REPORT

Remedial Investigation/Feasibility Study Work Plan
ITT Automotive, Inc.
Town of Gates, New York
(Site #8-28-112)

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May 2004

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ENGINEERS, INC.

Contents

List of Tables

List of Figures

List of Appendices

1. Introduction

1.1. General

This document is the Remedial Investigation/Feasibility Study (RI/FS) Final Work Plan for the ITT Automotive, Inc. Site (Site # 8-28-112) in Town of Gates, New York. The ITT Automotive (ITT) property is considered the Site for purposes of the RI/FS only. The adjacent former Alliance Metal Stamping and Fabricating (AMSF) property is presently considered an off-Site property for purposes of the RI/FS, however due to the distribution of constituents of concern the combined ITT and AMSF properties are included in the scope of work and are presented in figures. A Site location plan is included as Figure 1. The RI/FS is being performed pursuant to the Order on Consent (B8-0614-02-05) between the New York State Department of Environmental Conservation (NYSDEC) and ITT Automotive, Inc. dated August 28, 2003 (Consent Order).

The scope presented herein was developed based on reviews of previous Site and off-Site sampling activities and discussions with the NYSDEC. The RI/FS will be performed in accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988) and Part 300.68 of the National Contingency Plan, CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

1.2. Project Objectives

The objectives of the RI/FS are to:

- Collect additional data necessary to evaluate and characterize the nature and extent of volatile organic compounds (VOCs) and 1,4-dioxane associated with the ITT facility and adjacent off-Site properties including the former AMSF Facility;

- Further evaluate potential residual migration pathways;

- Evaluate potential exposure to human receptors via performance of formal risk assessments in accordance with USEPA Risk Assessment Guidance for Superfund (RAGS) guidance documents;

- Identify remedial action objectives;

- Gather sufficient data to support the FS; and

- Select a remedial alternative that provides protection to human health and the environment, complies to the extent practicable with applicable standards, criteria and guidance (SCGs), and reduces the mobility and/or toxicity of Site-related VOCs and 1,4-dioxane.

1.3. Project Approach

The following questions were used to evaluate existing data and identify data needs to develop this Work Plan to achieve the project objectives in a comprehensive, timely, cost-effective and technically supportable manner:

- What are the relative concentrations of VOCs and 1,4-dioxane at the Site and off-Site in soil, bedrock, and ground water?

- How are the VOCs and 1,4-dioxane distributed at the Site and off-Site within soil, bedrock, and ground water?

- What are the potential exposure pathways?

- What are the potential receptors?

- What VOCs and 1,4-dioxane pathways have actual or potential impacts on public health and the environment?

- What existing data is available and what additional data needs to be collected to evaluate the Site?

The previous investigations at the Site and off-Site provide a valuable frame of reference for this RI/FS. To some extent answers to the above questions have been partially developed by previous studies. This frame of reference based on previous investigations will shorten the project life cycle and reduce the duration of potential exposures to human health and the environment.

1.4. Document Format

This document contains the following sections:

Section 1 – Introduction
Section 2 – Site Background
Section 3 – Project Scoping
Section 4 – Remedial Investigation Work Plan
Section 5 – Development of Remedial Action Objectives
Section 6 – Remedial Investigation Report
Section 7 – Feasibility Study
Section 8 – Project Management

2. Background

2.1 Site Background

The ITT facility consists of a 45,500 square foot one-story building located on approximately three acres of property in the Town of Gates, New York. The property is located approximately ¾-mile north of the Little Black Creek and 2 ¼-miles to the southwest of the Erie Canal. The property is bordered to the north by a movie theater complex; to the south by a vacant lot; to the east by the former AMSF property; and to the west by the Batesville Casket Company (Figures 1 and 2) (Golder, March 2000).

The ITT facility manufactured aluminum components for automotive air conditioning and various general applications. Operations include drilling and machining, alkali cleaning, tube forming, aluminum brazing and welding (Golder, March 2000).

The former AMSF facility covers approximately 125,000 square foot. The original building has been expanded on several occasions since its construction in 1967. The property is bordered to the north by the movie theater complex; to the south by a vacant lot; to the west by the ITT Automotive Inc. property; and to the east by an industrial property (Figure 2) (GeoServices, 1992)

During its operation, the AMSF facility conducted stamping, forming, cleaning, grinding, painting and deburring of metals. The exact date AMSF ceased operations was not reported, but the air permits for the site were surrendered in 1995.

2.2 Physiography

Climate

Rochester has a humid, continental climate. Annual precipitation averages about 34 inches. The mean annual temperature is 47.7°F. The growing season lasts approximately 180 days per year. The National Weather Service Station located at the mouth of the Genesee River at about the mid point of the south shore of Lake Ontario is one of three stations that collect weather data for the area (NOAA, 2002).

Topography

The Site is generally flat with a gentle slope to the south. Located on the north and west sides of the ITT facility, drainage swales collect run off from the paved and grass area's on the north and west sides of the property, and drain to a drainage ditch located on the north side of Pixley Industrial Parkway. It is assumed that this storm water discharges into Little Black Creek. On the east side of the ITT facility, a drain tile pipe is located in a shallow swale. Surface water from the east side of the ITT property is collected and is discharged, through a berm, to the drainage swale on the west side of the AMSF facility. This swale then drains to a recharge well located at the southwest corner of the AMSF property (Golder, March 2000).

A recharge well is located on the ITT property near the southwest corner of the facility (Figure 2). Roof drains collecting water from the western two-thirds of the building and drain into this recharge well (Golder, March 2000).

Surface water and roof drainage on the AMSF property are directed to five (5) recharge wells located on the AMSF property (Figure 2) (GeoServices, 1994)

2.3 Regional and Site Hydrogeology

Regional Geology

Approximately 8 ft to 10 ft of overburden soil overlies the bedrock. The bedrock, Ordivician through Silurian sedimentary rocks, is made up of approximately 160 ft of dolomitic strata of the Middle Silurian Lockport Group underlain by the Decew Dolomite and the Rochester Shale formation of the Clinton Group. A dip of approximately 1 percent to the southeast occurs in the region (Golder, March 2000).

According to the Surficial Geologic Map of New York (1986), a northwest to southeast trending topographic high was located to the north of the Site. This topographic high was a kame moraine consisting of variably textured boulders to sand (Golder, March 2000). The topographic high has apparently been removed due to development.

Regional Hydrogeology

The overburden soils, identified as glacial tills and glaciolacustrine silts and clays, generally yield very low amounts of water. The Lockport Group contains the principle aquifers for the area. Ground water in this bedrock unit flows predominantly in the horizontal bedding plane with some flow occurring along the local and regional vertical fractures (Golder, March 2000). The professional literature reports a strong vertical anisotropy in the Lockport Dolomite that ranges from 70/1 in areas with vertical fractures to over 1,000/1 (Yager, 1996).

Regional bedrock ground water flow is to the north towards Lake Ontario but local features such as the Genesse River, the Erie Canal, and a local dolomite quarry may affect ground water flow at the Site (Golder, March 2000).

Site Geology

Overburden soil is present beneath the Site, which in turn overlies a thick sedimentary bedrock unit. The surficial geologic map indicates that the overburden soil is made up of lacustrine silts and clays. (Surficial Geologic Map of New York, Finger Lakes Sheet, 1,986; Golder, 2001).

Overburden soil thickness at the Site varies from 7 ft to 12 ft. This material consists of surficial fill materials (0 ft to 2 ft) overlying lacustrine clays with interbedded silt lenses. This silty clay varied in thickness from 2.5 ft to 6 ft. The unit is described as a firm to stiff, red brown, silty clay with trace to little sand and gravel, with limited inter-bedded silt layers and transitions to a soft, clayey silt with trace sand and gravel. The elevation of the top of bedrock, based on boring information, slopes southwards at approximately 1 percent (Golder, March 2000).

Based on bedrock and hydrogeologic characteristics, the bedrock was divided into three (3) zones. The upper most zone, designated the "shallow bedrock zone", is comprised of the Eramosa Dolomite. The Eramosa Dolomite is a thick to medium bedded, dark to medium brownish-grey, bituminous, styolitic, vuggy, dolomite, with carbonaceous partings that emits a petroliferous odor. At the Site, the Eramosa Dolomite is moderately fractured with a void or bedding plane between 15 ft and 18 ft bgs. This bedding plane marks the end of the shallow bedrock zone (Golder, March 2000).

The "intermediate bedrock zone," is defined as the bedrock between the "shallow bedrock zone" (void or bedding plane between 15 ft and 18 ft bgs) and the base of the Eramosa Dolomite (45 to 50 bgs). (Golder, March 2000).

The lowest zone identified at the Site, designated the "deep bedrock zone", correspond to the upper and lower Penfield Formation of the Lockport Group and the Decew Dolomite. The upper Penfield Formation is below the Eramosa Dolomite and is described as a medium to thick-bedded, fine grained, sandy, laminated, dolomite, which is sparsely styolitic, with carbenaceous partings. The upper Penfield Formation is between 24 and 32 ft thick and is located approximately 55 ft to 89 ft bgs. Below the upper Penfield formation is the lower Penfield Formation, which is described as a medium to thick-bedded, dark brownish-gray, laminated, bio-turbated, dolowackestone. The lower Penfield Formation is between 11 and 23 ft thick and is located approximately 80 ft to 100 ft bgs. The Penfield Formation is moderately to minimally fractured (Golder, March 2000).

Below the Penfield Formation is the Decew Dolomite of the Clinton Group. The Decew Dolomite is described as variably bedded, dark gray to olive gray argillaceous to sandy, fine-grained dolomite, with shaly partings. Site deep bedrock monitoring and recharge wells were terminated in this unit. Below the Decew Dolomite is the Rochester

Shale of the Clinton Group. This unit was not encountered during previous investigations.

Site Hydrogeology

Ground water occurrence in the Site overburden is localized. The water table occurs in the bedrock at the Site. Three (3) hydrogeologic zones have been identified at the Site based on geologic and hydraulic characteristics (Golder, March 2000). These zones coincide with the bedrock zones discussed above. The shallow bedrock zone extends from the top of bedrock to a depth of 15 ft to 18 ft bgs. The intermediate bedrock zone extends from the bottom of the shallow bedrock zone to a depth of 45 ft to 50 ft bgs. The deep bedrock zone is defined as extending from the bottom of the intermediate bedrock zone to the termination depth of the investigations. Ground water flow is primarily along bedding planes and horizontal fractures. Minor vertical fractures have been observed during Site and off-Site investigations, and vertical fractures are known to exist within this formation. These vertical fractures may provide vertical pathways for ground water flow and dense non-aqueous phase liquids (DNAPL).

The shallow bedrock zone consists of the upper 5 to 10 ft of the bedrock. The shallow bedrock zone is medium to thick-bedded dolomite and corresponds to the upper portion of the Eramosa Dolomite. On the ITT property, shallow wells ITTSBW-1A, ITTSBW-2, ITTSBW-4, ITTSBW-5A, ITTMW-6, ITTSBW-7, and ITTSBW-8 monitor this zone (Figure 2). On the AMSF property, shallow wells AMSFMW-4, AMSFMW-5S, AMSFMW-6, AMSFMW-7, AMSFMW-8S, AMSFMW9S, and AMSFMW-10 monitor this zone. In-situ tests documented a hydraulic conductivity range from 6.03×10^{-2} cm/sec to 1.36×10^{-1} cm/sec with a geometric mean of 1.3×10^{-1} cm/sec. Calculated ground water flow rates range between 2.5 ft/day and 7.3 ft/day.

Shallow bedrock ground water potentiometric maps developed for the ITT and AMSF properties in previous reports (GeoServices, 1994; Golder, March 2000; NYSDEC, 2000) indicate that ground water flow is generally towards the north/northeast. This is opposite to the direction of bedrock dip and site topography, which are to the south. The northward groundwater flow direction of the shallow aquifer is consistent with regional groundwater flow towards Lake Ontario.

The intermediate bedrock zone begins from the base of the shallow bedrock zone and extends to a depth of approximately 45 to 50 ft below ground surface. This zone corresponds to the lower portions of the Eramosa Dolomite. The estimated mean hydraulic conductivity of this zone is 3.5×10^{-3} cm/sec.

The deep bedrock zone is considered to extend from the base of the intermediate bedrock zone to the Decew Dolomite. The deep bedrock zone includes the lowermost portion of the Eramosa Dolomite, the Upper and Lower Penfield Formation, and the Decew Dolomite. ITT deep monitoring wells ITTDBW-2, ITTDBW-5, and ITTDBW-8 monitor this zone (Figure 2). On the AMSF property, deep wells AMSFMW-1D, AMSFMW-3D, AMSFMW-5D, AMSFMW-8D, and AMSFMW-9D monitor this zone. This zone is characterized by less conductive horizontal bedding plane/fractures. The estimated mean hydraulic conductivity for the deep bedrock zone is $4.8\text{x}10^{-4}$ cm/sec. Deep bedrock ground water potentiometric maps indicates that ground water flow is generally towards the north/northwest.

Deep bedrock wells on the Site reportedly have a history of clogging with existing sediment in the bedding planes/fractures.

Vertical hydraulic gradients on the ITT site and the neighboring AMSF site vary considerably. The vertical gradients between shallow bedrock and deep bedrock wells range from close to zero to over 1 ft/ft. The cause of this wide range in vertical gradients has not been reported, however it may relate to the degree of vertical fracturing in the vicinity of the individual nested wells.

Based upon the relative hydraulic conductivities of the three (3) bedrock zones, the shallow bedrock zone likely is a significant ground water flow zone.

3. Project Scoping

3.1 Previous Studies

ITT PROPERTY

The following studies were previously performed at the ITT Property. These studies were completed without NYSDEC review or approval. Consequently the NYSDEC does not necessarily endorse the assessments and conclusions. However the previous data will be used to assist in the site evaluation.

Quantitative Environmental Survey at ITT-Higbie Baylock Rochester Form Machine, H2M Group, April 1993.

The objective of the investigation was to evaluate potential impacts to the environment associated with eight (8) identified areas of potential environmental concern. The investigation consisted of the installation of soil borings and monitoring wells.

Chemical analysis of the soil and ground water included VOCs, total petroleum hydrocarbons (TPHs), pH quantified in soils, and metals.

Results of this investigation indicated that two (2) areas were identified as needing further investigation due to the presence of VOCs including 1,1,1-trichloroethane (TCA) and 1,4-dioxane. These areas were located in the southwest corner and in the northeast corner of the facility, respectively.

Final Report on Ground Water Investigation, ITT Industries, Fluid Handling System, Golder Associates Inc., March 2000.

The objective of this investigation was to further evaluate ground water conditions at the property. The investigation included the installation of five (5) shallow bedrock wells, three deep bedrock wells, and seven (7) overburden soil borings. The report also included a description of the site geology and hydrogeology for the shallow, intermediate, and deep bedrock zones. This description included the characterization of the ground water flow and hydrogeologic regime.

Results of the analytical testing indicated the presence of VOCs in the overburden soil and the ground water beneath the property. The primary VOC of concern was TCA, which was detected in both soil and ground water. The highest concentration of VOCs in the shallow ground water was located in the northeast corner of the ITT facility.

Analytical results from the ground water samples collected from the deep bedrock monitoring wells indicated the presence of VOCs. Results indicated the presence of TCA and 1,1-dichloroethane (1,1-DCA) at or slightly above the ground water standard. Benzene, toluene and xylene (BTX) compounds were also detected in deep bedrock wells. The VOCs detected in the deep bedrock zone are much lower in concentration than in the shallow bedrock zone.

Results of this investigation indicated that the presence of VOCs in the overburden soils at the ITT facility may be attributed to past operations at the Site and/or from VOCs present in the shallow bedrock ground water. BTX compounds detected in the deep bedrock zone were considered to be the likely result of the natural occurrence of these compounds in the bedrock underlying the Site.

Supplemental Subsurface Investigation, Risk Assessment, Natural Attenuation Evaluation and Soil Remediation, ITT Industries, Golder Associates, Inc., May 2000.

Golder Associates conducted a supplemental subsurface investigation, a screening level risk assessment, a natural attenuation evaluation, and soil remediation at the ITT facility. The investigation included the installation of 45 soil borings in the northeast corner of the property and ground water sampling of the existing monitoring wells.

The soil analytical results indicate that TCA and 1,4-dioxane were detected in most of the soil samples. Based on the results of the supplemental soil investigation, a soil remediation plan was designed and executed at the ITT facility. The remediation removed and disposed of soil containing VOCs above the NYSDEC recommended soil cleanup objective. Approximately 968 tons of impacted soils were removed from the northeastern portion of the property between November 17 and 24, 1999.

Ground water samples were collected from the shallow and deep bedrock monitoring wells at the ITT facility and analyzed for natural attenuation parameters. The natural attenuation evaluation provided a strong indication that natural attenuation processes were occurring in the shallow and deep ground water systems at the ITT property.

A screening level risk assessment was also performed to evaluate the potential risk to industrial/commercial site users of the ITT property. Results indicated that it was unlikely that the current site subsurface conditions would pose a health risk due to exposure to TCA and 1,4-dioxane in the soil and shallow ground water.

Transducer Study, ITT Automotive, Inc., O'Brien & Gere Inc., September 2003

This investigation included ground water head and temperature monitoring at eight (8) monitoring wells and one recharge well on the ITT facility for a period of 33 days. The objective of this study was to evaluate whether the discharge of precipitation runoff into recharge wells on the ITT and the neighboring properties affect ground water elevations and ground water flow patterns.

Results of the investigation showed that the shallow bedrock ground water head beneath the ITT property responded quickly to precipitation runoff discharge to the site recharge well. The ITT recharge well affected the ground water head and temperature in the shallow bedrock. A sequence in ground water head response also occurred in monitoring wells on the northern portion of the property, which were located at increasing distances from AMSF recharge well RW-2.

In addition, ground water elevations measured at the time of peak head response documents an east to west hydraulic gradient across the northern portion of the ITT property.

AMSF SITE

Characterization of Soil and Ground Water Quality at the Alliance Metal Stamping and Fabricating Property, Pixley Industrial Park, Gates, NY, GeoServices Ltd., October 16, 1992

GeoServices, Ltd. conducted a soil and ground water quality characterization at the AMSF property. Eleven soil borings were completed in the southwestern portion of the property and eight (8) borings were completed in the southern portion of the property.

Analytical results indicated that tetrachloroethene (PCE) and TCA were detected in the soil samples.

Four (4) monitoring wells had been previously installed at the AMSF property in conjunction with a November 1991 environmental site assessment for characterization of ground water flow and quality beneath the subject property. (A copy of the report documenting the November 1991 investigation is not available). Six (6) monitoring wells and five (5) deep piezometers were constructed during the 1992 investigation in order to characterize ground water flow and VOCs occurrences.

Analytical results indicate that VOCs were present in ground water at each of the locations sampled. TCA and PCE accounted for more than 65 percent of the total VOCs in 13 of the 15 wells sampled. Degradation products of those chlorinated compounds account for the remainder of the VOCs detected. The degradation products account for a greater percentage of the total VOCs in the ground water of the deep piezometers.

Report of June 1993 Site Testing and May 1994 Site Remediation Work, The Alliance Metal Stamping and Fabricating Property, Pixley Industrial Park, Gates, NY, GeoServices Ltd., August 2, 1994.

In 1993 and 1994, GeoServices, Ltd. conducted environmental testing and site remediation work at the AMSF property. Soil samples were collected beneath the depth interval previously tested at a location on the western side of the AMSF property and from the AMSF property hydraulically upgradient of MW-7.

The deeper soil sample results indicated that VOCs were present. The soil samples contained TCA, PCE and 1,1,2-trichloroethane.

Six (6) soil borings were completed at the upgradient location on the property. Analytical results indicated that soils at this upgradient location contained TCA.

Two (2) existing AMSF storm water recharge wells, RW-1 and RW-2, were sampled along with other site monitoring wells. Analytical results indicated that VOCs were detected in many of the monitoring and recharge wells. TCA was the principle VOC detected.

