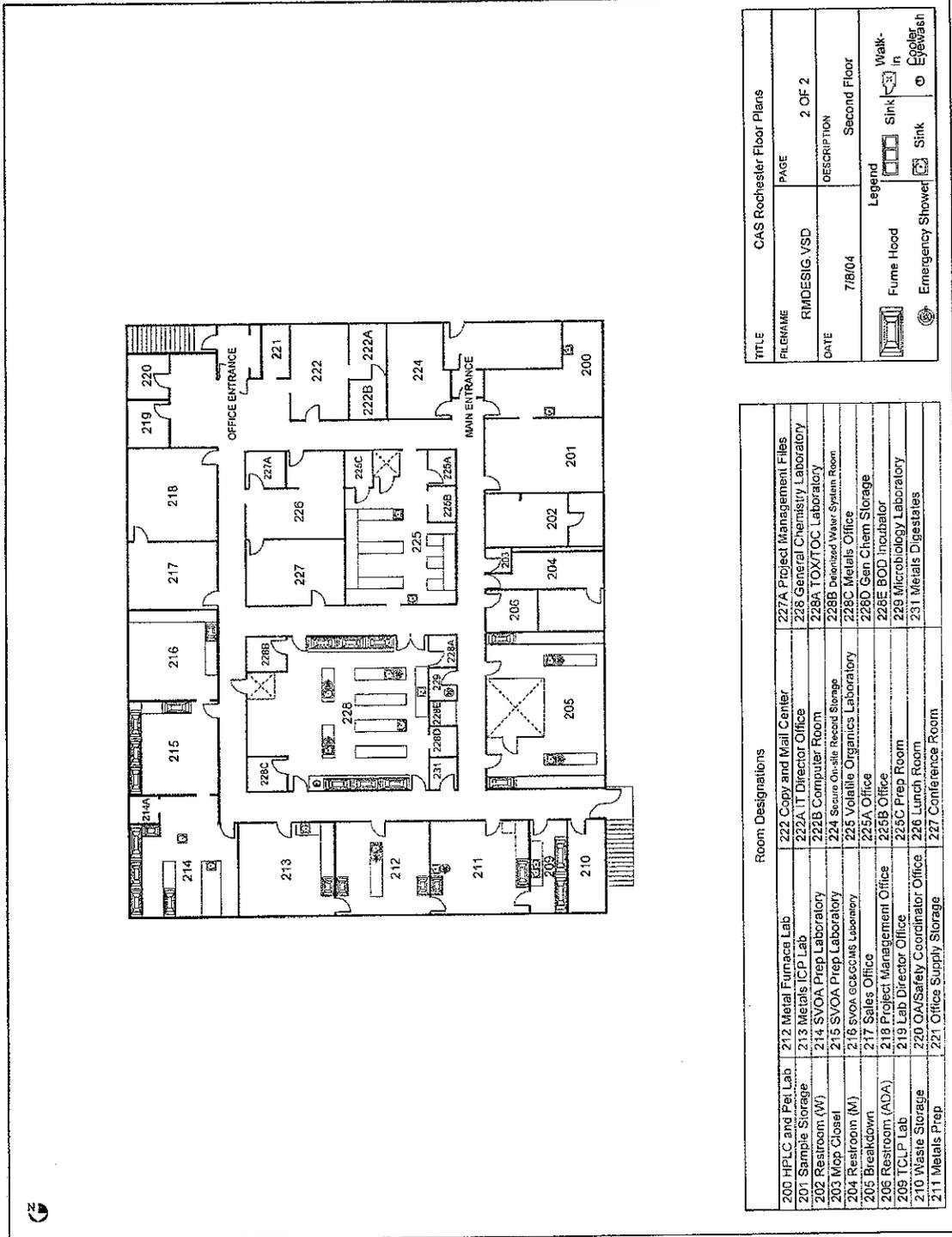
Analytical services are subcontracted when CAS/Rochester needs to balance workload and/or when the requested analyses are not performed in Rochester. However, subcontracting is only done with the knowledge and approval of the client. Subcontracting to another CAS laboratory is preferred over external-laboratory subcontracting. Further, subcontracting is only done to capable and qualified laboratories approved by the client. Subcontractors must be accredited by the applicable state or program to which apply to the samples being analyzed. Established procedures are followed to qualify external subcontract laboratories, see *Qualifying Subcontract Labs* (ADM-SUBLAB).

Figure 4-1
CAS/Rochester Laboratory Floor Plan



TITLE	CAS Rochester Site Plan	
FILENAME	RSITEPLAN.VSD	PAGE 1 OF 1
DATE	6/25/97	DESCRIPTION Site Plan

Figure 4-3
 CAS/Rochester Laboratory Floor Plan



TITLE		CAS Rochester Floor Plans	
FILENAME	PAGE	DESCRIPTION	
RMDESIG.VSD	2 OF 2	Second Floor	
DATE	7/8/04		
Legend		Fume Hood	Sink
		Emergency Shower	Walk-In Cooler

Room Designations	
200 HPLC and Pet Lab	227A Project Management Files
201 Sample Storage	228 General Chemistry Laboratory
202 Restroom (W)	228A TOX/TOC Laboratory
203 Wcp Closet	228B Designated Walk System Room
204 Restroom (M)	228C Metals Office
205 Breakdown	228D Gen Chem Storage
206 Restroom (ADA)	228E BOD Incubator
209 T.C.P. Lab	229 Microbiology Laboratory
210 Waste Storage	231 Metals Digestates
211 Metals Prep	
212 Metal Furnace Lab	222 Copy and Mail Center
213 Metals ICP Lab	222A IT Director Office
214 SVOA Prep Laboratory	223B Computer Room
215 SVOA Prep Laboratory	224 Security/Police Reciprocal Storage
216 SVOA Prep Laboratory	225 Volatile Organics Laboratory
217 Sales Office	225A Office
218 Project Management Office	225B Office
219 Lab Director Office	225C Prep Room
220 OHS/Safety Coordinator Office	226 Lunch Room
221 Office Supply Storage	227 Conference Room

5.0 STATEMENT OF PROFESSIONAL CONDUCT AND LABORATORY PRACTICE

One of the most important aspects of the success of CAS as a company is the emphasis placed on the integrity of the data provided and the services rendered. This success is reliant on both the professional conduct of all employees within CAS as well as established laboratory practices. All personnel involved with environmental testing and calibration activities must familiarize themselves with the quality documentation and implement the policies and procedures in their work.

5.1 Professional Conduct

To promote quality, CAS requires certain standards of conduct and ethical performance among employees. The following examples of documented CAS policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action.
- Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.
- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible.
- Unauthorized release of confidential information about the company or its clients is taken very seriously and is subject to formal disciplinary action. All employees sign a confidentiality agreement upon hire to protect the company and client's confidentiality and proprietary rights.

5.2 Prevention and Detection of Improper, Unethical or Illegal Actions

It is the intention of CAS to proactively prevent and/or detect any improper, unethical or illegal action conducted within the laboratory. This is performed by the implementation of a program designed for not only the detection but also prevention. Prevention consists of educating all laboratory personnel in their roles and duties as employees, company

policies, inappropriate practices, and their corresponding implications as described in Section 5.3 of this document.

In addition to education, appropriate and inappropriate practices are included in SOPs such as manual integration, data review and specific method procedures. Other aspects of this program include electronic data tape audits, post-analysis and whenever possible single blind and/or double blind analyses. All aspects of this program is documented and retained on file according to the company policy on record retention.

5.3 Laboratory Ethics Training Plan (Data Integrity Training Plan)

Laboratory ethics training (approximately 8-hours) is held annually for every new on-site employee including all full and part time personnel. The training session includes at a minimum the following legal and ethical topics:

- Triggers and types of unethical behavior
- CAS Employee Handbook (overview including mechanism for reporting and seeking advice on ethical decisions, organizational mission and its relationship to critical need for honesty and full disclosure).
- CAS' Commitment to Excellence in Data Quality (overview including legal consequences and specific examples of breaches of ethical behavior)
- Discuss and review all data integrity procedures and documentation
- Measures taken to prevent and detect fraud; how and when to report data integrity issues.
- Record keeping and examples of data falsification or misrepresentation
- Acceptable and unacceptable solutions to typical laboratory problems (emphasis on the importance of proper written narration by the analyst with respect to where analytical data may be useful, but in some way partially deficient)
- Data validation (in-depth data monitoring and electronic audits)
- Implications of laboratory data fraud and data investigations
- Potential punishments and penalties for improper, unethical or illegal actions (immediate termination, or civil/criminal prosecution)

It is the responsibility of the Quality Assurance Program Manager to ensure that the training plan described in this section including content and frequency is conducted. All employees may review the mechanism for reporting and seeking advice on ethical decisions as well as the legal consequences of unethical behavior in the CAS Employee Handbook & CAS Commitment to Excellence in Data Quality Statement, both of which are available to all employees. In addition, the Excellence in data Quality Statement is reviewed and signed on an annual basis by all laboratory personnel. Also, all employees are required to complete an ethics "refresher" training (approximately 1-hour) session. The subject and content are generally at the discretion of the Corporate Quality Assurance Department.

5.4 Laboratory Practices Affecting Personnel

CAS makes an attempt to ensure that it is impartial and its employees are free from any commercial, financial, or other undue pressures that might affect their technical judgement or quality of work. This is accomplished by utilizing each of the following policies, programs and procedures, wherever necessary.

CAS Corporate Ethics Point Program – An anonymous and confidential reporting system available to all employees that is used to communicate misconduct and other concerns. The program shall help minimize negative morale and promote a positive work place. Associated upper management is notified and the investigations are documented.

- Open Door Policy (CAS Employee Handbook) – Employees are encouraged to bring any work related problems or concerns to the attention of local management or their Human Resources representative. However, depending on the extent or sensitivity of the concern, employees are encouraged to directly contact any member of upper management.
- Project Scheduling – Jobs are scheduled (when prior notice is available) according to capacity and work schedules set and discussed by customer service personnel and laboratory supervisors. The scheduling is done not only to prevent missed holding times and on-time deliveries but as a way for management and analysts to be prepared for incoming samples and to utilize flexible work schedules, whenever necessary.
- Flexible Work Hours – Analysts are able to work flexible work hours (with management approval). Additionally, analysts may “team” with a co-worker (again with approval) and work split shifts in order to extend the work day and increase the number of samples that can be analyzed, whenever necessary.
- Gifts and Favors (CAS Employee Handbook) – To avoid possible conflict of interest implications, employees do not receive unusual gifts or favors to, nor accept such gifts or favors from, persons outside the Company who are, or may be, in any way concerned with the projects on the Company is professionally engaged. Anything beyond an occasional meal, an evening’s entertainment, or a nominal holiday gift is considered an “unusual gift or favor”.

6.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The CAS/Rochester staff, consisting of approximately 50 employees, includes chemists, technicians and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that a modern, state-of-the-art analytical laboratory requires.

CAS is committed to providing an environment that encourages excellence. Everyone within CAS shares responsibility for maintaining and improving the quality of our analytical services. The responsibilities of key personnel within the laboratory are described below. An organizational chart of the laboratory, as well as the resumes of key personnel, can be found in Appendix B. Specific Job Descriptions are available and kept on file by human resources.