Based on the soil sampling results obtained, a soil excavation/remediation plan was conducted at four (4) locations on the AMSF property in May 1994 in order to remove soil containing relatively elevated VOCs. The locations were: two in the area of the southwest corner of the building, the northeast corner of the building, and the south central portion of the property.

ITT/AMSF SITE

Site Investigation Report ITT Automotive Fluid Handling Systems and Former Alliance Metal Stamping and Fabricating, Town of Gates, Monroe County. NYSDEC, December 2001.

The NYSDEC performed an investigation at both the ITT and the AMSF facilities, focusing on the northeast corner of the ITT property and the adjacent northwest corner of the AMSF property.

Field activities consisted of sampling existing monitoring wells, surface and subsurface soils, storm water recharge wells and conducting several rounds of additional ground water sampling.

The NYSDEC report indicated that a consequential amount of hazardous waste, in the form of chlorinated VOCs, has been disposed of at the ITT property and potentially at the AMSF property. Additional compounds, including non-chlorinated VOCs, semivolatile organic compounds (SVOCs), and inorganic compounds were detected exceeding the standards, but the results were not indicative of hazardous waste disposal.

The report recommended that the ITT property and the AMSF property be considered for inclusion in the New York State Listing of Inactive Hazardous Waste Disposal Sites.

3.2 Site Access

The ITT property is currently accessible. Access for the AMSF property and other necessary off-Site properties will be negotiated prior to the initiation of Site activities. If necessary, NYSDEC may provide support in obtaining access to AMSF and other off-Site properties.

3.3 Conceptual Site Model

Based on the results of the previous investigations at the Site and off-Site, VOCs and 1,4-dioxane have impacted the soil and ground water. The nature and extent of the impacts are summarized below. The location of known potential historic sources is shown in Figure 3.

Overburden Soil

Chlorinated VOCs and 1,4-dioxane have been identified in the overburden soils under the northeast portion of the ITT property. The documented area of impacted soil included the northern edge of the building and a portion of the parking area north of the building. The northern and western extent of the VOCs and 1,4-dioxane was previously defined; however the southern extent of impacts was not defined because of access limitations in the building. The eastern extent of impacted soil has been partially defined. The impacted soil under the parking area was excavated and disposed of off-site (Golder, 2000). The overburden soils are generally unsaturated.

TCA was the primary VOC detected in the soils. The ITT facility used this compound during past operations; however, there is no documentation of a spill or release of TCA from the facility.

Soil investigations on the AMSF property have identified VOCs, including TCA. Based on the documentation of VOCs in soil, soil excavation/remediation activities were completed at four locations on the AMSF property. These remedial activities were in areas associated with VOC releases from AMSF operations.

Shallow Bedrock Ground Water

VOCs and 1,4-dioxane have been detected in the Site and off-Site shallow bedrock ground water, primarily in the northeast portion of the ITT property and the northwestern portion of the AMSF property. TCA is the principle VOC detected in the shallow bedrock ground water. The horizontal extent of the VOCs and 1,4-dioxane has been partially defined on the Site and off-Site, but the northern extent of the impacts has not been defined. The source of these VOCs and 1,4-dioxane has not been determined. Both the AMSF and ITT facilities used TCA during past operations.

PCE has been detected in the ground water beneath the southern portion of the AMSF property. The source of this PCE plume is not known at this time, but does not appear to be related to the ITT property.

Ground water flow in the shallow bedrock zone is generally to the north across the Site and off-Site. However, recharge wells on the Site and off-Site likely alter the ground water flow pattern during precipitation events.

Deep Bedrock Ground Water

Low concentrations of VOCs and 1,4-dioxane have been detected in the Site deep ground water monitoring wells. VOCs detected included chlorinated VOCs and benzene, toluene, and xylene. The aromatic VOCs are believed to be the result of the natural occurrences of these compounds in the Rochester shale, which underlies the Decew Dolomite.

VOCs and 1,4-dioxane have also been detected in some of the Site and off-Site recharge wells. High concentrations of VOCs have been detected in RW-2, located in the northwestern portion of the AMSF property and at the bottom of W-1 in the southwestern portion of the ITT property. It is believed that these high concentrations do not reflect deep ground water concentrations, but rather are isolated to the recharge well.

3.4 Data Needs to Complete the RI and FS

Based on the review of the data collected during previous studies, the following data needs have been identified:

- *Evaluation of source of impacts to ground water*: The extent of the known source does not appear to be fully defined and additional Site and off-Site sources may be present.

- *Confirm past soil sample results*: The results of previous ITT investigations need to be confirmed using investigation and analysis protocols consistent with the RI.

- *Subsurface investigations of the drum storage area and TCA storage tanks*: Historically these areas used material of environmental concern.

- *Subsurface investigations of two historic degreaser areas within the ITT facility*: Historically, these areas used materials of environmental concern.

- *Sub-slab soil gas evaluation*: There is a potential for migration of VOCs from ground water or soil to indoor air.

- *Nature of VOCs in shallow rock:* Shallow bedrock may provide a migration pathway for VOCs and 1,4-dioxane in the northern portion of the Site.

- *Evaluation of the extent of soil impacts on the northeastern portion of the ITT property and the northwestern portion of the AMSF property*. The northeast area of ITT property formerly contained VOC impacted soil. The extent of these soil impacts has not been defined.

- *Evaluation of the on-Site extent of ITT related impacts in shallow bedrock ground water*: The extent of impacted shallow bedrock ground water has not been defined on the northern portion of the Site.

- *Evaluation of off-Site extent of ITT related impacts in shallow bedrock ground water*: The northern extent of impacted shallow ground water has not been defined.

- *Evaluation of deep bedrock ground water conditions in the vicinity of recharge wells*: The extent of deep ground water impacts has not been defined.

3.5 Identification of Data Quality Objectives

Data Quality Objectives (DQOs) are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision making process. DQOs define the total acceptable uncertainty in the data for each specific activity conducted during the investigation. The uncertainty includes both sampling error and analytical error. The overall objective is to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data. Laboratory analyses and analytical levels will adhere to the guidelines described in *Data Quality Objectives for Remedial Response Activities* (USEPA, 1987).

3.6 Preliminary Identification and Compliance with Standards, Criteria, and Guidelines

New York State standards, criteria and guidelines (SCGs) and federal requirements are either potentially applicable or relevant and appropriate (ARARs) given the conditions at the Site. There are three types of SCGs that are identified throughout the RI/FS process: 1) chemical-specific, 2) location-specific and 3) action-specific. Chemical-specific SCGs are requirements and/or guidance that establish health or risk-based numerical values or methodologies which, when applied to Site-specific conditions, result in numerical values. These numerical values establish an acceptable or target amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. Location-specific SCGs establish restrictions on activities based on conditions of the Site or immediate environs. Action-specific SCGs set controls or restrictions on particular types of actions related to management of hazardous substances, pollutants or contaminants.

The identification of SCGs is an iterative process that continues throughout the RI/FS process as a better understanding of Site conditions, VOCs, SVOCs, metals, and 1,4-dioxane, and remedial action alternatives is gained. Preliminary sources of SCGs, which may be applicable to this RI/FS, are:

- 6 NYCRR Parts 702 and 703 and NYSDEC TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values (NYSDEC, 1998)

- USEPA Soil Screening Guidance (USEPA, 1996)

- NYS TAGM 4046 – Determination of soil cleanup objectives and cleanup levels (NYSDEC, 1994)

- 6 NYCRR Part 608 – Use and Protection of Waters (NYDEC, 1994)

The RI data will be screened against the appropriate SCGs and the risk-based thresholds in the RI and associated human exposure assessments. SCGs will be modified during the RI and FS as necessary.

4. Remedial Investigation Work Plan

The proposed tasks for the RI are presented in Section 4 of this document. The proposed tasks correspond to the eight (8) tasks described in the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988).

4.1 Project Management Plan

This task involved the performance of several subtasks to produce the project planning documents and the project schedule necessary to execute the RI. These subtasks included field reconnaissance, RI discussion sessions, evaluation of existing data, identification of DQOs, determination of potential SCGs, scoping of the RI and development of a conceptual site model.

Preparation of the project plans includes this Work Plan, a Citizen Participation Plan (CPP), a Health and Safety Plan (HASP) and a Sampling and Analysis Plan (SAP). The CPP provides a framework to promote public understanding of the responsibilities of NYSDEC and ITT with respect to planning and performance of the RI/FS. The CPP also provides both NYSDEC and ITT the opportunity to provide the public with information pertaining to the RI/FS and answer questions from the public concerning the project. Community relations for this project will include, but not be limited to, providing public meeting support. A CPP that is consistent with the New York State Inactive Hazardous Waste Site Citizen Participation Plan (NYSDEC, 1988) has been prepared and is included as Appendix A (bound separately).

The HASP provides the minimum safety requirements and general procedures to be followed by Site personnel while working on-Site, including ITT representatives, subcontracted personnel and state and local government agency representatives. The HASP describes the responsibilities, training requirements, protective equipment and procedures necessary to protect workers and visitors from exposure to potentially harmful materials. The HASP was prepared in accordance with 29 CFR 1910 by a certified health and safety professional. The HASP is included in Appendix B.

The SAP is divided into two (2) plans: the field sampling plan (FSP), which is contained within this Work Plan beginning with Section 4.4, and the Quality Assurance Project Plan (QAPP), which is included in Appendix C. The FSP provides guidance for fieldwork by defining the sampling and data collection methods to be used during the investigation. The QAPP provides quality assurance/quality control (QA/QC) criteria for work associated with the sampling of environmental media from the Site. The QAPP will assist in generating data of a known and acceptable level of precision and accuracy. It also provides information regarding the project scope and personnel responsibilities and sets forth specific procedures to be used during sampling of relevant environmental matrices, other field activities, DQOs and analyses of data. The QAPP has been prepared in accordance with the RCRA Quality Assurance Project Plan Guidance (NYSDEC, 1991) and the EPA Requirements for the Preparation of Quality Assurance Project Plans (USEPA, 2001).

4.2 Organization

See the Project Management Organization in Appendix C in the QAPP section at Appendix C.

4.3 Community Relations

Community relations for this project will include, but not be limited to, providing public meeting support. A Citizens Participation Plan that is consistent with the *New York State Inactive Hazardous Waste Site Citizen Participation Plan* (NYSDEC, 1988) has been prepared and is included with this Work Plan as Appendix A (bound separately).

4.4 Field Investigation and Sampling Plan

4.4.1 Site Access

The ITT property is currently accessable. ITT will obtain access to the AMSF property and other necessary off-Site properties prior to the initiation of on-Site investigation activities. The off-Site property owners will be identified through tax records and property maps. If necessary and requested by ITT, NYSDEC may provide support in obtaining the necessary access.

Marking of Subsurface Utilities

Prior to initiation of intrusive activities, an underground facilities protective organization (UFPO) request will be made. A date and time will then be established for the various utility companies to meet an ITT representative at the Site to mark the locations of subsurface public utilities in the areas of proposed work both on-site and off-Site. The location of utilities will be obtained from the current owners as part of this task.

Identification of Recharge Well Locations

ITT will identify the location of recharge wells that may be present on properties immediately surrounding ITT and AMSF. The Town of Gates and neighboring property owners will be contacted to identify the locations of recharge wells. If additional recharge wells are identified, then the NYSDEC and ITT will jointly evaluate whether it is necessary to sample those recharge wells during the RI.

4.4.2 Data Management/Validation

Analytical data from the laboratory will be received in hardcopy and electronic format. The electronic data will be entered into a project database for use in preparation of summary tables and the Human Health Exposure Assessment.

Analytical data will be validated in accordance with applicable USEPA and NYSDEC guidance as discussed in the QAPP. Data validation reports will be prepared and included as an appendix in the RI/FS Report.

4.4.3 Mobilization

Prior to the initiation of the RI/FS fieldwork, subcontractors will be retained for drilling, surveying and analytical services. Field equipment needed to complete the work will be procured and arrangements will be made with the appropriate laboratories for sample containers.

4.4.3.1 ITT Trench Drains

Objective

ITT and the NYSDEC will inspect the trench drains. If the drains are deemed to be competent then no soil samples will be necessary. If the drains are judged to be compromised, then soil samples will be completed.

Methods

If the trench drains are not competent, then a soil sample will be collected from below each trench drain. ITT and the NYSDEC will select the location of the soil samples at the time of inspection. The soil sample will be collected by coring through the concrete at the bottom of the drain and collecting a soil sample from 0-6 inches below the bottom of the concrete. The soil samples will be collected with a decontaminated hand auger. These soil samples will be transferred to the appropriate laboratory containers and placed in a cooler containing ice. Samples will be submitted to O'Brien & Gere Labs for analysis by the ASP/CLP methods that correspond to USEPA SW846 methods (USEPA, 1996a). VOCs parameter analyses will be performed using method 8260. Analysis for 1-4 dioxane will be performed using method 8270. Metals analysis will be completed using method 6010B.

4.4.4 Soil Gas Sampling

Objectives

Sub-slab soil vapor samples will be collected from the northwestern portion of the former AMSF building and the ITT building to assess the potential for migration of vapor to indoor air at concentrations that are incompatible with building uses and potential receptors.

Methods

Sub-slab samples will be collected from locations illustrated on Figure 4. At the locations in the ITT building indoor, air samples will also be collected adjacent to each sub-slab sample. Previous investigation results performed at the Site and off-Site indicate that chlorinated VOCs and 1,4-dioxane are present in soils and ground water primarily in the northeast portion of the ITT property and the northwestern portion of the AMSF property. Seven (7) sub-slab soil vapor samples will be collected; three (3) within the northwestern portion of the AMSF building and four (4) within the ITT building (Figure 4). The procedures for collection and analysis are included in Appendix D. Samples will be collected with 6 liter Summa canisters equipped with vacuum gauges and analyzed for VOCs and 1,4-dioxane using method TO-15.

This sampling method involves the collection of a sample of vapor from the unsaturated soil beneath the building foundation for analysis. The sample collection device is typically tubing constructed of Teflon. If the surface is covered by asphalt of concrete a nominal hole shall be drilled through the surface. A small diameter hole shall be completed to just below the concrete slab using a slide hammer, drill or soil gas sampling device. Tubing is placed to the base of the hole and the annulus of the tubing is sealed. The tubing will be attached to the Summa canister.

Data Uses

The soil vapor data will be used, as appropriate, to assess the potential indoor air concentrations that would result from migration of the vapor to the inside of the building. Specifically, a combined Tier 1 and Tier 2 evaluation will be completed.

The objective of the Vapor Intrusion Potential Evaluation (VIPE) is to assess if constituents detected in sub-surface environments have the potential to migrate via vapor infiltration to the indoor air of buildings at concentrations that represent unacceptable indoor concentrations relative to building uses and exposed receptors.

The VIPE will be conducted be in accordance with the Environmental Protection Agency (EPA), 2002, *Draft Guidance For Evaluating The Vapor Intrusion to Indoor Air Pathway From Groundwater And Soils*, USEPA-OSWER. Docket ID No. RCRA-2002-0033. (OSWER Guidance).

The OSWER guidance recommends a tiered approach to VIPEs. The evaluation will be guided by the Site conditions and available Site data and the "starting tier" may be selected based on the conditions and data. As part of the data evaluation, the draft OSWER guidance identifies three (3) tiers of assessment that involve increasing levels of complexity and specificity.

- *Tier 1 - Primary Screening:* The primary screening is designed to be used with general knowledge of a site and the chemicals known or reasonably suspected to be present in the subsurface. The primary screening process evaluates if chemicals of sufficient volatility and toxicity are present; if inhabited buildings are located above or in close proximity to subsurface contamination; and if current conditions warrant immediate action. If these conditions do not occur, the pathway is classified as incomplete and not evaluated further.

- *Tier 2 - Secondary Screening*: The secondary screening analysis compares measured or modeled concentrations of target chemicals in various media (groundwater, soil gas, and/or indoor air) to conservative health based numerical criteria. These numerical criteria reflect reasonable worst-case estimates of site-specific conditions such as depth of contamination, soil type, building specific properties, and receptor populations.

- *Tier 3 – Detailed Site-Specific Pathway Assessment*: If the results of the Tier 1 and Tier 2 evaluation suggests that further assessment is warranted, a Tier 3 evaluation may be considered. The Tier 3 assessment may involve the collection of more detailed site-specific information such as confirmatory soil vapor, sub-slab, and/or indoor air sampling.

A more detailed discussion of the evaluation procedure is provided in Appendix D.

4.4.5 Soil Borings and Bedrock Cores

Objective

Advancement of 33 soil borings to top of bedrock to collect soil samples from areas of known or suspected impact and to evaluate the extent of VOC and 1,4-dioxane impacts in the soil and shallow bedrock.

Approach

Soil borings will be advanced in seven (7) areas of the Site (Figure 4). A discussion of each location and the purpose for the sampling is presented below:

- Area 1: Between the ITT soil remediation area and the AMSF recharge well RW-2: (16 borings): These areas contain the highest VOCs and 1,4-dioxane concentrations in soil and ground water. These borings will evaluate the potential source of impacts to RW-2 and will evaluate the extent of soil impacts associated with the ITT facility between ITT soil remediation area and RW-2. Soil samples will be analyzed for VOCs and 1,4-dioxane.

- Area 2: Northern portion of ITT building (up to 5 borings): VOC impacted soil was documented and excavated immediately north of the building in this area. Facility operations limited soil investigations under the building. Access to the northern portion of the building is currently available, therefore these borings are proposed to evaluate the extent of impacted soils under the building. Soil samples will be analyzed for VOCs and 1,4-dioxane.

- Area 3: Former ITT degreaser areas (8 borings): Former operations in these areas indicate the use of material of environmental concern (i.e. TCA). The objective of these borings is to evaluate whether past operations have impacted subsurface soil. Soil samples will be analyzed for VOCs and 1,4-dioxane.

- Area 4: Former ITT brazing dumpster (4 borings): Previous investigations identified 1,4-dioxane and petroleum hydrocarbons in this area. The proposed borings will characterize impacts in this area. Soil samples will be analyzed for VOCs and 1,4-dioxane. Analysis will also include TAL metals and SVOCs.

- Area 5: Former ITT acid wash underground storage tanks (USTs) (6 borings): The area contained two (2) 500 gallons USTs, which were reportedly closed in-place. These borings will confirm past soil sampling results. Soil samples will be analyzed for VOCs and 1,4-dioxane. Analysis will also include TAL metals and SVOCs. In addition, the disposition of each tank will be identified. If the tanks are still in place and are accessible, the residuals will be sampled.

- Area 6: Former ITT TCA above ground storage tanks (ASTs) (2 borings): This area contained four (4) 275 gallon ASTs, which were reportedly removed. These borings will confirm past soil sampling results. Soil samples will be analyzed for VOCs and 1,4-dioxane.

- Area 7: Former ITT heating oil storage tank (2 borings): The area contained one (1) 500 to 1,000 gallons UST. This tank was reportedly closed in-place. These borings will confirm past soil sampling results. Soil samples will be analyzed for VOCs and 1,4-

dioxane. Analysis will also include SVOCs. In addition, the disposition of the tank will be identified. If the tank is still in place and contains residuals, the residuals will be sampled.

Borings will be installed using a Geoprobe® direct push drilling method. Soil samples will be collected continuously throughout the boring. The sampling device is an acetate sleeve attached inside the direct-push sampler. Drilling will be overseen by a geologist who will complete a boring log to document encountered subsurface strata and other pertinent observations. Soil samples will be screened using a photo-ionization detector (PID), visual observations, and UV light.

Two (2) soil samples from each boring, selected on the basis of visual inspection and field screening, will be submitted to the laboratory. These soil samples will be transferred from the acetate sleeve to the appropriate laboratory containers and placed in a cooler containing ice. Samples will be submitted to O'Brien & Gere Labs for analysis by the ASP/CLP methods that correspond to USEPA SW846 methods (USEPA, 1996a). VOCs parameter analyses will be performed using method 8260. Analysis for 1-4 dioxane will be performed using method 8270. Metals analysis will be completed using method 6010B.

Based upon the results of the first round of ground water sampling, three (3) shallow bedrock cores may be completed in the northern portion of the Site and off-Site (Figure 4), between the area of the ITT soil remediation and RW-2. These cores will be completed if additional bedrock characterization is deemed necessary. The decision as to whether to complete the cores or not will be discussed with the NYSDEC. These shallow bedrock cores will be advanced to evaluate whether VOCs are present in the shallow bedrock and to evaluate the nature of VOCs in shallow rock. Each shallow bedrock core will be advanced to a depth of 25 ft. The shallow bedrock core will be advanced by coring, using HQ (nominal 3 inch outside diameter) wireline coring techniques, with potable water as the drilling fluid. Each core run will be examined for lithology, mineralogy, degree of cementation and/or infilling, grain size, color, percent recovery, and rock quality designation. The volume of water lost to the bedrock formation during drilling will be monitored and at the completion of the core 110% of that volume will be purged from the core hole prior to abandonment. The open hole generated due to the bedrock coring will be filled with grout to the ground surface.

The cores will be screened for VOCs in the field using a PID, visual observations, and a UV light. In some cases DNAPL may have stained the rock fracture walls and could be visible upon inspection of the core. During coring, the return water will be inspected for visual or olfactory evidence of hydrocarbons (iridescent sheens or odors). If field screening suggests the possible presence of VOCs in the bedrock matrix, then up to two bedrock samples per core hole will be collected for VOC analysis. Small samples of the bedrock will be immersed in methanol in the field and transported to the laboratory.

The core runs will be placed in boxes and saved at an on-Site location specified by ITT. A boring and rock core log will be prepared detailing the observations noted above. Borehole logs will be completed in the field and will also include a borehole designation, borehole termination depth, sample depth, sample description, and depth to ground water. Bedrock coring protocols are included in the Appendix D.

4.4.6 Monitoring Well Installation

Objective

Complete testing, rehabilitation, and replacement (as needed) of existing monitoring wells. Installation and sampling of monitoring wells to further characterize ground water quality and evaluate off-Site extent of VOCs and 1,4-dioxane will be performed. A summary of historic and existing monitoring and recharge wells at both the ITT and AMSF properties is shown in Table 1.

Approach

Site and off-Site reconnaissance has identified several existing monitoring wells on the AMSF property that are damaged (Table 1). Efforts will be made to rehabilitate these wells. Before the well is rehabilitated it will be examined to evaluate whether it is still reliable for ground water elevation monitoring and ground water sampling. If the well is still usable then it will be rehabilitated. Each monitoring well on the Site and off-Site will also be checked and superficial repairs performed.

If rehabilitation is not possible, the wells will be decommissioned in a manner consistent with Ground Water Monitoring Well Decommissioning Procedures (NYSDEC, 1996). The procedure for decommissioning will be presented to the NYSDEC for approval prior to completing the decommissioning. If an existing monitoring well is decommissoned, ITT will reach agreement with the NYSDEC as to whether the well needs to be replaced.

Eleven (11) shallow and one (1) deep monitoring wells will be installed (Figure 5). Three (3) shallow bedrock monitoring wells will be located south and east of RW-2. A total of two (2) shallow bedrock monitoring wells will be installed within or immediately adjacent to each of the two Area 3 degreasers. One (1) shallow bedrock monitoring wells will be installed immediately downgradient of Area 6 and one (1) shallow bedrock monitoring wells will be installed immediately downgradient of the former brazing waste dumpster (Area 4). Four (4) shallow bedrock monitoring wells will be placed off-Site between the Site and the downgradient cinema complex (Figure 5). Each shallow bedrock well will be approximately 25 ft deep. The actual depth of the wells will be selected to sample the same intervals within the bedrock. The deep bedrock monitoring well will be installed downgradient and in the immediate vicinity of RW-2 which has a reported depth of approximately 149 ft. The purpose of these monitoring wells installation is as follows:

- <u>Shallow monitoring wells located south and east of RW-2</u>: To evaluate the northwest corner of AMSF building as a potential source of VOCs and 1,4-dioxane observed in the northwestern portion of the AMSF property.

- Shallow monitoring wells located in the area of the two Area 3 degreasers: To evaluate the former degreasers as a potential source of VOCs in ground water.

- Shallow monitoring well located downgradient of Area 6: To evaluate Area 6 as a potential source of VOCs in ground water.

- Shallow monitoring well located downgradient of Area 4: To evaluate the former brazing waste dumpster as a potential source of VOCs in ground water.

- Off-Site shallow monitoring wells: To evaluate the horizontal extent of VOCs and 1,4-dioxane in the shallow bedrock ground water.

- Deep monitoring well located in the vicinity of RW-2: Recharge well RW-2 contains high concentration of TCA and possible DNAPL at the bottom of the well (149 ft bgs). The newly installed deep monitoring well will be used to evaluate whether impacted ground water is migrating from the lower portion of RW-2.

Drilling for the monitoring wells installation will be conducted with a truck-mounted drill rig. The boreholes through the overburden will be advanced with a 6 ¼-inch inside diameter (ID) hollow stem auger with continuous split-spoon sampling to the top of the bedrock, which is 8 ft to 10 ft deep. The soil cuttings generated will be managed according to section 4.9 IDW management.

Upon reaching the top of bedrock, the boreholes for the shallow bedrock monitoring wells will be advanced approximately 2 ft into bedrock. The boreholes will be advanced using a 5 7/8 inch roller bit through the augers. A 4-inch diameter steel casing fitted with a plastic end cap will be lowered through the auger string. The annular space between the borehole wall and the 4-inch casing will be filled with cement/bentonite grout using a tremie pipe as the auger string is removed. The grout will be allowed to cure for a minimum of 12 hours prior to further borehole advancement.

Subsequent to curing of the grout, coring drilling methods will be used to deepen the boreholes to the terminal depths. Fluids and cuttings that are carried to the ground surface will be managed according to section 4.9 IDW management. The volume of drilling water lost to the bedrock formation will be recorded.

The shallow bedrock wells will be completed as open hole bedrock wells, similar to the wells previously installed at the Site. Should the presence of incompetent bedrock require the use of well screens, then a DNAPL collection sump below the screen will be included. Well completion will include the installation of a flush mounted protective casing/road box. A concrete pad will be installed around the well to direct precipitation away from the borehole. Monitoring well installation protocol is included in Appendix D.

Deep bedrock monitoring well installation will be advanced using a 6 ¼-inch inside diameter hollow steam auger with continuous split-spoon sampling to the bedrock interface. The borehole for the deep bedrock monitoring well will be advanced approximately 2 ft below the bottom of the shallow bedrock monitoring wells. A 4-inch diameter steel casing fitted with a plastic end cap will be lowered through the auger string. The annular space between the borehole wall and the 4-inch casing will be filled with cement/bentonite grout using a tremie pipe as the auger string is removed. The grout will be allowed to cure for a minimum of 12 hours prior to further borehole advancement. Subsequent to curing of the grout, coring drilling methods will be used to deepen the boreholes to the terminal depths. The volume of drilling water lost to the bedrock formation will be recorded. Monitoring for explosive gases will be performed during the installation of the deep well. Procedures documented in the HASP will be followed if explosive gases are detected.

Subsequent to the terminal depth for the borehole, a 2-inch diameter PVC well consisting of a 10-ft length of 0.010-inch slot screen flush-threaded to riser casing will be lowered through the 4-inch casing. The riser casing will be extended to ground surface. A sandpack suitable for use with the screen slot size will be installed within the annular space between the borehole and the well. The sandpack will extend from the bottom of the well to 2 ft above the top of the well screen. A 2 ft thick bentonite seal will be installed in the annular space above the sand pack to prevent water from moving vertically along the borehole. The remaining annular space will be filled with a Portland cement/bentonite grout through a tremie pipe to a maximum depth of 5-ft below grade. Well completion will include the installation of a flush mounted protective casing/road box. A concrete pad will be installed around the well to direct precipitation away from the borehole. Monitoring well installation protocol is included in Appendix D.

Prior to the installation of the well screen and casing, a dual-inflatable packer testing apparatus will be utilized to measure the hydraulic conductivity of the isolated fracture intervals in the boring for the deep bedrock monitoring well. Fracture intervals for testing will be selected based on field observations of fractures during the drilling processes. The packer assembly will be positioned in the well so that the upper and lower packers straddled the selected fracture interval. The packer will be inflated to create a top and bottom seal, and a bailer or pump will be used to rapidly evacuate water from the interval between the packers. The rate of recovery of ground water levels will be monitored with an electronic water level probe. Packer testing protocols is included in Appendix D. Based on the results of this packer testing, the depth of RW-2, and the vertical contaminant profile in RW-2 the screen interval for the deep well will be selected in consultation with the NYSDEC.

Following installation of the wells and prior to collection of ground water samples, each new and existing monitoring well will be developed to remove the fine material which may have settled in the monitoring wells, to remove introduced drilling fluids, and to provide better hydraulic communication with the surrounding formation. Development will consist of the removal of 110% of the volume of drilling water lost to the bedrock formation using either a bailer or centrifugal pump. A 50 NTU turbidity goal has been established. If this goal cannot be achieved, ITT's representative will coordinate with NYSDEC to establish a mutually agreeable development volume. Development water will be contained in 55-gallon drums for subsequent disposal. The method of disposal will be selected based on ground water analytical results.

4.4.7 Hydraulic Conductivity Testing

In-situ hydraulic conductivity tests of the newly installed monitoring wells, and existing wells not previously tested, will be performed to estimate the horizontal hydraulic conductivity of material surrounding the wells. ITT wells not previously tested include SBW-2, DBW-2, DBW-5, MW-1, MW-2, and MW-4. No information was found regarding conductivity tests performed on the AMSF wells, so the existing AMSF monitoring wells will also be tested. Rising and falling head ground water head measurements will be obtained following both insertion and removal of a PVC slug into the well. A pressure transducer will be used to collect ground water head data during the tests. Hydraulic conductivity test protocol is included in the Appendix D.

Results of the test will be used to calculate the relative hydraulic conductivity of the open portion of the formation at each monitoring well using Hvorslev (Hvorslev, 1951) or Bouwer and Rice (Bouwer and Rice, 1976) methods.

4.4.8 Ground Water Elevation Monitoring

Quarterly ground water elevation monitoring of the Site and off-Site monitoring wells and recharge wells will be completed for a period of one year. The monitoring will be performed to evaluate seasonal ground water elevation changes. Ground water elevation data will also be used to evaluate the vertical hydraulic gradients across the site. Ground water elevations will be measured with an accuracy of 0.01 ft using an electronic water level probe. In addition, non-aqueous phase liquid (NAPL) level monitoring, using a conductivity NAPL well probe, will also be performed.

A ground water elevation study will be performed for up to one month using AMSF recharge well RW-2 and 10 selected monitoring wells. Termination of this study prior to one month may be done with NYSDEC approval. The objective of this study will be to evaluate whether the discharge of precipitation runoff into recharge well RW-2 on the AMSF property affects ground water elevations and ground water flow patterns on the Site and off-Site. In order to accomplish the study objective, ground water elevations will be continuously monitored and the data will be compared to precipitation records for the area.

The ground water elevations and temperature data will be collected using automated transducers. These transducers will be installed at RW-2 and 10 selected monitoring wells and set to record data at five (5) minutes intervals. The transducers will be checked periodically during the study. At each time, the data will be downloaded to a computer. At the end of the study the data will be downloaded to a computer and the transducers will be removed from the wells.

During the ground water elevation study, barometric pressure and precipitation data will be retrieved daily from the Greater Rochester International Airport (www.anythingweather.com), which is located in the vicinity of the Site. Precipitation data will be correlated to the head and temperature data to evaluate the timing and magnitude of the precipitation event necessary to induce runoff discharge to the recharge well. The barometric pressure data will be used to evaluate whether the barometric pressure fluctuations affect the head data and corrections of the transducer head data for barometric pressure influences will be needed.

The transducer head and temperature data along with the precipitation data will be plotted on graphs in order to qualitatively and quantitatively evaluate the impact of the recharge well on the Site and off-Site ground water. In addition, the transducer head data will be converted to ground water elevations to assess the impact of the recharge events on ground water flow patterns.

4.4.9 Ground Water Sampling

Objective

Ground water sampling of Site and off-Site monitoring wells and recharge wells will be completed to provide further characterization of ground water quality and evaluate the off-Site extent of VOCs and 1-4 dioxane.

Approach

Two (2) rounds of ground water samples will be collected from newly installed and existing Site and off-Site monitoring wells. One round will be collected during a time of high ground water elevation and the other in a time of low ground water elevation. Sampling will be conducted a minimum of seven (7) days after well development. Ground water samples from the Site and off-Site monitoring wells will be collected using bailing techniques. A dedicated or decontaminated bailer will be used to purge 3 well volumes from the well and sample the well. During purging, ground water quality parameters including pH, conductivity, and temperature will be monitored sing a Horiba U-10 water quality instrument. After removal of 3 well volumes, samples will be transferred directly from the bailer to the appropriate sample containers. Ground water samples will be collected for VOCs and 1,4-dioxane analysis. The samples will be shipped by overnight courier and send to O’Brien & Gere Labs. VOCs and 1,4-dioxane analyses will be performed using the ASP/CLP method that corresponds to USEPA Method 8260. Purge water will be managed according to section 4.9 IDW management.

Two (2) rounds of ground water samples will be collected from the six (6) recharge wells, at the ITT and AMSF properties, at the time of the monitoring well sampling. Ground water samples will be collected from immediately below the water table and at the bottom of well using low flow purging techniques. Sampling will initiate at the water table and proceed to the bottom of the well. Low flow purging involves inserting a stainless steel Grundfos® pump (or similar) and dedicated Teflon tubing at the target depth within the well and purging at a maximum rate of 0.5 liters/minute. During purging, ground water quality parameters including pH, conductivity, temperature, eH, turbidity and dissolved oxygen will be monitored continuously using an in-line meter. Once the ground water quality parameters have stabilized (within three consecutive readings, see low flow sampling protocol in Appendix D), samples will be collected directly from the Teflon tubing. The pump will be decontaminated between depth intervals and wells in accordance with the procedures set forth in the QAPP (Appendix C). Purge water will be contained in 55-gallon drums for subsequent disposal. Ground water will be collected for VOCs and 1,4-dioxane analysis. Low-flow ground water sampling protocol is included in Appendix D.

Vertical profile sampling will be completed in selected shallow monitoring wells to provide more detailed information on the distribution and transport of contaminants. The vertical profile sampling will be completed using passive bags. ITT and the DEC will jointly select the wells for vertical sampling and the depth intervals of those samples. The vertical profile samples will be analyzed for VOCs.

One round of ground water sampling of up to 10 selected monitoring wells and recharge wells will be performed during a precipitation recharge event. The objective is to evaluate the impact of recharge wells on VOC concentrations in shallow bedrock. The previously conducted transducer study data indicated that the pressure response in monitoring wells to recharge was rapid and short-lived. The actual migration of recharge water is expected to be slower and the recharged water is expected to remain in the subsurface for some time following the recharge event. Therefore simultaneous sampling of multiple wells is not considered necessary. The recharge and monitoring wells to be sampled, the depth of the sample in the recharge wells, the sampling schedule, and order of wells will be based on results of the one month ground water elevation monitoring study data and will be presented to the DEC for their acceptance prior to sampling. Ground water samples from monitoring wells will be collected using the bailing technique described above. Ground water samples from the recharge wells will be collected utilizing a Groundfos® submersible pump or peristaltic pump using dedicated tubing. Ground water will be collected for VOCs and 1,4-dioxane analysis. Purge water will be treated according to section 4.9

IDW management. Ground water sampling protocol is included in Appendix D.

4.4.10 Recharge Well Evaluation

Borehole geophysics (caliper and video) will be performed in each of the six (6) recharge wells at the ITT and AMSF properties. The borehole geophysics will be completed prior to the installation of the proposed deep monitoring well near RW-2. The objective is to characterize the depth of the recharge wells casing and the fracture distribution of the open hole recharge wells. Procedures for the performance of the caliper and video are included in the QAPP (Appendix C).

A vertical profile sampling in each of the six (6) recharge wells will be performed. The objective is to evaluate changes in VOCs and 1,4-dioxane concentrations with depth. Ground water samples will be collected using low flow purging techniques as described above. Up to 5 sampling intervals will be performed throughout the length of the recharge wells. A minimum of two (2) samples, water table and bottom of the well, will be collected from each well. The number of samples and the depth of the samples will be presented to the NYSDEC for their approval prior to the collection of the samples. Ground water collected will be analyzed for VOCs and 1,4-dioxane.

4.4.11 Topographic Survey

Following completion of the above proposed work, a Site and off-Site topographic will be performed by a licensed surveyor. For soil borings, monitoring wells and recharge wells, the New York State Plane coordinates will be determined. For soil borings the ground surface elevation will be surveyed to a 0.01 ft accuracy. For existing and new monitoring wells and recharge wells, the ground surface elevation and top of casing elevation will be surveyed to an accuracy of 0.01 ft to allow for calculation of ground water elevations and development of ground water flow maps.

A topographic survey of the Site and off-Site will also be used to document site topography and other site features. The topographic contour interval will be 1-ft.

The horizontal survey will use NAD83 UTM Zone 18 Coordinates expressed in meters and the vertical datum will be NGVD88 and expressed in feet.

4.5 Quality Assurance Project Plan (QAPP)

See Appendix C

4.6 Safety Plan (HASP)

See Appendix B

4.7 Human Exposure Assessment

4.7.1. Human Health

A baseline human health exposure assessment (HHEA) addressing chemical concentrations in soil, bedrock and ground water at the Site will be performed. Exposures will be calculated for the Site. Identified hot-spots within the Site may be assessed separately, if appropriate. This section describes the methods and procedures that will be applied to complete the HHEA. A more detailed description of the specific exposure assessment assumptions for this Site will be presented upon completion of the RI. The assumptions will be based upon the current and reasonably foreseeable future Site land uses, nature and extent of contamination, and Interim Remedial Measures (IRMs) implemented, or proposed to be implemented, at the Site.

Based on current conditions and activities at the Site, potential human receptors include:

- Adult and child trespasser
- Utility maintenance worker
- Construction worker
- Industrial worker
- Sewer/water line workers

The exposure assessment will be conducted in accordance with the latest applicable USEPA guidance documents. The following documents will be the primary guidance for performing the HHEA:

- Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A) Interim Final, EPA/540/1-89/002 (USEPA, 1989)

- Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part D) Final, Publication 9285.7-47 (USEPA, 2001a)

- Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors. OSWER Directive 9285.6-03. March 25, 1991 (USEPA, 1991)

- Guidelines for Exposure Assessment (57 FR 104, May 29, 1992) (USEPA, 1992)

- Guidance on Risk Characterization for Risk Managers and Risk Assessors, February 26 1992, USEPA Memorandum from Henry Habicht, Deputy Administrator, to Assistant Administrators and Regional Administrators (USEPA, 1992a)

- Guidance for Risk Characterization. Science Policy Council (USEPA, 1995)

- Exposure Factors Handbook – Final. Office of Health and Environmental Assessment, Washington, D.C. (USEPA, 1997)

- Supplemental Guidance to RAGS: Calculating the Concentration Term. OSWER Publication 9285.7-081. (USEPA, 1992b)

Consistent with the above guidance materials, the risk assessments will be conducted in the following phases:

1. Characterization of Exposure Setting - The output of this step will be a summary description of the Site and surrounding human populations with respect to characteristics that influence exposure.

2. Data Evaluation - The objective of the data evaluation step will be to evaluate the overall data for exposure assessment purposes. In addition, the VOCs of concern and 1,4-dioxane at the Site will be identified based on a comparison with risk-based screening values, frequency of detection and toxicity.

3. Constituent Fate and Transport - The fate and transport analysis uses constituent-specific and Site-specific data to evaluate the potential persistence and environmental transport of constituents detected at the Site. The information will be used to identify potential current and future exposures at the Site.

4. Exposure Assessment - In the exposure assessment, the pathways by which receptors may be exposed to VOCs and 1,4-dioxane will be identified, exposure point concentrations of the VOCs and 1,4-dioxane will be estimated, and chemical specific Chronic Daily Intakes (CDIs) will be estimated for potentially exposed human receptors.