- The role of the **Laboratory Director** is to provide technical, operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. This person is responsible for quality (including compliance with the current version of the Quality Systems, NELAC, Chapter 5), overall laboratory efficiency, and financial performance of the Rochester CAS facility. The Laboratory Director also provides support for business development by identifying and developing new markets and through continuing support of the management of existing client activities. The Lab Director, QA Program Manager and Business Development Manager are authorized signatories for the Rochester facility.
- The responsibility of the **Quality Assurance Program Manager (QAPM)** is to provide a focus for overall QA activities within the laboratory and maintain compliance with the Quality Systems Standards (NELAC, Chapter 5). This person works with individual laboratory production units to establish effective quality assurance and quality control. The QAPM is also responsible for maintaining this QA Manual and performing an annual review of it, updating it if necessary; reviewing, approving, and controlling SOPs; ensure continuous process improvements through the use of control charts and proficiency test samples; reviewing data (Section 12.0); maintaining the laboratory's certifications and approvals (Section 13.0); performing internal QA audits (Section 13.0); preparing QA reports (Section 16.0); maintaining training documentation for all employees including IDCs, CDCs, Training Plan forms, and seminar attendance; maintaining MDL study documentation, responding to QA needs, problems, and requests from technical staff. This person is a technical advisor and is responsible for summarizing and reporting overall unit performance.
- The **Quality Assurance Director (Corporate Quality Assurance)** is responsible for the overall QA program at all the CAS laboratories. The QA Director is responsible for performing an annual on-site audit at each CAS laboratory and preparing a written report; maintaining a data base of information about state certifications and accreditation programs; writing laboratory-wide SOPs; maintaining a data base of CAS-approved subcontract laboratories; providing assistance to QAPMs and laboratory managers; preparing an annual QA activity report; etc.

- The **Health and Safety Officer** is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections. The safety officer is also designated as the Chemical Hygiene Officer.
- The **Client Services Manager** is responsible for the Client Services Department (customer services/project managers, and marketing functions). The Client Services Department provides a complete interface with clients from initial project specification to final deliverables.
- The **Project Manager** is a senior-level, non-line scientist assigned to each client to act as a technical liaison between the client and the laboratory. The Project Manager is responsible for ensuring that the analyses performed by the laboratory meet all project, contract, and regulatory-specific requirements. This entails coordinating with the CAS laboratory and administrative staff to ensure that client-specific needs are understood, and that the services CAS provides are properly executed and satisfy the requirements of the client.
- **Information Technology (IT)** staff are responsible for the administration of the Laboratory Information Management System (LIMS) and other necessary support services. Other functions of the IT staff include laboratory network maintenance, education of analytical staff in the use of scientific software, custom software development and implementation, Electronic Data Deliverable (EDD) generation and data back-up, archival and integrity operations.
- The Analytical Laboratory is divided into operational units, based upon specific disciplines. Each department is responsible for establishing, maintaining and documenting a quality control program based upon the requirements within the Quality Assurance Manual. Each **Department Supervisor/Manager** has the responsibility to ensure that quality control functions are carried out as planned, and to guarantee the production of high quality data. Supervisors have the responsibility to monitor the day-to-day operations to ensure that productivity and data quality objectives are met. Each analyst in the laboratory has the responsibility to carry out testing according to prescribed methods, standard operating procedures and quality control guidelines particular to the laboratory in which he/she is working.
- The **Sample Management Office** plays a key role in the laboratory QA program by providing documentation for all samples received by the laboratory, distributing samples, and maintaining proper storage.
- **Support Services** are provided by corporate purchasing department and/or local purchasing representative to coordinate facility and instrument maintenance, ordering of standards, supplies, reagents, and any other services required.

Analytical work will be conducted by the laboratory under the approval of the client. If any aspect of a project requires sub-contracting, CAS project manager shall notify the client and obtain approval for any sub-contractors prior to completing the analytical program.

7.0 SAMPLING, SAMPLE PRESERVATION, AND HANDLING PROCEDURES

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. CAS recommends that clients follow sampling guidelines described in specifically reference methods including EPA, NIOSH, ASTM, and SW846. Sample handling factors that must be taken into account to insure accurate, defensible analytical results include:

- Amount of sample taken
- Type of container used
- Type of sample preservation
- Sample storage time
- Proper custodial documentation

CAS uses the sample preservation, container, and holding-time recommendations published in a number of documents. The primary documents of reference are: USEPA SW-846, Third Edition (wastewater, soils, and hazardous waste samples), USEPA 600/4-79-020 and 600/4-82-057 (wastewater samples), USEPA 600/4-88-039, 600/4-91-010 and 600/R-93/100 (drinking water samples) and NIOSH, Manual of Analytical Methods 4th Edition (air samples). The complete citation for each reference can be found in section 18.0 of this document. The container, preservation and holding time information are summarized in Table 7-1.