5. Toxicity Assessment - In the toxicity assessment, available toxicological data for VOCs and 1,4-dioxane, including cancer classifications, slope factors, reference dose (RfD), and other relevant toxicity information, will be compiled and evaluated.

6. Exposure Characterization - In the exposure characterization step, the toxicity and exposure assessments are integrated into quantitative expressions of potential human health exposure. Lifetime excess cancer exposures and hazard indices will be calculated.

Characterization of Exposure Setting

A brief description of the history, physical features, environmental setting and land use at the Site will presented in this section of the RI. This information will be used to characterize potential exposure pathways in the exposure assessment report.

Data Evaluation

The objective of data evaluation will be to identify a set of data that will be used in performing the exposure assessment and to identify VOCs of concern and 1,4-dioxane. The steps that will be performed in the data evaluation process include:

- Compilation of data available from the Site investigation and classification of data according to medium sampled

- Evaluation of data quality with respect to laboratory qualifiers and detection limits

- Comparison of the concentrations of potential Site-related constituents with reference site/background levels to identify Site-related constituents and discern Site verses background exposure

- Comparison of the concentrations of potential Site-related constituents with health-based screening values

Based on the evaluation, a set of data appropriate for use in the exposure assessment will be developed for each media. Site constituents of concern will be defined in accordance with USEPA guidance (USEPA, 1989). This will include a comparison of Site constituent concentrations with health-based preliminary remediation goals (PRG) screening values provided by USEPA Region 9 (USEPA, 2000), a review of historical Site information, consideration of the substance's toxicity, and the substance's frequency of detection. If there are limitations regarding the applicability of the available data for completing the exposure assessment, recommendations for additional sampling will be made.

Constituent Fate and Transport

The fate and transport analysis will use constituent-specific and Site-specific data to evaluate the potential persistence and environmental transport of constituents detected at the Site. The information will be used to identify and quantify potential current and future exposures at the Site.

This analysis will include consideration of the following constituent-specific factors: persistence in the environment, potential formation of toxic degradation products in the environment and factors that impact mobility in the environment. The Site-specific data that will be evaluated in the fate and transport analysis include soil characteristics such as porosity and organic carbon content, ground water characteristics (e.g. flow rate and direction), surface water flow rate, sediment characteristics (e.g. organic carbon content, particle size, etc.) and atmospheric characteristics (e.g. fugitive dust generation, subsurface contamination volatilization, wind speed, presence of buildings, etc.).

Exposure Assessment

The objective of the exposure assessment is to identify and characterize exposure pathways at the Site, and determine or estimate the likely magnitude, frequency, duration and route of exposure of human receptors that may be exposed. Exposure is defined as the contact of a receptor with a chemical or physical agent. An exposure pathway describes a mechanism by which a receptor may be exposed to a constituent present at or migrating from a site. The exposure assessment consists of two steps: characterization of exposure pathways and quantification of exposure. A brief description of these steps is provided below.

Characterization of exposure pathways - in this step, the potential exposure pathways for receptor populations are identified and characterized. Receptor populations may include groups such as maintenance workers, construction workers, on-Site trespassers, etc. Exposure pathways are identified and characterized based on consideration of the sources, releases, types and locations of constituents at the Site, as well as current and reasonable anticipated future land use scenarios. Exposure pathways may be classified as being complete or incomplete. A complete pathway is an exposure pathway in which exposure to receptors may occur under the Site-specific conditions. An incomplete exposure pathway is an exposure pathway for which it is determined that receptors would not be exposed under the specified conditions. Incomplete exposure pathways are not considered further in the exposure assessment.

The RI at the Site has yet to be completed. This may include the implementation of appropriate IRMs. As such, there is currently insufficient information to assess the status of potential exposure pathways at the Site. The exposure pathways will be classified when data from the RI are available and IRMs have been completed or defined. The exposure pathway analysis will consider potential IRMs implemented at the Site and current and potential future land use scenarios at the Site.

Quantification of exposure - in this step, the magnitude, frequency and duration of exposure for complete pathways will be estimated. Media-specific exposure point concentrations for VOCs and 1,4-dioxane will be estimated based on the statistical evaluation of Site data or via the use of fate and transport models. Based on the exposure point concentrations and the estimated frequency, duration, and route of exposure, the estimated intakes of the on-Site constituents by receptor populations will be estimated.

Toxicity Assessment

The purpose of the toxicity assessment is to weigh available evidence regarding the potential for Site VOCs and 1,4-dioxane to cause adverse effects in exposed individuals. Information, which provides an estimate of the relationship between the extent of exposure and the increased likelihood and/or severity of toxic effects, is identified for the VOCs and 1,4-dioxane. For constituents that may produce non-cancer toxic effects, information on the critical effect caused by constituent exposure will also be compiled and reported. The following toxicity values published in the USEPA Integrated Risk Information System database (IRIS) (USEPA, 2002) will be used in the toxicity assessment:

- Slope factor for carcinogenic health effects
- Reference dose (RfD) for non-carcinogenic health effects

If these toxicity values are not available in IRIS (USEPA, 2001), the USEPA Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997a) or USEPA's National Center for Environmental Assessment (NCEA) (USEPA, 2002a) will be used as a reference. For those site constituents that do not have USEPA-established toxicity values, toxicity values will be calculated (if possible) using EPA methodology, based on data from subchronic or chronic toxicity studies.

Exposure Characterization

The purpose of the exposure characterization step is to quantify the potential health exposure to receptors that may result from exposures to Site-related VOCs and 1,4-dioxane. Non-carcinogenic health effects are evaluated by comparing calculated intakes with chemical-specific RfDs. For carcinogenic health effects, the incremental cancer risk associated with exposure to VOCs and 1,4-dioxane is calculated using EPA-established slope factors. Risk associated with exposure to Site VOCs and 1,4-dioxane may be compared to background risks as part of the exposure characterization.

To assess the risk posed by multiple non-carcinogenic chemicals, a hazard index (HI) approach will be used to calculate the total non-carcinogenic health exposures associated with the Site. The HI is the sum of the ratio of intake to RfD for each chemical of concern. A HI of less than unity (one) indicates that adverse health effects are not expected to occur. Since non-cancer health impacts can involve many different target organs, the HI may be segregated based on the critical effect associated with exposure to a particular constituent. To assess the risks related to exposure to multiple potential carcinogens, the estimated individual carcinogenic risks related to exposure to Site-related chemical residues are summed to give an overall Site cancer risk. This calculated risk estimate is then compared with an acceptable excess cancer risk as defined for this Site. In most cases, a total Site cancer risk which is less than 10^{-4} to 10^{-6} is considered to be acceptable, depending on the Site in question (National Oil and Hazardous Substances Pollution Contingency Plan, March 1990, 40 CFR 300).

The methods used in this HHEA to estimate exposures associated with exposure to Site related VOCs and 1,4-dioxane are not precise, deterministic estimates of actual risk. Rather, these are conditional estimates based upon a considerable number of consecutive upper-bound assumptions regarding exposure and toxicity. They are designed to estimate an upper-bound on the potential health exposure value, as opposed to presenting a precise, realistic estimate of actual health risks. This is done by convention, consistent with USEPA protocols (USEPA, 1989). The main sources of uncertainty relative to the assumptions, results, and conclusions of the HHEA are:

- Estimation of data quality
- Estimation of VOCs and 1,4-dioxane and exposure point concentrations
- Evaluation of exposure scenarios
- Estimation of toxicity values
- Calculation of quantitative exposure estimates

These factors and their influence on the exposure estimates will be discussed within the HHEA.

4.8 No Ecological Risk Assessment

Due to the developed nature of the Site and adjacent properties, no Ecological Risk Assessment is appropriate at this time. Should RI data indicate that there could be ecological receptors, then an Ecological Risk Assessment will be discussed with the NYSDEC at that time.

4.9 IDW Management

Waste Handling

Wastes produced during this project include soil, ground water, decontamination water, and personal protective equipment that may potentially be contaminated. The following paragraphs describe the procedures to be followed for disposal of each of these waste materials.

Personal protective equipment and soil produced during drilling will be placed in 55-gallon DOT approved drums. The drums will then be sealed, labeled, and placed on palettes in a centralized location on the ITT property for later pickup and disposal. Disposal options will be evaluated after characterization of the wastes. Wastes that contain chlorinated compounds will be considered a listed hazardous waste unless otherwise specified in writing by the NYSDEC. The NYSDEC will be advised as to the proposed disposal method.

Water produced during decontamination, well development, and well sampling will be placed in 55-gallon DOT approved drums and contained on site until field work is complete, at which point the waste water will be characterized. The NYSDEC will be advised as to the proposed disposal method.

5. Development of Remedial Action Objectives

A set of remedial action objectives (RAOs) for each media, if factors indicate that remediation is necessary, will be prepared for each of the areas under investigation. Factors to be considered when developing RAOs include: unacceptable exposures, current and future site use, and exceedances of applicable standards, criteria, and guidance values. The set of remedial objectives will specify contaminants of concern, contaminant action levels, areas and volumes of contaminated media at or above action levels, existing and potential exposure routes and contaminant-specific or location-specific SCGs. Also, preliminary remedial technologies applicable to identified RAOs will be developed.

While developing preliminary RAOs, the need for specific treatability/pilot studies will be evaluated. If it is determined that treatability/pilot studies are needed, separate work plans may be negotiated between ITT and NYSDEC. If it is decided that treatability/pilot studies are needed, they will more likely be performed as part of the screening of remedial alternatives during the Feasibility Study tasks discussed in Section 7 of this Work Plan.

6. Remedial Investigation Report

Upon completion of the tasks detailed in Sections 4.4 through 4.7 of this document, a Remedial Investigation Report (RIR) will be produced in accordance with the Section 3 of the Draft DER-10 guidance document and Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988). The RIR will summarize the data collected during the RI, as well as relevant data prior to the RI for the Site. Conclusions based on this data will be provided. Types of information to be included include, but are not limited to, the following:

- An updated Site description
- Updated Site maps
- Field investigation results
- Hydrologic interpretation
- Chemical analyses results
- On- and off-Site nature and extent characterization
- Human exposure assessment results
- Revised conceptual site model
- Assessment of existing data to establish whether there is the need for supplemental data collection for the FS

7. Feasibility Study

Objective

The objective of the Feasibility Study (FS) is to develop, screen and evaluate remedial alternatives for the Site to present sufficient information for decision makers to compare alternatives and select a remedy.

The completion of the FS will be in accordance with the provisions of CERCLA as amended by SARA, the NCP (NCP 1990), USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988), and NYSDEC's revised TAGM on *Selection of Remedial Actions at Inactive Hazardous Waste Sites* (NYSDEC 1990).

7.1 Development of Alternatives

The first phase of the FS is the development of a range of remedial alternatives that are reflective of appropriate waste management options and that are protective of public health and the environment. The development of alternatives encompasses the following steps:

Development of remedial action objectives. Remedial action objectives identify the contaminants and media of interest, pathways of exposure, and preliminary remediation goals. Remedial action objectives, standards, criteria and guidance will be based on public health and environmental concerns identified in the RI and NYS Standards, Criteria, and Guidelines (SCGs) given conditions at the site. The identification of SCGs is an iterative process that continues throughout the RI/FS. SCGs will be identified and modified throughout the RI/FS as a better understanding of site conditions, contaminants and remedial action alternatives are gained.

SCGs are identified as chemical-specific, location-specific, or action-specific. Chemical-specific SCGs are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to the ambient environment. Location-specific SCGs set restrictions on activities based on the characteristics of the site or immediate environs. Action-specific SCGs set controls or restrictions on particular types of actions related to management of hazardous substances, pollutants, or contaminants.

Development of general response actions. General response actions are medium-specific actions (*e.g.* containment, treatment) that satisfy the remedial action objectives.

Identification of volumes or areas of media. The volumes or areas of contaminated media will be identified based on the site conditions defined by the RI, the nature and extent of contamination, potential exposure routes, and the level of protectiveness specified by the remedial action objectives.

Identification and screening of remedial technologies and process options. Remedial technology types and process options that address the site-specific issues will be identified and screened on the basis of technical implementability. Site contaminant information and physical characteristics will be used to evaluate the technical feasibility of identified process options. Infeasible process options will not be considered further.

Evaluation of process options. Each of the process options remaining after the initial screening will be evaluated in greater detail based on the following criteria:

- Effectiveness – the evaluation of effectiveness addresses the potential effectiveness of process options in handling the estimated areas or volumes of contaminated media and meeting the pertinent remedial action objectives; the effectiveness of the process options in protecting human health and the environment during construction and implementation; and how proven and reliable the process options are relative to site conditions.

- Implementability – the evaluation of implementability includes the technical and administrative feasibility of implementing a process option under such institutional constraints as the availability of treatment, storage, and disposal services, special permitting requirements, and the need and availability of equipment and skilled workers.

- Cost – the capital and operation and maintenance costs of each process option will be evaluated relative to the other process options of each technology type.

Based on the evaluation of process options, representative process options are selected to represent each technology type in the assembly of alternatives.

Assembly of remedial alternatives. In this phase, general response actions and process options selected to represent each technology type will be assembled into alternatives such that the site impacts are addressed. The alternatives will be developed to represent a range of treatment and containment combinations. For source control actions, a range of alternatives will be developed that utilize, as their principal element, treatment technologies that reduce the toxicity, mobility, or volume of materials. Alternatives that primarily involve containment with little or no treatment will also be developed. For ground water response actions, if appropriate, a range of alternatives will be developed that attain site-specific remediation levels within varying time frames using one or more technologies. In addition, a no action alternative will be developed. The results of the development of alternatives will be documented in the FS Report. The assembled remedial alternatives will then be screened as detailed in the following section.

7.2 Screening of Alternatives

The second phase of the FS will be the screening of alternatives. The objective of this task will be to screen the remedial alternatives developed during the development of alternatives such that a refined range of the most promising alternatives is identified.

It should be noted that, since the intent of this task is to reduce the range of alternatives to a manageable number prior to the detailed analysis of alternatives, this task may not be necessary if the number of alternatives assembled during the development of alternatives is manageable for detailed analysis. The screening of alternatives consists of three steps. The first step will be the refinement of the alternatives as appropriate by incorporating updated information generated in the RI. In the second step, the alternatives will be screened utilizing the following criteria:

- Effectiveness – this criterion relates to the protectiveness an alternative will provide for human health and the environment, both in the short-term and long-term. Alternatives which achieve reductions in toxicity, mobility or volume of hazardous constituents shall be considered more effective than those that do not accomplish permanent reductions. Alternatives that would result in an increase in the toxicity, mobility, or volume of hazardous constituents will not be considered further.

- Implementability – this criterion relates to the technical and administrative feasibility of implementing the remedial alternative. Technical feasibility involves the ability to construct, operate, and maintain the alternative, as well as monitoring of technical components of an alternative. Administrative feasibility refers to the ability to obtain approvals; the availability of treatment, storage, and disposal services; and the requirements for and availability of equipment and specialists.

- Cost – estimates will be developed for each of the alternatives. The cost estimates will include capital, operation and maintenance, and present worth costs. An alternative that provides a similar level of protection at a significantly higher cost would be eliminated from further consideration. Cost will not be used as the sole deciding factor when comparing alternatives that provide different degrees of public health or environmental protection.

If any of the alternatives require the acquisition of additional data in order to be evaluated, such as treatability data, the data will be generated at that time. If treatability data is required, a treatability study work plan will be developed for review by NYSDEC.

Remedial alternatives with favorable evaluations will be analyzed in detail as outlined in the next section. The alternatives selected for further analysis should preserve, if possible, the range of treatment and containment alternatives developed initially. Alternatives with one or more innovative treatment technologies will be carried through to the detailed analysis if there is reasonable belief that they offer potential for better treatment performance or lower costs for similar levels of performance than demonstrated treatment technologies.

The screening of alternatives process, as well as the rationale for eliminating any alternatives during the screening process, will be documented in the FS Report.

7.3 Detailed Analysis of Alternatives

The objective of this task is to evaluate the most promising remedial alternatives in detail to provide the basis for selection of a remedy. The detailed evaluation will include a technical and statutory assessment and a cost analysis, as presented below. Prior to the evaluation of alternatives, a detailed description of each alternative will be prepared, including any refinements to the alternatives resulting from the acquisition of additional data.

The alternatives will be evaluated based on specific regulatory requirements, technical, cost, and institutional considerations, and community and support agency acceptance. The detailed evaluation will consist of an assessment of each alternative against the evaluation criteria described below. The evaluation will also include a comparative analysis identifying the relative performance of each alternative against the criteria. The following criteria will be used to evaluate the alternatives in detail.

7.3.1. Overall Protection of Human Health and the Environment

The analysis of each alternative with respect to overall protection of human health and the environment will provide an evaluation of whether each alternative achieves and maintains adequate protection of human health and the environment and a description of how site risks are eliminated, reduced, or controlled through treatment, engineering, or institutional controls.

7.3.2 Compliance with SCGs

Each alternative will be evaluated to determine whether it will attain federal, state, and local SCGs.

7.3.3 Long-Term Effectiveness and Permanence

The evaluation of long-term effectiveness and permanence will address the magnitude of residual risk remaining at the Site after alternative implementation from untreated material or treatment residuals and the adequacy and reliability of controls used to manage untreated materials or treatment residuals. The magnitude of residual risks remaining after the implementation of a remedial alternative will be assessed in terms of the amounts and concentrations of the remaining hazardous materials, considering the persistence, toxicity and mobility of the hazardous substances. Long-term management controls include engineering controls, (*e.g.*, containment technologies), institutional controls, monitoring, operation and maintenance. The potential need for replacement of the remedy will also be evaluated.

7.3.4 Reduction of Toxicity, Mobility or Volume

The degree to which the alternatives employ treatment that reduces toxicity, mobility, or volume of the hazardous materials will be evaluated. The factors that will be considered include:

- The treatment technologies utilized and the materials they would treat
- The amount of hazardous materials that would be destroyed or treated
- The expected degree of reduction in toxicity, mobility, or volume of the hazardous materials
- The degree to which treatment is irreversible
- The type and quantity of residuals that would remain following treatment of hazardous materials. This will include consideration of the persistence, toxicity, and mobility of the residuals

7.3.5 Short-Term Effectiveness

The short-term effectiveness of each alternative will be evaluated with respect to the protection of workers and the community during construction and implementation of the alternative, environmental effects resulting from implementation of the alternative, and the time required to achieve remedial action objectives.

7.3.6 Implementability

The ease or difficulty of implementing each alternative will be evaluated. The following factors will be considered:

- The degree of difficulty in constructing the technologies associated with the alternative

- The expected reliability of the technologies associated with the alternative

- The need to coordinate with or obtain permits and approvals from government agencies in order to implement the alternative

- The availability of necessary equipment and specialists

- The available capacity and location of treatment, storage, and disposal services necessary for implementation

- The availability of prospective technologies that are under consideration

- The ability to monitor the effectiveness of the remedy

- The ease of undertaking additional remedial actions, if required.

7.3.7 Cost

The costs that will be evaluated include:

- Capital costs
- Operation and maintenance costs
- Present worth of capital costs and operation and maintenance costs

7.3.8 Community Acceptance

Community positions on specific alternatives that are documented during the RI/FS will be addressed in the detailed analysis of alternatives.

7.3.9 Regulatory Acceptance

Regulatory acceptance will be addressed by NYSDEC in the Record of Decision (ROD) following the public comment period.

The detailed analysis of each of the alternatives will be compiled, and the alternatives will be compared to each other based on the evaluation criteria. The results of the detailed analysis of alternatives will be documented in the FS Report.

7.4 Recommendations

One alternative will be identified that is preferred over the others. In accordance with SARA, the preferred alternative must be protective of human health and the environment, be cost-effective, and utilize permanent solutions and alternative technologies or resource recovery technologies to the maximum extent practicable. The recommended alternative will be documented in the FS Report.