CAS routinely provides sample containers with appropriate preservatives for our clients. The containers are purchased as "precleaned" to a level 1 status, and conform to the requirements for analytical sample established by the USEPA. Certificates of analysis for the sampling containers are available upon request. Our sample kits typically consist of foam-lined, precleaned shipping coolers, specially prepared and labeled sample containers individually wrapped in bubble wrap, chain-of-custody (COC) forms, and custody seals. An example of a sample container label and a custody seal is shown in Figure 7-1. Figure 7-2 is a copy of the chain-of-custody form used at CAS. For extremely large sample container shipments, the containers may be shipped in their original boxes. Such shipments will consist of several boxes of labeled sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc...) to allow the sampling personnel to process the sample containers and return them to CAS. The proper preservative will be always be added to the sample containers or provided in a separate vial prior to shipment, unless otherwise instructed by the client. CAS keeps client-specific shipping requirements on file and utilizes all major transportation carriers to guarantee that sample shipping requirements (same-day, overnight, etc.) are met. CAS also provides its own courier service that makes regularly scheduled trips to the Buffalo, Rochester area.

**Table 7-1
Sample Preservation and Holding Times^a**

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Bacterial Tests				
Coliform, Fecal and Total	W	P,G	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ^d	6-24 hours ^e
Inorganic Tests				
Acidity	W	P,G	Cool, 4°C	14 days
Alkalinity	W	P,G	Cool, 4°C	14 days
Ammonia	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Biochemical Oxygen Demand (BOD)	W	P,G	Cool, 4°C	48 hours
Bromide	W	P,G	None Required	28 days
Chemical Oxygen Demand (COD)	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Chloride	W	P,G	None Required	28 days
Chlorine, Total Residual	W	P,G	None Required	24 hours
Color	W	P,G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	W	P,G	Cool, 4°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid	14 days
Cyanide, Weak Acid Dissociable	W	P,G	Cool, 4°C, NaOH to pH>12	14 days
Fluoride	W	P,G	None Required	28 days
Hardness	W	P,G	HNO ₃ or H ₂ SO ₄ to pH<2	6 months
Hydrogen Ion (pH)	W	P,G	None Required	24 hours
Ignitability	W	G	None Required	14 days
Kjeldahl and Organic Nitrogen	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Nitrate	W	P,G	Cool, 4°C	48 hours
Nitrate-Nitrite	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Nitrite	W	P,G	Cool, 4°C	48 hours
Orthophosphate	W	P,G	Filter Immediately, Cool, 4°C	48 hours
Oxygen, Dissolved (Probe)	W	G, Bottle and Top	None Required	Analyze immediately
Oxygen, Dissolved (Winkler)	W	G, Bottle and Top	Fix on Site and Store in Dark	8 hours
Phenolics, Total	W	G Only	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Phosphorus, Elemental	W	G Only	Cool, 4°C	48 hours
Phosphorus, Total	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Residue, Total	W	P,G	Cool, 4°C	7 days
Residue, Filterable (TDS)	W	P,G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	W	P,G	Cool, 4°C	7 days
Residue, Settleable	W	P,G	Cool, 4°C	48 hours
Residue, Volatile	W	P,G	Cool, 4°C	7 days

Table 7-1 (continued)
Sample Preservation and Holding Times^a

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Silica	W	P Only	Cool, 4°C	28 days
Specific Conductance	W	P,G	Cool, 4°C	28 days
Sulfate	W	P,G	Cool, 4°C	28 days
Sulfide	W	P,G	Cool, 4°C, Add Zinc Acetate plus Sodium Hydroxide to pH>9	7 days
Sulfite	W	P,G	None Required	24 hours
Surfactants (MBAS)	W	P,G	Cool, 4°C	48 hours
Tannin and Lignin	W	P,G	Cool, 4°C	28 days
Temperature	W	P,G	None Required	Analyze immediately
Turbidity	W	P,G	Cool, 4°C	48 hours
Metals				
Chromium VI	W	P,G	Cool, 4°C	24 hours
Mercury	W	P,G	HNO ₃ to pH<2	28 days
	S	P,G	Cool, 4°C	28 days
Metals, except Chromium VI and Mercury	W	P,G	HNO ₃ to pH<2	180 days
	S	G, Teflon-Lined Cap	Cool, 4°C	180 days
	A	Filters in Cassettes	None Required	180 days
Organic Tests				
Oil and Grease	W	G, Teflon-Lined Cap	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Organic Carbon, Total (TOC)	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Organic Halogens, Total (TOX)	W	G, Teflon-Lined Cap	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Organic Halogens, Adsorbable (AOX)	W	G, Teflon-Lined Cap	Cool, 4°C, HNO ₃ to pH<2	28 days
Petroleum Hydrocarbons, Total Recoverable	W	G, Teflon-Lined Cap	Cool, 4°C, HCl or H ₂ SO ₄ to pH<2	28 days
Petroleum Hydrocarbons, Total	W	G, Teflon-Lined Cap	Cool, 4°C, HCl or H ₂ SO ₄ to pH<2	7 days until extraction; 40 days after extraction
	S	G, Teflon-Lined Cap	Cool, 4°C	14 days until extraction; 40 days after extraction
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics)	W	G, Teflon-Lined Septum Cap	Cool, 4°C, HCl to pH<2 No Headspace	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C Minimize Headspace	14 days

Table 7-1 (continued)
Sample Preservation and Holding Times^a

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Volatile Organics				
Purgeable Halocarbons	W	G, Teflon-Lined Septum Cap	No Residual Chlorine Present: HCl to pH<2, Cool, 4°C, No Headspace Residual Chlorine Present: 10% Na ₂ S ₂ O ₃ , HCl to pH<2, Cool, 4°C, No Headspace	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE)	W	G, Teflon-Lined Septum Cap	No Residual Chlorine Present: HCl to pH<2, Cool, 4°C, No Headspace Residual Chlorine Present: 10% Na ₂ S ₂ O ₃ , HCl to pH<2, Cool, 4°C, No Headspace	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
Acrolein, Acrylonitrile, Acetonitrile	W	G, Teflon-Lined Septum Cap	Adjust pH to 4-5, Cool, 4°C, No Headspace	14 days
Semivolatile Organics				
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics)	W,S	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction; ^f 40 days after extraction
EDB and DBCP	W,S	G, Teflon-Lined Cap	Cool, 4°C, HCl to pH<2, No Headspace	28 days
Alcohols and Glycols	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Phenols	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Phthalate Esters	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Nitrosamines	W,S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark ^g	7 days until extraction; ^f 40 days after extraction
Organochlorine Pesticides and PCBs	W,S	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction; ^f 40 days after extraction

Table 7-1 (continued)
Sample Preservation and Holding Times^a

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Nitroaromatics and Cyclic Ketones	W,S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark ^g	7 days until extraction; ^f 40 days after extraction
Polynuclear Aromatic Hydrocarbons	W,S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark ^g	7 days until extraction; ^f 40 days after extraction
Haloethers	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Chlorinated Hydrocarbons	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Organophosphorus Pesticides	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Nitrogen- and Phosphorus-Containing Pesticides	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Chlorinated Herbicides	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Chlorinated Phenolics	W	G, Teflon-Lined Cap	Cool, 4°C ^g	30 days
Resin and Fatty Acids	W	G, Teflon-Lined Cap	Cool, 4°C ^g	30 days
Carbonyl Compounds (Formaldehyde)	W	G, Teflon-Lined Cap	Cool, 4°C	3 days until extraction, 3 days after extraction
Industrial Hygiene Solvents	A	IH Air Tubes	None Required	14 days from sample collection
Toxicity Characteristic Leaching Procedure (TCLP)				
Mercury	HW	P,G	Sample: Cool, 4°C TCLP extract: HNO ₃ to pH<2	28 days until extraction; 28 days after extraction
Metals, except Mercury	HW	P,G	Sample: Cool, 4°C TCLP extract: HNO ₃ to pH<2	180 days until extraction; 180 days after extraction
Volatile Organics	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C Minimize Headspace TCLP extract: Cool, 4°C, HCl to pH<2, No Headspace	14 days until extraction; 14 days after extraction