8. Project Management

Organization and Approach

A project management team will be assembled to implement and coordinate the Site investigation. The project management team will consist of a project officer, a project manager, a quality control officer, a project geologist, a project engineer, a data validator, a field supervisor and sampling personnel. Progress reports will be submitted to the project management team and copied to NYSDEC by the project manager on a monthly basis. The monthly progress reports will include 1) a brief introduction, 2) work performed for that period, 3) schedule status, 4) upcoming work activities, 5) project deliverables/milestones, and 6) key project issues (including technical and scheduling issues).

Quality Assurance and Data Management

The Site-specific quality assurance requirements will be performed in accordance with the QAPP (Appendix C). The project supervisor will oversee on-Site sample collection by qualified chemists, engineers, geologists, hydrogeologists and/or environmental technicians. Sampling will be performed in accordance with QA/QC protocols set forth in the QAPP.

Project management will ensure that data management aspects of the program, such as controlling and filing documents, will be thorough and performed in an efficient manner. The program will also ensure that the documents associated with the RI/FS are properly stored and filed. The program will include document receipt control procedures, a file review and inspection system and security measures.

Project Schedule

The RI/FS schedule is presented on Figure 6. Remedial investigation field work will begin within 30 days after the approval of this Work Plan, assuming that access to the AMSF and off-Site properties has been obtained.

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Table 1
Existing Monitoring and Recharge Well Details
ITT Automotive Inc. and Alliance Metal Stamping and Fabrication Corporation
Rochester, New York

Well Number ITT	**Location**		**TOC Elevation** (ft amsl)	**TOP of PVC Riser** (ft amsl)	**Total Depth** (ft bgs)	**Bottom Elevation** (ft amsl)	**Ground Elevation** (ft amsl)	**Top of Screen** (ft bgs)	**Bottom of Screen** (ft bgs)	**Elevation Top Screen** (ft amsl)	**Elevation Bottom Screen** (ft amsl)	**Screen Interval** (ft bgs)	**Geologic Formation**	**Well Status** *
	Northing (site datum)	**Easting** (site datum)												
Monitoring Well														
ITT SBW-1A	10460.01	10164.01	563.91	563.47	25			12.5	25				Eramosa Dolomite	Existing
ITT SBW-2	10409.47	10204.06	564.60	564.25	25			11	25				Eramosa Dolomite	Existing
ITT SBW-3	10391.46	10157.34	564.35	563.94	25			11	25				Eramosa Dolomite	Decomissioned
ITT SBW-4	10030.62	9983.07	559.69		25	535.3	560.3	13.5	25	546.8	535.3	13.5-25	Eramosa Dolomite	Existing
ITT SBW-5A	10436.28	10055.28	563.66		25	539.0	564.0	16	25	548.0	539.0	16-25	Eramosa Dolomite	Existing
ITT SBW-6	10207.6	10220.06	563.00		25	538.4	563.4	11	25	552.4	538.4	11-25	Eramosa Dolomite	Existing
ITT SBW-7	10309.74	10223.23	563.40		25	538.9	563.9	12	25	551.9	538.9	12-25	Eramosa Dolomite	Existing
ITT SBW-8	10028.02	10179.99	561.72		25	537.0	562.0	13.5	25	548.5	537.0	13.5-25	Eramosa Dolomite	Existing
ITT MW-1	10029.71	9979.02			10.4		561.4	5.4	10.4					Existing
ITT MW-2	10392.29	10202.57	574.67	574.82	10	564.8	565.5	5	10					Existing
ITT MW-3***					11									Abandoned
ITT MW-4	10247.22	10043.97	563.42	563.01	8.9	554.1	564.5	3.9	8.9					Existing
ITT DBW-2	10427.03	10205.09	564.27		110	454.6	564.6	100	110	464.6	454.6	100-110	Decew Formation	Existing
ITT DBW-5	10438.49	10030.65	563.86		110	454.1	564.1	100	110	464.1	454.1	100-110	Decew Formation	Existing
ITT DBW-8	10035.28	10180.49	562.37		115.2	447.4	562.6	105	115	457.6	447.6	105-115	Decew Formation	Existing
Recharge Well														
ITT W-1	10042.27	10000.07	560.20		137									Existing

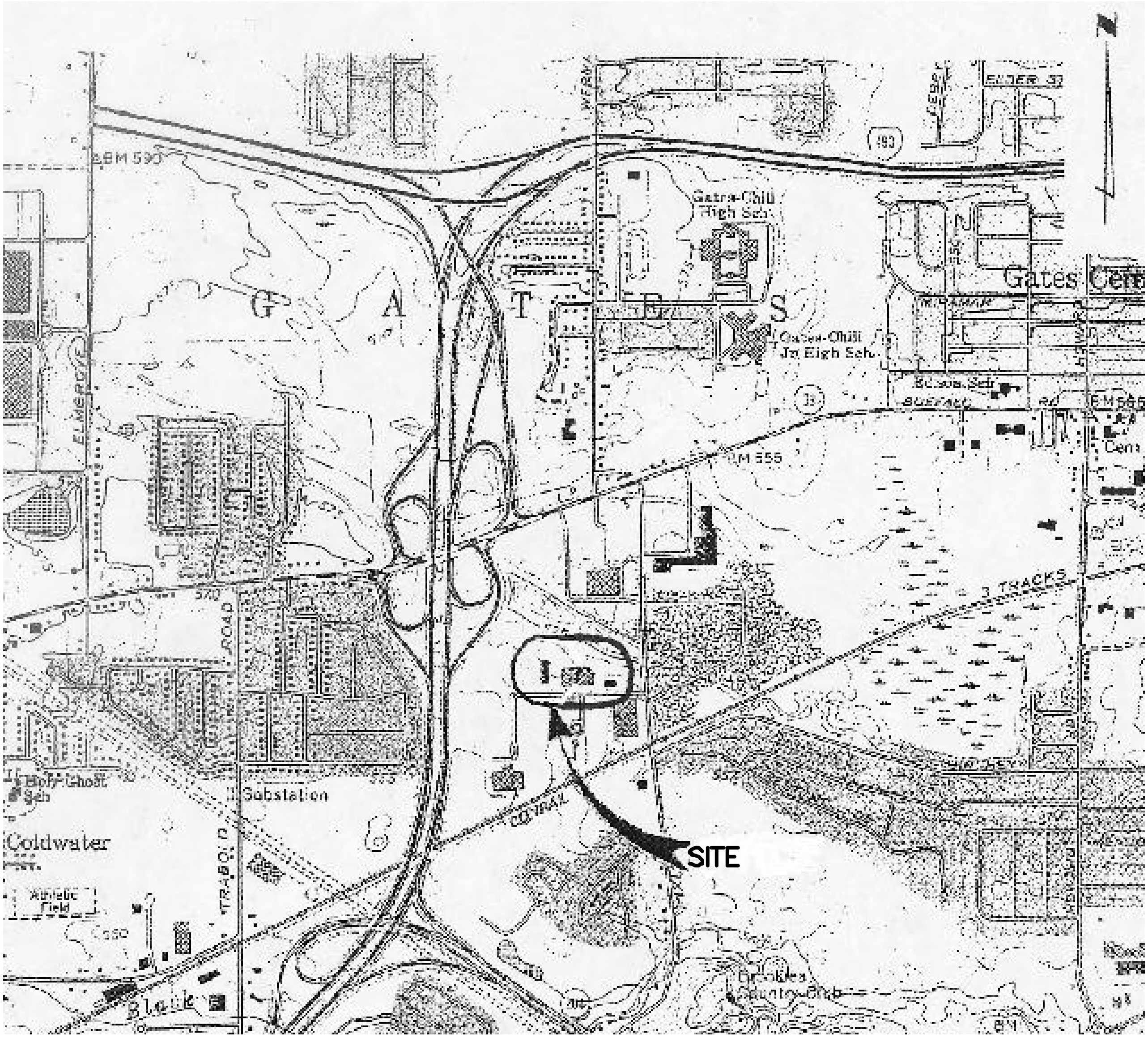
Well Number AMSF	**Location**		**TOC Elevation** (ft amsl)	**TOP of PVC Riser** (ft amsl)	**Total Depth** (ft bgs)	**Bottom Elevation** (ft amsl)	**Ground Elev** (ft amsl)	**Top of Screen** (ft bgs)	**Bottom of Screen** (ft bgs)	**Elevation Top Screen** (ft amsl)	**Elevation Bottom Screen** (ft amsl)	**Screen Interval** (ft bgs)	**Geologic Formation**	**Well Status** **
	Northing (site datum)	**Easting** (site datum)												
Monitoring Well														
AMSF MW-1S	10460.39	10280.46	565.41	565.35			563.6							Damaged
AMSF MW-2	10441.24	10756.48			32	541.1	573.1	22	32	551.1	541.1	22-32	Eramosa Dolomite	Destroyed
AMSF MW-3S	10023.03	10574.06	560.42	560.14										Existing
AMSF MW-4	10093.04	10329.63			25			9	25			9-25	Overburden & Eramosa Dolomite	Existing
AMSF MW-5S	10448.45	10614.6	570.32	570.00	25	542.1	567.1	10	25	557.1	542.1	10-25	Weathered Bedrock & Eramosa Dolomite	Damaged
AMSF MW-6	10454.82	10431.65	566.64	566.59	24	540.9	564.9	9	24	555.9	540.9	9-24	Weathered Bedrock & Eramosa Dolomite	Destroyed
AMSF MW-7	10408.07	10252.41	563.64	563.25	24	538.2	562.2	9	24	553.2	538.2	9-24	Eramosa Dolomite	Existing
AMSF MW-8S	10029.03	10237.54	562.36	562.28	23	537.2	560.2	8	23	552.2	537.2	8-23	Eramosa Dolomite	Damaged
AMSF MW-9S	10202.7	10326.52	564.64	564.28	25.5			10.5	25.5			10.5-25.5	Overburden & Eramosa Dolomite	Damaged
AMSF MW-10	10010.31	10455.72	560.67	560.45	23.3			8.3	23.3			8.3-23.3	Eramosa Dolomite	Existing
AMSF MW-1D	10460.47	10291.71	564.97	564.41	84	479.7	563.7	79	84	484.7	479.7	79-84	Upper Penfield Formation	Damaged
AMSF MW-3D	10022.97	10588.3	560.48	560.08	65			60	65			60-65	Upper Penfield Formation	Damaged
AMSF MW-5D	10447.31	10623.85	570.45	570.29	69	499.1	568.1	64	69	504.1	499.1	64-69	Upper Penfield Formation	Existing
AMSF MW-8D	10021.84	10237.49	561.76	561.59	67.5	492.5	560.0	62.5	67.5	497.5	492.5	67.5-62.5	Upper Penfield Formation	Existing
AMSF MW-9D	10191.84	10326.42	564.59	564.49	70.5			65.5	70.5			65.5-70.5	Upper Penfield Formation	Damaged
Recharge Well														
AMSF RW-1	10026.52	10228.25	557.64		95									Existing
AMSF RW-2	10414.22	10286.92	562.47		149									Existing
AMSF RW-3	10430.8	10468.9	564.27		19									Existing
AMSF RW-4	10434.02	10617.47	565.62		19									Existing
AMSF RW-5	10260.25	10764.4	565.05											Existing
AMSF RW-6	10225.75	10740.01	564.73											Existing

Notes:
* As of October 2003
** As of 1998-2000 NYSDEC Investigation
*** It was later abandoned . No well construction details found
Blank spaces in chart indicate unknown data

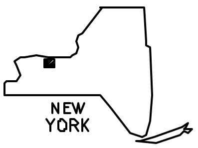
(2) Survey Data from

DWG PATH: I:\DIV71\PROJECTS\4655\31777\DWG\034.DWG

FIGURE 1



ADAPTED FROM: USGS QUADRANGLE MAP ROCHESTER WEST, N.Y. 1978

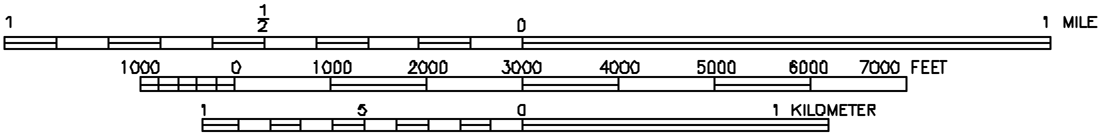


QUADRANGLE LOCATION

ITT AUTOMOTIVE INC.
TOWN OF GATES, N.Y.

SITE LOCATION MAP

SITE #8–28–112



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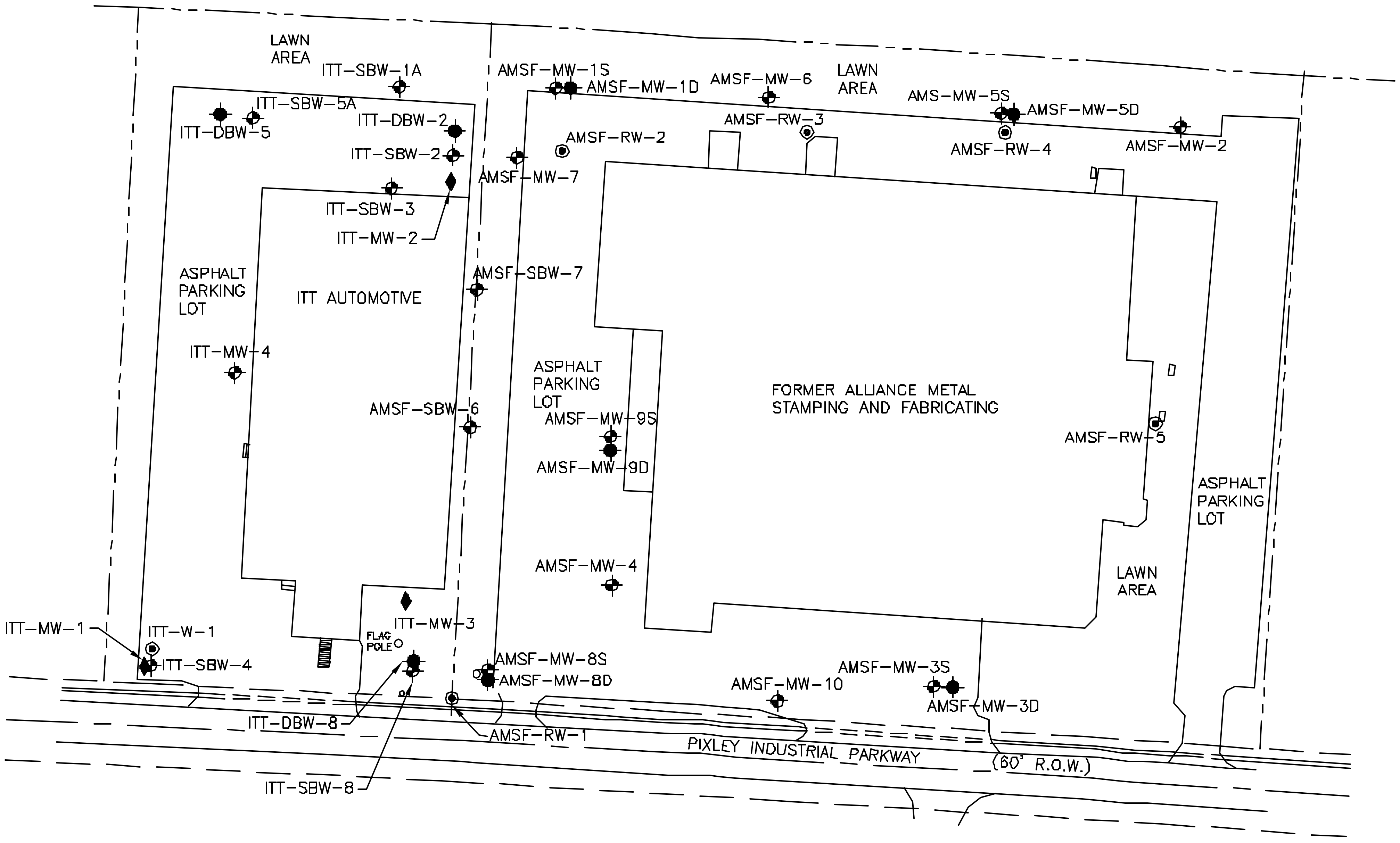
FILE NO. 4655.31777.034
OCTOBER 2003

ENGINEERS INC.

PLOT DATE: 10/28/03

DWG PATH: I:\DIV71\PROJECTS\4655\31777\DWG\035.DWG SF-100

FIGURE 2



LEGEND

⊕	SHALLOW BEDROCK MONITORING WELL
●	DEEP BEDROCK MONITORING WELL
◎	RECHARGE WELL
♦	OVERBURDEN MONITORING WELL
– – – –	PROPERTY LINE
—— – ——	CENTER OF ROADWAY

ITT AUTOMOTIVE INC.
ROCHESTER, NEW YORK
SITE #8-28-112

SITE PLAN

100 0 100

FILE NO. 4655.31777.035
OCTOBER 2003

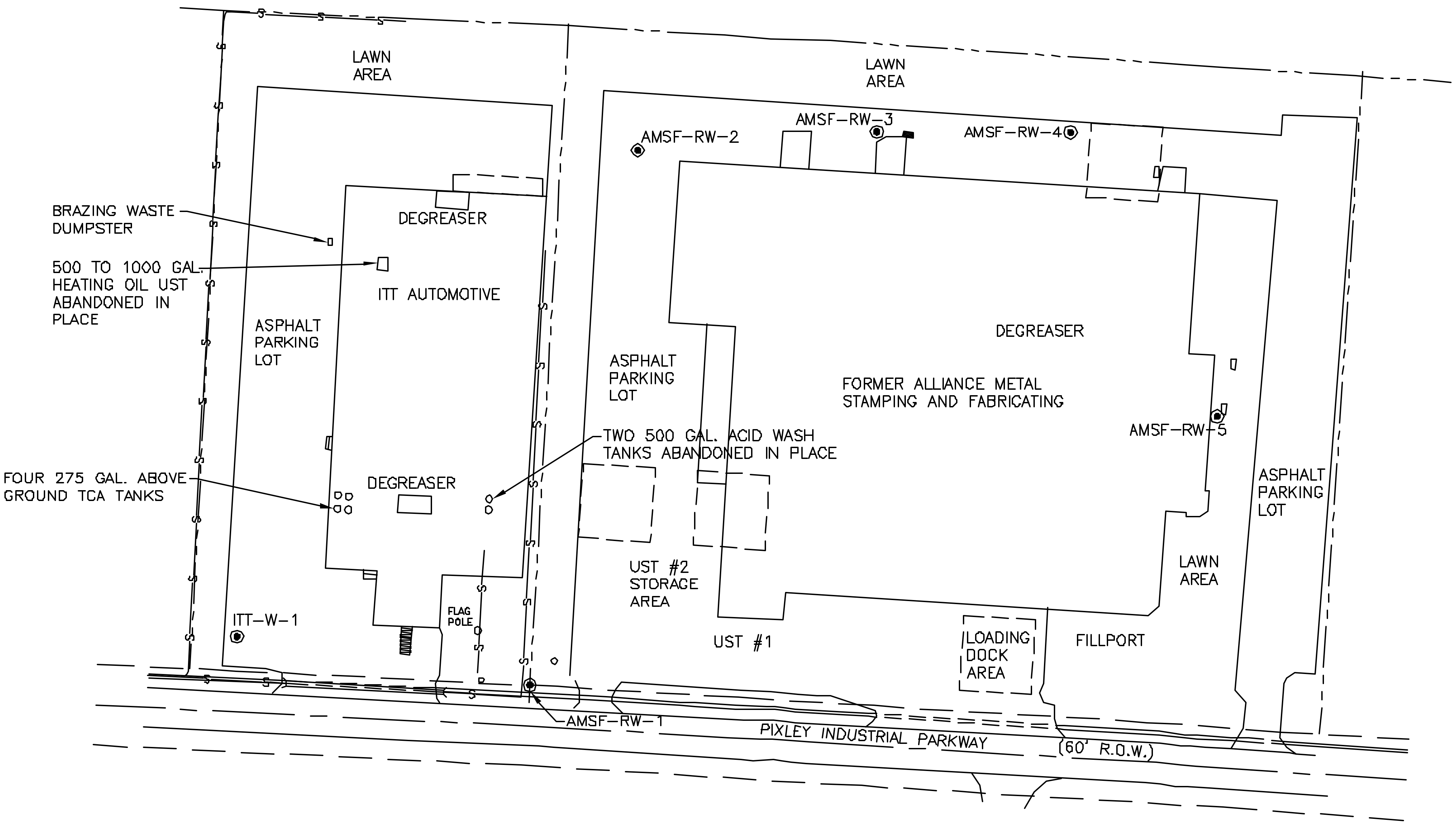
OBRIEN & GERE
ENGINEERS INC.

PLOT DATE: 10/28/03

NOTE:
FIGURE BASED ON NYSDEC DECEMBER 2001 FIGURE 3

DWG PATH: I:\DIV71\PROJECTS\4655\31777\DWG\040.DWG SF-100

FIGURE 3



LEGEND

●	RECHARGE WELL
- - -	PROPERTY LINE
— — —	CENTER OF ROADWAY
—S—S—	SANITARY SEWER
------	SOIL REMEDIATION AREA

ITT AUTOMOTIVE INC. &
TOWN OF GATES, NEW YORK
SITE #8-28-112

LOCATION OF POTENTIAL HISTORIC SOURCES

100 0 100

FILE NO. 4655.31777.040
OCTOBER 2003

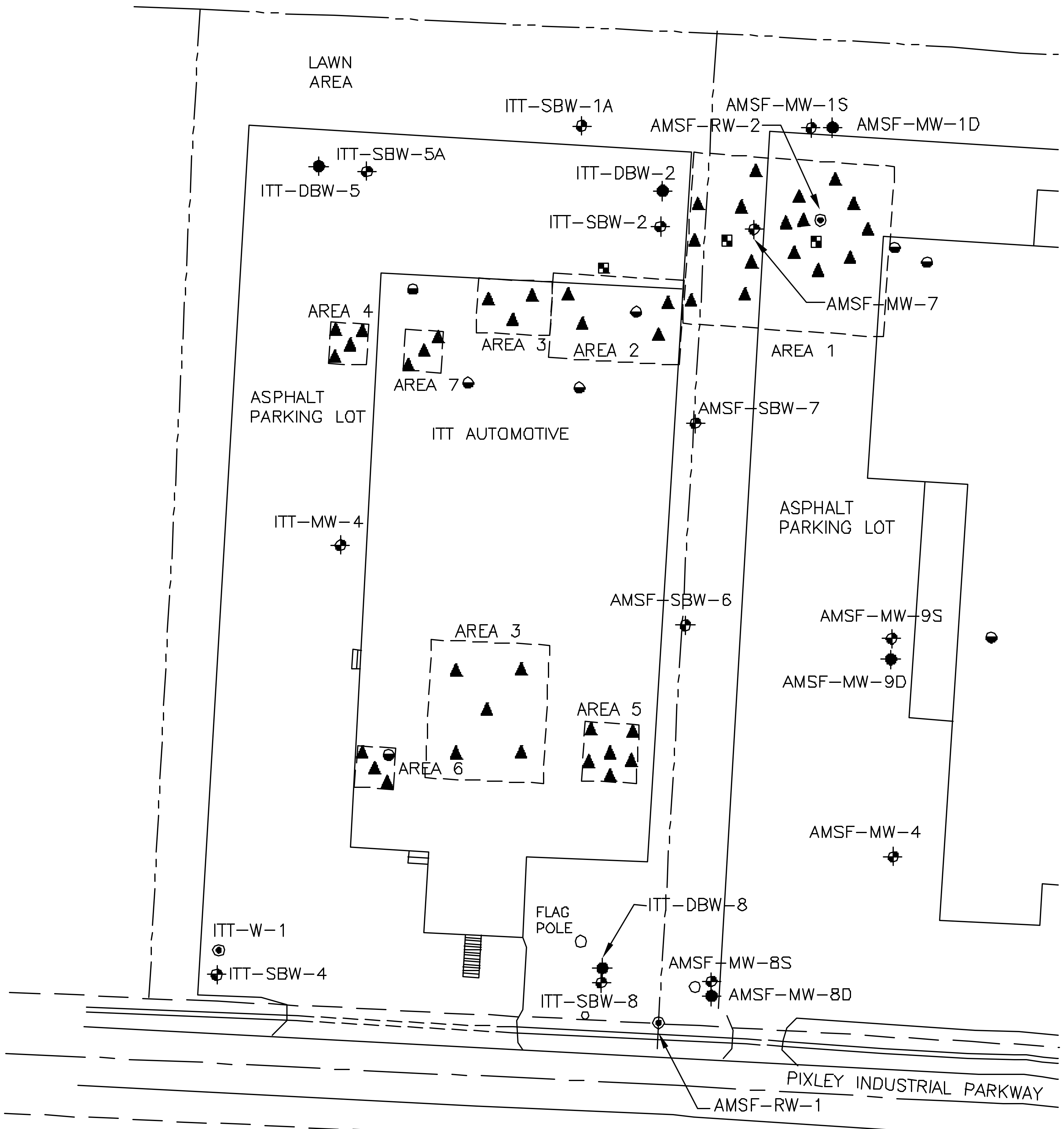
O'BRIEN & GERE
ENGINEERS INC.

PLOT DATE: 10/28/03

NOTE:
FIGURE BASED ON NYSDEC DECEMBER 2001 FIGURE 3

DWG PATH: I:\DIV71\PROJECTS\4655\31777\DWG\037.DWG SF-100

FIGURE 4



NOTE:

FIGURE BASED ON NYSDEC DECEMBER 2001 FIGURE 3

PLOT DATE: 5/5/04

LEGEND

⊕	SHALLOW BEDROCK MONITORING WELL
●	DEEP BEDROCK MONITORING WELL
◉	RECHARGE WELL
♦	OVERBURDEN MONITORING WELL
▲	PROPOSED SOIL BORINGS
▣	PROPOSED BEDROCK CORES
◒	PROPOSED SOIL GAS SAMPLING
– – – –	PROPERTY LINE
—— – ——	CENTER OF ROADWAY

ITT AUTOMOTIVE INC. &
TOWN OF GATES, NEW YORK
SITE #8-28-112

PROPOSED SOIL BORING, BEDROCK CORES, AND SOIL GAS SAMPLES

60 0 60

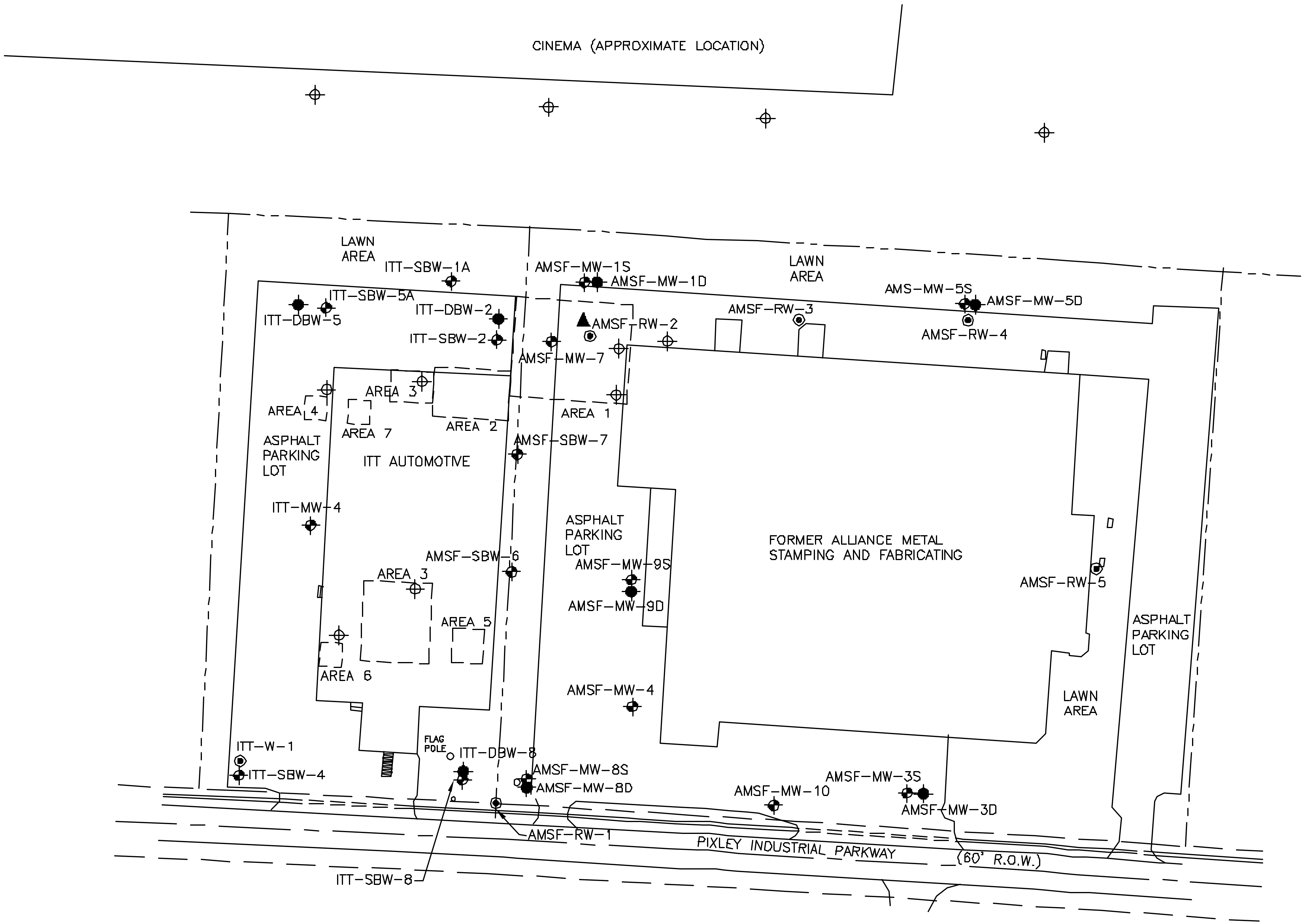
FILE NO. 4655.31777.037
MAY 2004

OBRIEN & GERE ENGINEERS INC.

DWG PATH: I:\DIV71\PROJECTS\4655\31777\DWG\041.DWG SF-100

PLOT DATE: 5/5/04

FIGURE 5



LEGEND

⊕ SHALLOW BEDROCK MONITORING WELL

⌖ PROPOSED SHALLOW MONITORING WELL

● DEEP BEDROCK MONITORING WELL

◉ RECHARGE WELL

▲ PROPOSED DEEP MONITORING WELL

- - - - PROPERTY LINE

— — — CENTER OF ROADWAY

ITT AUTOMOTIVE INC. &
TOWN OF GATES, NEW YORK
SITE #8-28-112

PROPOSED SHALLOW AND DEEP MONITORING WELLS

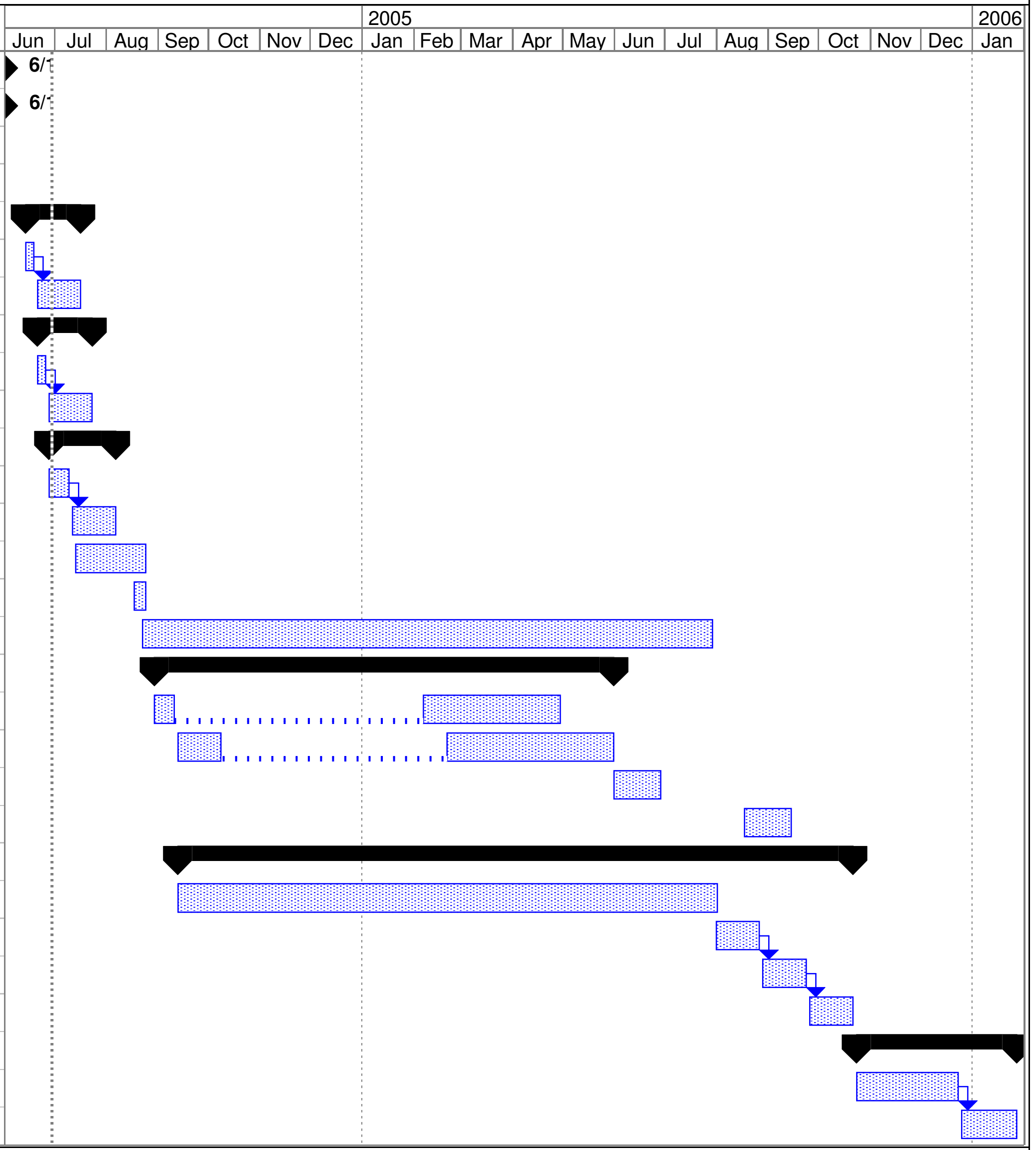
100 0 100

FILE NO. 4655.31777.041
MAY 2004

O'BRIEN & GERE
ENGINEERS INC.

Figure 6
Remedial Investigation/Feasibility Study Work Plan
ITT Automotive, Inc.
Town of Gates, NY

ID	Task Name	Duration	Start	Finish
1	**NYSDEC Approval RI/FS Work Plan**	1 day	Tue 6/1/04	Tue 6/1/04
2	**Off-Site Access**	1 day	Tue 6/1/04	Tue 6/1/04
3	**Mobilization**	5 days	Thu 6/7/07	Wed 6/13/07
4	**Drain Testing**	5 days	Thu 6/14/07	Wed 6/20/07
5	**Soil Gas Sampling**	**25 days**	**Mon 6/14/04**	**Fri 7/16/04**
6	Field effort	5 days	Mon 6/14/04	Fri 6/18/04
7	Lab effort	20 days	Mon 6/21/04	Fri 7/16/04
8	**Recharge Well Sampling**	**25 days**	**Mon 6/21/04**	**Fri 7/23/04**
9	Field effort	5 days	Mon 6/21/04	Fri 6/25/04
10	Lab effort	20 days	Mon 6/28/04	Fri 7/23/04
11	**Soil Borings**	**30 days**	**Mon 6/28/04**	**Fri 8/6/04**
12	Field effort	10 days	Mon 6/28/04	Fri 7/9/04
13	Lab effort	20 days	Mon 7/12/04	Fri 8/6/04
14	**Well Installation**	30 days	Wed 7/14/04	Tue 8/24/04
15	**Hydraulic Testing**	5 days	Wed 8/18/04	Tue 8/24/04
16	**Quarterly Elevation Monitoring**	245 days	Mon 8/23/04	Fri 7/29/05
17	**Ground Water Sampling**	**197 days**	**Mon 8/30/04**	**Tue 5/31/05**
18	Field effort	70 days	Mon 8/30/04	Fri 4/29/05
19	Lab effort	92 days	Mon 9/13/04	Tue 5/31/05
20	**Human Exposure Assessment**	20 days	Wed 6/1/05	Tue 6/28/05
21	**Topographic Survey**	20 days	Thu 8/18/05	Wed 9/14/05
22	**RI Report**	**290 days**	**Mon 9/13/04**	**Fri 10/21/05**
23	RI Report	231 days	Mon 9/13/04	Mon 8/1/05
24	NYSDEC Review	20 days	Mon 8/1/05	Fri 8/26/05
25	RI Report Revision	20 days	Mon 8/29/05	Fri 9/23/05
26	NYSDEC Approval of RI Report	20 days	Mon 9/26/05	Fri 10/21/05
27	**Feasibility Study**	**70 days**	**Mon 10/24/05**	**Fri 1/27/06**
28	Feasibility Study Evaluation	45 days	Mon 10/24/05	Fri 12/23/05
29	Feasibility Study Report	25 days	Mon 12/26/05	Fri 1/27/06



Project: RIFS Schedule
Date: Tue 6/29/04

Task	▨	Milestone	◆	External Tasks	▭
Split	┄┄┄┄	Summary	▬	External Milestone	◆
Progress	▬	Project Summary	▬	Deadline	⇩

REPORT

Citizen Participation Plan for the ITT Automotive, Inc. Inactive Hazardous Waste Disposal Site Town of Gates, New York (Site #8-28-112)

ITT Automotive, Inc.

May 2004

REPORT

Citizen Participation Plan for the ITT Automotive, Inc. Inactive Hazardous Waste Disposal Site Town of Gates, New York (Site #8-28-112)

ITT Automotive, Inc.

Steven J. Roland

Steven J. Roland, P.E.
Executive Vice President

May 2004

O'BRIEN & GERE ENGINEERS, INC.

Contents

List of Tables

List of Figures

List of Attachments

1. Introduction and Overview of the Citizen Participation Plan

What is a Citizen Participation Plan?

A Citizen Participation Plan, or CP Plan, provides interested citizens like you with information on how ITT and the New York State Department of Environmental Conservation (NYSDEC) will involve the public during the process of investigating and remediating (cleaning up) a hazardous waste site. The plan identifies information ITT and the State want to communicate to site neighbors as well as information needed from the community. Additionally, the plan is used to track public involvement activities that must be conducted according to state regulations, such as notifying residents when a cleanup plan is selected.

What documents are included in this plan?

- Background information about the site and investigations occurring there;
- Information on planned citizen participation activities (see Section 3.2);
- Locations where you can find more information ("document repositories") and a list of documents available there;
- A glossary of terms and acronyms you may encounter while learning about the site (see Section 7);
- A list of people interested or involved with the site ("Mailing List");
- A copy of the site's page from the state's official list, or registry, of hazardous wastes sites in New York State (see Attachment A); and
- Fact sheets explaining the steps in the investigation and cleanup process (see Attachment B).

The plan is periodically updated to include new fact sheets, additions to the mailing list, or changes in planned citizen participation activities.

If you would like more information on citizen participation activities, contact Lisa LoMaestro Silvestri of the New York State Department of Environmental Conservation at (585) 226-5326.

This document is the site-specific Citizen Participation Plan (CPP) for the Remedial Investigation/Feasibility Study (RI/FS) activities for the ITT Automotive, Inc. site (Site #8-28-112) in the Town of Gates, New York. The Site Page from the New York State Department of Environmental Conservation (NYSDEC) Registry of Inactive Hazardous Waste Disposal Sites is included as Attachment A. The ITT Automotive

(ITT) property, in conjunction with the adjacent former Alliance Metal Stamping and Fabricating (AMSF) property are considered the Site for purposes of the RI/FS and this CPP. A Site location plan is included as Figure 1-1. The RI/FS is being performed pursuant to the Order on Consent (B8-0614-02-05) between the New York State Department of Environmental Conservation (NYSDEC) and ITT Automotive, Inc. dated August 28, 2003 (Consent Order).

The RI/FS will be conducted in accordance with the RI/FS Work Plan, of which this CPP is one component. The field sampling activities will be conducted in accordance with the Field Sampling Plan (FSP). The FSP is provided in Section 4.4 to the RI/FS Work Plan. Attachment B provides Fact Sheets Explaining the Investigation and Cleanup Stages in the Hazardous Waste Site Program.

2. Site Background

2.1. Site Setting

The Site consists of the ITT Automotive, Inc. property located at 30 Pixley Industrial Parkway (Figure 1). This property covers approximately 3 acres of land located in the City of Rochester, Town of Gates, Monroe County, New York. The adjacent former Alliance Metal Stamping and Fabricating (AMSF) property is presently considered an off-site property for purposes of the RI/FS, however due to the distribution of constituents of concern the combined ITT and AMSF properties are included in the scope of work and are presented in figures.

The Site is located approximately 0.75 miles north of the Little Black Creek and 2.25 miles to the southwest of the Erie Canal. The Site is bordered to the north by a large movie theater complex and commercial district, the AMSF property to the east, and commercial district; industrial properties border the Site to the south and west.

2.2. Site History

The original ITT facility was constructed on vacant land in 1973 for Rochester Form Machine. The facility has undergone several expansions since that time. The ITT Automotive, Inc. facility currently consists of a 45,500 square foot one-story building located on approximately three acres of property. Operations at the ITT Automotive, Inc. facility included the manufacture of aluminum components for automotive air conditioning and various general applications that involve drilling and machining, alkali cleaning, tube forming, aluminum brazing and welding.

The original AMSF building was constructed in 1967 and has been expanded on several occasions. Operations at the former AMSF facility included stamping, forming, cleaning, grinding, painting, and deburring metals. The facility also provided machining and tool building services. The property is currently owned by Maguire Family Properties, Inc. The former AMSF building has been expanded and subdivided and is currently used by various tenants for commercial and light industrial activities.

2.3. Environmental Issues Identified at the Site and AMSF Property

The following studies were previously performed at the ITT Property. These studies were completed without NYSDEC review or approval and the NYSDEC does not necessarily endorse the assessments and conclusion. However the previous data will be used to assist in the site evaluation.

Quantitative Environmental Survey at ITT-Higbie Baylock Rochester Form Machine, H2M Group, April 1993.

The objective of the investigation was to evaluate potential impacts to the environment associated with eight areas of potential environmental concern on the ITT property. The investigation consisted of the installation of soil borings and monitoring wells.

Chemical analysis of the soil and ground water included Volatile Organic Compounds (VOCs), total petroleum hydrocarbons (TPHs), pH quantified in soils, and metals.

Results of this investigation indicated that two areas were identified as needing further investigation due to the presence of VOCs including 1,1,1-trichloroethane (TCA) and 1,4-dioxane. These areas are located in the southwest corner and in the northeast corner of the ITT facility, respectively.

Final Report on Ground Water Investigation, ITT Industries, Fluid Handling System, Golder Associates Inc., March 2000.

The objective of this investigation was to further evaluate ground water conditions at the ITT property. The investigation included the installation of five shallow bedrock wells, three deep bedrock wells, and seven overburden soil borings. The report also included a description of the site geology and hydrogeology for the shallow, intermediate, and deep bedrock zones. This description included the characterization of the ground water flow and hydrogeologic regime.

Results of the analytical testing indicated the presence of VOCs in the overburden soil and the ground water beneath the property. The primary VOC of concern was TCA, which was detected in both soil and ground water. The highest concentration of VOCs in the shallow ground water was located in the northeast corner of the ITT facility.

Analytical results from the ground water samples collected from the deep bedrock monitoring wells indicated the presence of VOCs. Results indicated the presence of TCA and 1,1-dichloroethane (1,1-DCA) at or slightly above the ground water standard. Benzene, toluene and xylene (BTX) compounds were also detected in deep bedrock wells. The VOCs detected in the deep bedrock zone are much lower in concentration than in the shallow bedrock zone.

Results of this investigation indicated that the presence of VOCs in the overburden soils at the ITT facility may be attributed to past operations at the Site and/or from VOCs present in the shallow bedrock ground water. BTX compounds detected in the deep bedrock zone were considered the result of the natural occurrence of these compounds in the bedrock underlying the Site.

Supplemental Subsurface Investigation, Risk Assessment, Natural Attenuation Evaluation and Soil Remediation, ITT Industries, Golder Associates, Inc., May 2000.

Golder Associates conducted a supplemental subsurface investigation, a screening level risk assessment, a natural attenuation evaluation, and soil remediation at the ITT facility. The investigation included the installation of 45 soil borings in the northeast corner of the ITT property and ground water sampling of the existing monitoring wells.

The soil analytical results indicate that TCA and 1,4-dioxane were detected in most of the soil samples. Based on the results of the supplemental soil investigation, a soil remediation plan was designed and executed at the ITT facility. The remediation removed and disposed of soil containing VOCs above the NYSDEC recommended soil cleanup objective. Approximately 968 tons of impacted soils were removed from the northeastern portion of the ITT property.

Ground water samples were collected from the shallow and deep bedrock monitoring wells at the ITT facility and analyzed for natural attenuation parameters. The natural attenuation evaluation provided a strong indication that natural attenuation processes were occurring in the shallow and deep ground water systems at the ITT property.

A screening level risk assessment was also performed to evaluate the potential risk to industrial/commercial site users of the ITT facility. Results indicated that it was unlikely that the current site subsurface conditions would pose a health risk due to exposure to TCA and 1,4-dioxane in the soil and shallow ground water.

Transducer Study, ITT Automotive, Inc., O'Brien & Gere Inc., September 2003

This investigation included ground water head and temperature monitoring at eight monitoring wells and one recharge well on the ITT facility for a period of 33 days. The objective of this study was to evaluate whether the discharge of precipitation runoff into recharge wells on the ITT and the neighboring properties affect ground water elevations and ground water flow patterns.

Results of the investigation showed that the shallow bedrock ground water head beneath the ITT property responded quickly to precipitation runoff discharge to the site recharge well. The ITT recharge well affected the ground water head and temperature in the shallow bedrock. A sequence in ground water head response also occurred in monitoring wells on the northern portion of the property, which were located at increasing distances from AMSF recharge well RW-2.

In addition, ground water elevations measured at the time of peak head response documents an east to west hydraulic gradient across the northern portion of the ITT property.

The following studies were previously performed at the AMSF Property.

Characterization of Soil and Ground Water Quality at the Alliance Metal Stamping and Fabricating Property, Pixley Industrial Park, Gates, NY, GeoServices Ltd., October 16, 1992.

GeoServices, Ltd. conducted a soil and ground water quality characterization at the AMSF property. Eleven soil borings were completed in the southwestern portion of the site and eight borings were completed in the southern portion of the property.

Analytical results indicated that tetrachloroethene (PCE) and TCA were detected in the soil samples.

Four monitoring wells had been previously installed at the AMSF property in conjunction with a November 1991 environmental site assessment for characterization of ground water flow and quality beneath the subject property. Six monitoring wells and five deep piezometers were constructed during the 1992 investigation in order to characterize ground water flow and VOCs occurrences.

Analytical results indicate that VOCs were present in ground water at each of the locations sampled. TCA and PCE accounted for more than 65 percent of the total VOCs in 13 of the 15 wells sampled. Degradation products of those chlorinated compounds account for the remainder of the VOCs detected. The degradation products account for a greater percentage of the total VOCs in the ground water of the deep piezometers.

Report of June 1993 Site Testing and May 1994 Site Remediation Work, The Alliance Metal Stamping and Fabricating Property, Pixley Industrial Park, Gates, NY, GeoServices Ltd., August 2, 1994.

In 1993 and 1994, GeoServices, Ltd. conducted environmental testing and site remediation work at the AMSF property. Soil samples were collected beneath the depth interval previously tested at a location on the western side of the AMSF property and from the AMSF property hydraulically upgradient of MW-7.

The deeper soil sample results indicated that VOCs were present. The soil samples contained TCA, PCE and 1,1,2-trichloroethane.

Six soil borings were completed at the upgradient location on the property. Analytical results indicated that soils at this upgradient location contained TCA.

Two existing AMSF storm water recharge wells, RW-1 and RW-2, were sampled along with other site monitoring wells. Analytical results indicated that VOCs were detected in many of the monitoring and recharge wells. TCA was the principle VOC detected.

Based on the soil sampling results obtained, a soil excavation/remediation plan was conducted at four locations on the AMSF property in order to remove soil containing relatively elevated VOCs. The locations included two in the area of the southwest corner of the building, the northeast corner of the building, and the south central portion of the property.

Site Investigation Report ITT Automotive Fluid Handling Systems and Former Alliance Metal Stamping and Fabricating, Town of Gates, Monroe County. NYSDEC, December 2001.

The NYSDEC performed this investigation at both the ITT and the AMSF facilities, focusing on the northeast corner of the ITT property and the adjacent northwest corner of the AMSF property.

Field activities consisted of sampling existing monitoring wells, surface and subsurface soils, storm water recharge wells and conducting several rounds of additional ground water sampling.

The NYSDEC report indicated that a consequential amount of hazardous waste, in the form of chlorinated VOCs, has been disposed of at the ITT property and potentially at the AMSF property. Additional compounds, including non-chlorinated VOCs, semivolatile organic compounds (SVOCs), and inorganic compounds were detected exceeding the standards, but the results were not indicative of hazardous waste disposal.

The report recommended that the ITT property and the AMSF property be considered for inclusion in the New York State Listing of Inactive Hazardous Waste Disposal Sites.

3. Project Description

Site investigation tasks, for the RI/FS, will include collection of environmental samples including soil samples, soil gas samples, and ground water samples. Thirty-three soil borings and 12 monitoring wells will be installed as part of this investigation. The environmental samples will be submitted to a New York State certified laboratory for analysis of VOCs, SVOCs, metals, and 1.4-dioxane.

3.1. Upcoming Site Investigation Activities

After NYSDEC determines that the Site has been adequately investigated, NYSDEC, in conjunction with the New York State Department of Health (DOH), will propose a final action plan for the Site. This plan is called a Proposed Remedial Action Plan, or PRAP. This plan will compare different cleanup options that could be taken at the Site and recommend a preferred cleanup option based on a series of criteria, such as short and long-term permanence of the cleanup, cost, and ease of implementation. NYSDEC will solicit public input into the plan.

After considering all comments received, NYSDEC will make a final decision on the cleanup plan and outline the decision in a document called a Record of Decision, or ROD. NYSDEC will include responses to comments they receive from citizens in an appendix in the Record of Decision. More details about the citizen participation activities that will take place during the investigation and selection of a cleanup plan can be found in the next section of this Citizen Participation Plan.

3.2. Description of Specific Citizen Participation Activities

NYSDEC is committed to keeping the public informed and involved throughout the process of investigating and remediating the ITT Automotive, Inc. Site. As such, the NYSDEC requires several citizen participation activities. Table 1 describes the citizen participation activities that will take place during the RI/FS and evaluation of a cleanup plan for the ITT Automotive, Inc. Site.

Some citizen participation activities may be performed by the NYSDEC, and some may be performed by ITT Automotive, Inc. The project managers will use Table 1 to track required citizen participation activities for the ITT Automotive, Inc Site.

3.3. Project Schedule

A preliminary project schedule has been established for the RI/FS activities. The preliminary schedule is provided on Figure 6 of the RI/FS Work Plan.

4. Project Contacts

For more information about this project, please contact the following persons:

Environmental Concerns

Mr. Frank Sowers, P.E.
Division of Environmental Remediation
NYSDEC – Region 8
6274 East Avon-Lima Road
Avon, New York 14414
(585) 226-5357

Health Related Concerns

Ms. Deborah McNaughton
NY State Dept. of Health
335 East Main Street
Rochester, New York 14604
(585) 423-8069

Citizen Participation

Ms. Lisa LoMaestro Silvestri – Citizen Participation Specialist
NYSDEC – Region 8
6724 East Avon-Lima Road
Avon, New York 14414
(585) 226-5326

5. Public Mailing List

A mailing list is used to provide information to area residents, elected officials, media and other interested parties who want to be kept informed about the ITT Automotive, Inc. site. The public mailing list is included as Table 2.

6. Identification of Document Repositories

Documents related to the ITT Automotive, Inc. site will be available for public review at the locations listed below. As additional documents are created during the remediation process, they will be added to the repositories.

Gates Public Library
1605 Buffalo Road
Rochester, New York 14624
(585) 247-6446
Hours of Operation: M-F: 10am – 9pm
Sat: 10am – 5pm
Sun: Closed

NYSDEC
Region 8 Offices
6724 East Avon-Lima Road
Avon, New York 14414
(585) 226-5326
Contact: Ms. Lisa LoMaestro Silvestri – Citizen Participation Specialist
Hours of Operation: Mon-F: 8:30am-4:45pm
(by appointment only)

7. Glossary of Key Terms and Major Program Elements

This glossary defines terms associated with New York's hazardous waste site citizen participation program, and important elements of the hazardous waste site remedial program. Words in **bold** in the definitions are defined elsewhere in the glossary. A list of acronyms often used in the remedial program is presented at the end of this section.

Administrative Record
Part of a site's **Record of Decision** that lists and defines documents used in the development of NYSDEC's decision about selection of a remedial action.

Availability Session
A scheduled gathering of program staff and members of the public in a casual setting, without a formal presentation or agenda but usually focusing on a specific aspect of a site's remedial process.

Citizen Participation
A program of planning and activities to encourage communication among people affected by or interested in hazardous waste sites and the government agencies responsible for investigating and remediating them.

Citizen Participation (CP) Record
A document prepared at a major remedial stage that describes the citizen participation activities required at that stage. A CP Record also directs a scoping process to determine if additional citizen participation activities are appropriate and feasible.

Citizen Participation Specialist
A staff member from a NYSDEC central office or regional office who has specialized training and experience to assist a **project manager** and other staff to plan, conduct and evaluate a site-specific citizen participation program.

Classification
A process to place a hazardous waste site within a category which defines its hazardous waste status and its threat or potential threat to public health and the environment. Sites are listed along with their classification in the **Registry of Inactive Hazardous Waste Disposal Sites**.

- **Class 1** – causing or representing an imminent danger of causing irreversible or irreparable damage to public health or environment – immediate action required.

- **Class 2** – significant threat to public health or environment – action required.
- **Class 2a** – temporary classification assigned to a site for which there is inadequate or insufficient data for inclusion in any other classification.
- **Class 3** – does not present a significant threat to public health or environment – action may be deferred.
- **Class 4** – site properly closed – requires continued management.
- **Class 5** – site properly closed – no further action required.
- **Delisted** – site no longer considered an inactive hazardous waste disposal site.

Comment Period
A time period for the public to review and comment about various documents and **Division of Environmental Remediation (DER)** actions. For example, a 30-day comment period is provided when DER issues a **Proposed Remedial Action Plan (PRAP)**, and when DER proposes to **delist** a site from the **Registry of Inactive Hazardous Waste Disposal Sites.**

Consent Order
A legal and enforceable agreement negotiated between NYSDEC and a **responsible party**. The order sets forth agreed upon terms by which a responsible party will undertake site investigation and/or cleanup, or pay for the costs of those activities. The order includes a description of the remedial actions to be taken by the responsible party with NYSDEC oversight, and a schedule for implementation.

Contact List
Names, addresses and/or telephone numbers of individuals, groups, organizations, government officials and media affected by or interested in a particular hazardous waste site. The size of a contact list and the categories included are influenced by population density, degree of interest in a site, the stage of the remedial process and other factors. It is an important tool needed to conduct outreach activities.

Delist
Action by which DER removes a hazardous waste site from the **Registry of Inactive Hazardous Waste Disposal Sites** upon determination that: the site contains inconsequential amounts of hazardous wastes; or that a remediated site no longer requires **Operation and Maintenance.** A proposal to delist a site triggers a public notification and **comment period** process.

Division of Environmental Enforcement (DEE)
A unit within NYSDEC that works with the **Division of Environmental Remediation** and others to negotiate with **responsible parties** to achieve agreements for the investigation and remediation of hazardous waste sites. A negotiated agreement is contained in a **consent order**.

Division of Environmental Remediation (DER)
Formerly the **Division of Hazardous Waste Remediation**, a major program unit within NYSDEC created to manage the hazardous waste site remedial program from site discovery through **Operation and Maintenance** activities. Staff include: engineers, geologists, chemists, attorneys, citizen participation specialists, environmental program specialists and support staff.

Division of Hazardous Waste Remediation
(See **Division of Environmental Remediation**.)

Document Repository
A file of documents pertaining to a site's remedial and citizen participation programs which is made available for public review. The file generally is maintained in a public building near the hazardous waste site to provide access at times and a location convenient to the public.

Enforcement
NYSDEC's effort, through legal action if necessary, to compel a **responsible party** to perform or pay for site remedial activities. NYSDEC may perform this effort by itself or in concert with other agencies.

Environmental Quality Bond Act (EQBA)
The 1986 Environmental Quality Bond Act which gives New York State bonding authority of up to $1.2 billion to fund the State's share of the total cost of remediating hazardous waste sites in New York State.

Fact Sheet
A written discussion about part or all of a site's remedial process, prepared and provided by DER to the public. A fact sheet may focus on: a particular element of the site's remedial program; opportunities for public involvement; availability of a report or other information, or announcement of a **public meeting** or **comment period**. A fact sheet may be mailed to all or part of a site's **contact list**, distributed at meetings, placed in a **document repository** and/or sent on an "as requested" basis.

Interim Remedial Measure (IRM)
A discrete action which can be conducted at a site relatively quickly to reduce the risk to people's health and the environment from a well-defined hazardous waste problem. Examples of IRMs include removing contaminated soil and drums, providing alternative water supplies or securing a site to prevent access.

National Priorities List
The U.S. Environmental Protection Agency's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response using money from a special trust fund.

New York State Department of Health
Agency within the executive branch of New York State government which: performs health-related inspections at suspected hazardous waste sites; conducts health assessments to determine potential risk from environmental exposure; reviews Risk Assessments prepared during the

Remedial Investigation and Feasibility Study; conducts health-related community outreach around sites; and reviews remedial actions to assure that public health concerns are adequately addressed.

New York State Department of Law
Agency within the executive branch of New York State government that takes the lead on hazardous waste sites requiring civil enforcement through court action. Litigation can involve negotiations and court action with **responsible parties** to clean up sites; natural resource damage claims, and recovery of remedial costs.

New York State Registry of Inactive Hazardous Waste Disposal Sites
The "Registry." A document that NYSDEC is directed by law to maintain and that lists and provides information about every hazardous waste site in New York State that meets criteria established through a definition of hazardous waste and **classification** system.

Operable Unit
A discrete part of an entire site that produces a release, threat of release, or pathway of exposure. An Operable Unit can receive specific investigation, and a particular remedy may be proposed. A **Record of Decision** is prepared for each Operable Unit.

Operation and Maintenance
A period in which remedial action may be conducted following construction at a site (for example, operation of a "pump and treat" system), or which is performed after a remedial action to assure its continued effectiveness and protection of people's health and the environment. Activities can include site inspections, well monitoring and other sampling.

Preliminary Site Assessment (PSA)
A PSA is DER's first investigation of a site. A PSA is performed to determine if a site meets New York State's definition of an inactive hazardous waste disposal site by confirming the presence of hazardous waste and determining if the site poses a significant threat to public health or the environment.

Project Manager
A NYSDEC staff member within the DER (usually an engineer, geologist or hydrogeologist) responsible for the day-to-day administration of remedial activities at, and ultimate disposition of, a hazardous waste site. The Project Manager works with legal, health, **citizen participation** and other staff to accomplish site-related goals and objectives.

Proposed Remedial Action Plan (PRAP)
An analysis by DER of each alternative considered for the remediation of a hazardous waste site and a rationale for selection of the alternative it recommends. The PRAP is created based on information developed during the site's **Remedial Investigation and Feasibility Study**. The PRAP is reviewed by the public and other state agencies.

Public Meeting
A scheduled gathering of DER staff with the affected/interested public to give and receive information, ask questions and discuss concerns about a site's remedial program. Staff from other NYSDEC divisions, legal and health staff, and staff from consultants and a responsible party often also attend. A public meeting, unlike an **availability session**, generally features a formal presentation and a detailed agenda.

Reclassification
A process by which DER redefines the threat posed by a hazardous waste site to public health and the environment by developing and assessing site information and, based on findings and conclusions, assigning a new **classification** code.

Record of Decision (ROD)
A document that provides a definitive record of the cleanup alternative that will be used to remediate a hazardous waste site. The ROD is based on information and analyses developed during the **Remedial Investigation/Feasibility Study** and the public comment.

Remedial Alternatives Report (RAR)
A report that contains an evaluation of options for the remediation of any contamination in, on, or under, or emanating from, a property that includes an analysis of data and other information concerning the nature and extent of that property's contamination and is generally performed concurrently, and in an interactive fashion, with the site investigation.

Remedial Construction
The physical development, assembly and implementation of the remedial alternative selected to remediate a site. Construction follows the **Remedial Design** stage of a site's remedial program.

Remedial Design
The process following finalization of a **Record of Decision** in which plans and specifications are developed for the **Remedial Construction** of the alternative selected to remediate a site.

Remedial Investigation/Feasibility Study (RI/FS)
The RI fully defines and characterizes the type and extent of hazardous waste contamination at the site. The FS, which may be conducted during or after the RI, uses information developed during the RI to develop alternative remedial actions to eliminate or reduce the threat of hazardous waste contamination to public health and the environment.

Responsible Party
An individual or business who: currently owns or operates a hazardous waste site; or historically owned or operated a site when hazardous waste was disposed; or generated hazardous waste at a site; or transported hazardous waste to a site.

Responsiveness Summary
A written summary of major oral and written comments received by DER during a **comment period** about key elements of a site's remedial program, such as a **Proposed Remedial Action Plan**, and DER's response to those comments.

Site Investigation (SI)
A process undertaken to determine the nature and extent of contamination in, on, under, and emanating from a property. The **SI** includes the gathering of sufficient information to determine the necessity for, and the selection of the appropriate method of, remediation of contamination in, on, under, or emanating from a property.

Site Issues And Community Profile Scoping Sheet
A document prepared to support each **Citizen Participation Record**. Each Scoping Sheet identifies issues and information important to the DER and the community and information that needs to be exchanged at a particular remedial stage. The Scoping Sheet also summarizes information about the surrounding community, including demographics, special needs, etc.

Superfund
The common name for the Federal program established by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended in 1986. The Superfund law authorizes the U.S. Environmental Protection Agency to investigate and clean up sites nominated to the **National Priorities List**.

Title 3 Project
Remediation of a municipally owned site through the State Superfund Title 3 Program whereby New York State pays 75 percent of eligible costs for remediation and the municipality pays 25 percent.

Acronyms

AG	New York State Attorney General's Office
ARAR	Applicable or Relevant and Appropriate Requirement
C&D	Construction and Debris
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CO	Consent Order
CP	Citizen Participation
CPP	Citizen Participation Plan
CPS	Citizen Participation Specialist

CQC/CQA	Construction Quality Control/Construction Quality Assurance
DEE	Division of Environmental Enforcement
DER	Division of Environmental Remediation, formerly the Division of Hazardous Waste Remediation
DHWR	Division of Hazardous Waste Remediation, now the Division of Environmental Remediation
DOD	Department of Defense
DOL	Department of Law
DOW	Division of Water
ENB	Environmental Notice Bulletin
EQBA	1986 Environmental Quality Bond Act
EPA	Environmental Protection Agency
F&W	Division of Fish and Wildlife
FDA	Food and Drug Administration
FSF	Federal Superfund
FOIL	Freedom of Information Law
FS	Feasibility Study
FY	Fiscal Year
GPM	Gallons Per Minute
HeLP	Health Liaison Program
IRM	Interim Remedial Measure
mg/kg	milligrams per kilogram
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PM	Project Manager
ppm/ppb/ppt	parts per million/parts per billion/parts per trillion
PRAP	Proposed Remedial Action Plan
PRP	Potentially Responsible Party
PRS	Priority Ranking System
PSA	Preliminary Site Assessment
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFP	Request for Proposals
RHWRE	Regional Hazardous Waste Remediation Engineer
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Responsible Party
SSF	State Superfund
SVOC	Semi-Volatile Organic Compound
TAGM	Technical and Administrative Guidance Memorandum
TCLP	Toxicity Characteristic Leading Procedure

TSDF	Treatment, Storage and Disposal Facility
ug/l	micrograms per liter
USGS	U.S. Geological Service
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound

Citizen Participation Plan
ITT Automotive, Inc.
Town of Gates, NY

Table 1 *Citizen Participation Activities*

Activity:	**Activity will occur at this point in the investigation/cleanup:**	**The activity is scheduled to be completed:**	**The activity was completed:**
Set up Document Repositories, where citizens can review site-related documents, at the regional DEC office and a public location near the site	Before start of the remedial investigation		
Create a list of people ("Mailing List") interested in the site, including residents, government representatives, media, and any interested civic, environmental or business groups	Before the remedial investigation starts		
Create a Citizen Participation Plan and place it in Document Repositories	Before the remedial investigation starts		
Mail a fact sheet to the Mailing List describing activities proposed for the site	At the start of the remedial investigation		
Mail a fact sheet to the Mailing List describing results of the investigation	When the remedial investigation is complete		
NYSDEC will mail a fact sheet to the Mailing List describing the Proposed Remedial Action Plan (PRAP) and announcing a 30 day comment period	After all investigations are completed and the PRAP is written		
Allow the public 30 days to comment on the proposed clean up plan (PRAP)	After fact sheet announcing the PRAP is mailed		
NYSDEC will hold a public meeting to discuss the PRAP and gather public comments	During the 30- day public comment period		
NYSDEC will mail a fact sheet to the Mailing List describing the selected remedy. NYSDEC will place the "Record of Decision," which outlines the final remedy, at the document repositories. The Record of Decision will include responses to significant comments received during the comment period. (These responses will appear as an appendix called a "Responsiveness Summary.")	When the Record of Decision is signed.		

Citizen Participation Plan
ITT Automotive, Inc.
Town of Gates, NY

Table 2 ***Mailing List***

MEDIA

NEWS DIRECTOR
WROC-TV 8
201 HUMBOLDT ST
ROCHESTER NY 14610

ED BUTTACIO, NEWS DIRECTOR
R NEWS CHANNEL 9
71 MT HOPE AVE
ROCHESTER NY 14620

DAVE OVERACKER ASSIGNMENT EDITOR
WHEC-TV 10
191EAST AVE
ROCHESTER NY 14604

KENT BECKWITH, GENERAL MANAGER
WOKR-TV
NEWS SOURCE 13
4225 WEST HENRIETTA ROAD
ROCHESTER, NY 14623

NEWS DIRECTOR
WXXI-TV 21
280 STATE ST
ROCHESTER NY 14603-3021

ASSIGNMENT EDITOR
WUHF FOX 31
360 EAST AVE
ROCHESTER NY 14604

JEFF HOWLETT, STATION MANAGER
WHAM-AM
207 MIDTOWN PLAZA
ROCHESTER NY 14606

NEWS DIRECTOR
WXXI-AM
280 STATE ST
ROCHESTER NY 14603-3021

Citizen Participation Plan
ITT Automotive, Inc.
Town of Gates, NY

MARIA HILEMAN, EDITOR LOCAL NEWS
DEMOCRAT & CHRONICLE
55 EXCHANGE BLVD
ROCHESTER NY 14614-2001

CORY IRELAND
DEMOCRAT & CHRONICLE
55 EXCHANGE BLVD
ROCHESTER NY 14614-2001

TOM SUDORE, ASSISTANT MANAGING EDITOR
GATES-CHILI NEWS
2968 CHILI AVENUE
ROCHESTER, NY 14624

MIKE DICKINSON, ASSISTANT EDITOR
ROCHESTER BUSINESS JOURNAL
45 EAST AVENUE, SUITE 500
ROCHESTER, NY 14604

ELECTED OFFICIALS/STATE AGENCY

THE HONORABLE AMO HOUGHTON
THE DEPOT BUILDING
20 PLEASANT STREET, SUITE 100
CANANDAIGUA, NY 14424

THE HONORABLE
HILLARY RODHAM CLINTON
UNITED STATES SENATE
KENNETH B. KEATING FEDERAL OFFICE BUILDING
100 STATE ST
ROOM 3280
ROCHESTER NY 14614 E

THE HONORABLE CHARLES SCHUMER
UNITED STATES SENATE
100 STATE ST, ROOM 3040
ROCHESTER NY 14614

THE HONORABLE DAVID F GANTT
NYS ASSEMBLY
74 UNIVERSITY AVE
ROCHESTER NY 14605-2928

Citizen Participation Plan
ITT Automotive, Inc.
Town of Gates, NY

THE HONORABLE JAMES S ALESI
NYS SENATE
220 PACKETT'S LANDING
PO BOX 66081
FAIRPORT NY 14450

THE HONORABLE GEORGE D MAZIARZ
NYS SENATE
60 PROFESSIONAL PKWY
LOCKPORT NY 14094

LOCAL GOVERNMENT OFFICIALS

RALPH EPOSITO
TOWN OF GATES SUPERVISOR
1605 BUFFALO RD
ROCHESTER NY 14624

RICHARD WARNER
TOWN CLERK
TOWN OF GATES
1605 BUFFALO RD
ROCHESTER NY 14624

COUNCILPERSON ELAINE TETTE
TOWN HALL
1605 BUFFALO RD
ROCHESTER NY 14624

COUNCILPERSON GREGORY HART
TOWN HALL
1605 BUFFALO RD
ROCHESTER NY 14624

COUNCILPERSON JOHN MAGGIO
TOWN HALL
1605 BUFFALO RD
ROCHESTER NY 14606

COUNCILPERSON MICHAEL ROCHE
TOWN HALL
1605 BUFFALO RD
ROCHESTER NY 14624

Citizen Participation Plan
ITT Automotive, Inc.
Town of Gates, NY

DAVE RICHARDS
FIRE CHIEF, TOWN OF GATES
2355 CHILI AVE
GATES NY 14624

TED DAPP
CHIEF OF POLICE
TOWN OF GATES
1605 BUFFALO RD
ROCHESTER NY 14624

ROBERT HANLEY
PLANNING BOARD CHAIR
TOWN OF GATES
1605 BUFFALO RD
ROCHESTER NY 14624

NEW YORK STATE AGENCIES

LARRY ENNIST
NYSDEC
ENVIRONMENTAL REMEDIATION
625 BROADWAY
ALBANY NY 12233-7010

LISA SILVESTRI
NYSDEC
6274 EAST AVON LIMA RD
AVON, NY 14414

LINDA VERA
NYSDEC
6274 EAST AVON LIMA RD
AVON, NY 14414

BART PUTZIG, PE
NYSDEC
6274 EAST AVON LIMA RD
AVON, NY 14414

FRANK SOWERS
NYSDEC
6274 EAST AVON LIMA RD
AVON, NY 14414

Citizen Participation Plan
ITT Automotive, Inc.
Town of Gates, NY

CAPT STEVE GEROULD
NYSDEC
6274 EAST AVON LIMA RD
AVON, NY 14414

MARK VAN VALKENBURG
BUREAU OF ENV INVESTIGATION
NYS DEPARTMENT OF HEALTH
FLANIGAN SQUARE ROOM 300
547 RIVER STREET
TROY NY 12180

DEBBIE MCNAUGHTON
NYSDOH
335 EAST MAIN ST
ROCHESTER, NY 14604

WAYNE ZYRA, PRESIDENT
MONROE COUNTY LEGISLATURE
RM 407 COUNTY OFFICE BLDG
39 W MAIN ST
ROCHESTER NY 14614-1476

CHERYL DINOLFO
MONROE COUNTY CLERK
101 COUNTY OFFICE BLDG
39 W MAIN ST
ROCHESTER NY 14614

THOMAS T. MOONEY, PRESIDENT
GREATER ROCHESTER METRO CHAMBER OF COMMERCE
55 ST PAUL ST
ROCHESTER NY 14604

JIM FARR, PRESIDENT
CORNELL COOPERATIVE EXTENSION - MONROE COUNTY
249 HIGHLAND AVE
ROCHESTER NY 14620

MUFFY MEISENZAHL, ADMINISTRATOR
MONROE COUNTY OFFICE OF EMERGENCY PREPAREDNESS
1190 SCOTTSVILLE ROAD
ROCHESTER, NY 14624

LOUISE HARTSHORN, COORDINATOR
MONROE COUNTY EMC
MCDOH

Citizen Participation Plan
ITT Automotive, Inc.
Town of Gates, NY

111 WESTFALL ROAD, ROOM 962
P.O. BOX 92832
ROCHESTER, NY 14692-8932

MAGGIE BROOKS, MONROE COUNTY EXECUTIVE
110 COUNTY OFFICE BLDG
39 W MAIN ST
ROCHESTER NY 14614-1476

JOE ALBERT
MONROE COUNTY HEALTH DEPT
PO BOX 92832
111 WESTFALL RD
ROCHESTER NY 14692-8932

PAUL JOHNSON, ACTING DIRECTOR
MONROE COUNTY DEPARTMENT OF PLANNING & DEVELOPMENT
50 WEST MAIN STREET, SUITE 8100
ROCHESTER, NY 14614

PATRICK O’FLYNN
MONROE COUNTY SHERIFF
130 S PLYMOUTH AVE
ROCHESTER NY 14614

CHUCK COLBY, CHAIRMAN
MONROE COUNTY SOIL & WATER CONSERVATION DISTRICT
249 HIGHLAND AVE
ROCHESTER NY 14620

ENVIRONMENTAL ORGANIZATIONS

CENTER FOR ENVIRONMENTAL INFO INC
55 ST PAUL ST
ROCHESTER NY 14604-1314

CITIZENS' ENVIRONMENTAL COALITION
ATTN: MIKE SCHADE, WNY DIRECTOR
WESTERN NY OFFICE
543 FRANKLIN STREET
BUFFALO, NY 14202

VAL WASHINGTON, EXECUTIVE DIRECTOR
EPL-ENVIRONMENTAL ADVOCATES

353 HAMILTON ST
ALBANY NY 12210

WILLIAM LARSEN, P.E., ASSOCIATE PROFESSOR
CIVIL ENGINEERING TECHNOLOGY
RIT JAMES BOOTH BLDG
78 LOMB MEMORIAL DR
ROCHESTER NY 14623

LEAGUE OF WOMEN VOTERS
ROCHESTER METRO LEAGUE
45 EXCHANGE BLVD STE 508
ROCHESTER NY 14614

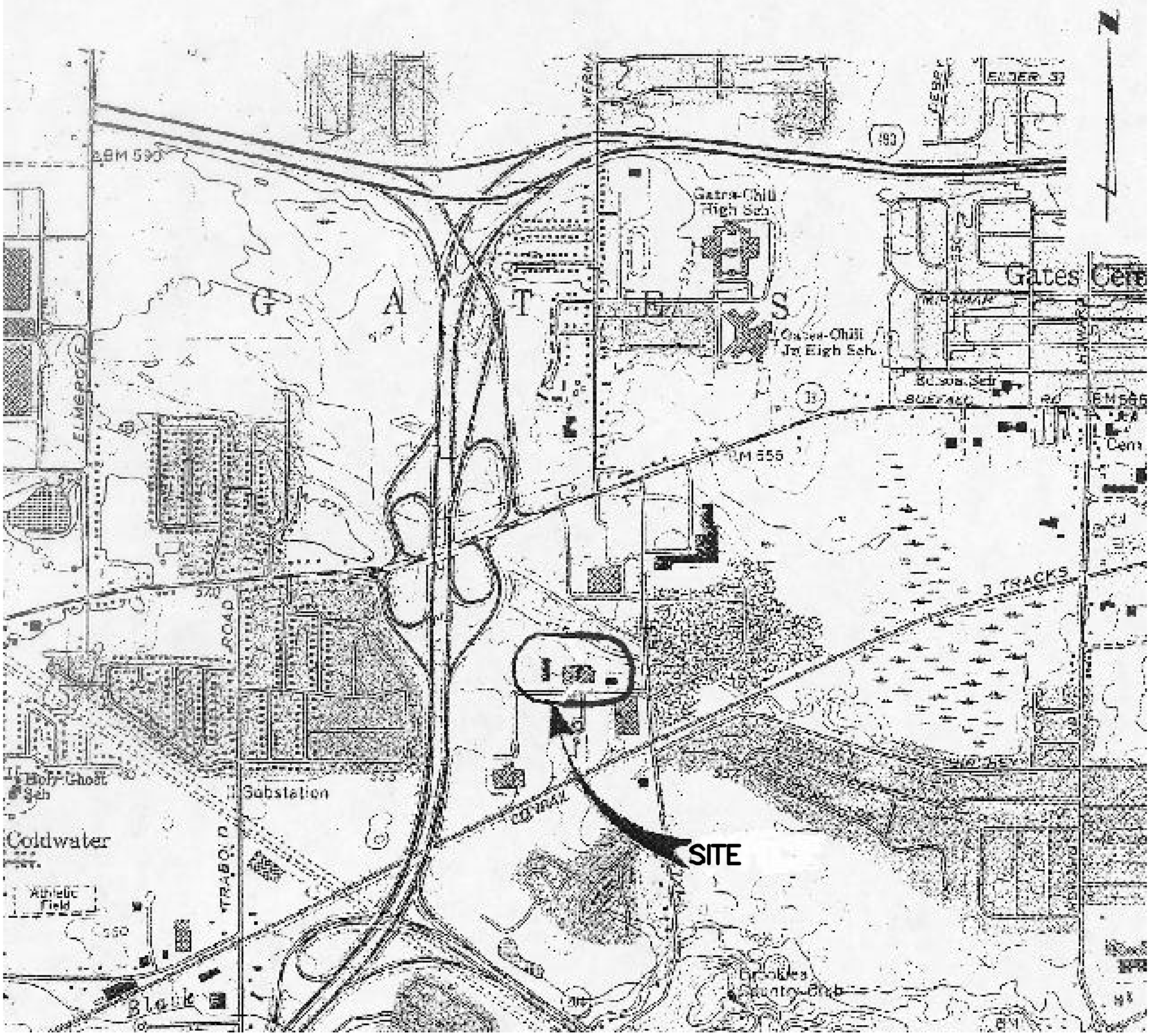
CHRIS FREDETTE
RCSI
CPU 276766
RIVER CAMPUS STA
ROCHESTER NY 14627

DOCUMENT REPOSITORY

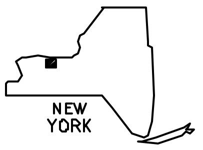
JUDY MACKNIGHT, DIRECTOR
GATES PUBLIC LIBRARY
1605 BUFFALO ROAD
GATES NY 14624

DWG PATH: I:\DIV71\PROJECTS\4655\31777\DWG\034.DWG

FIGURE 1



ADAPTED FROM: USGS QUADRANGLE MAP ROCHESTER WEST, N.Y. 1978

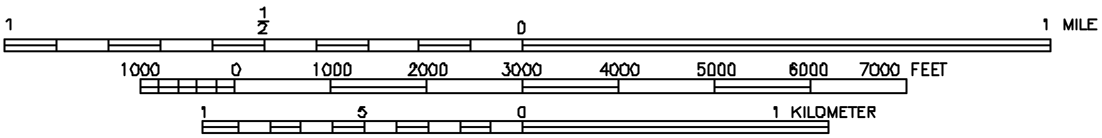


QUADRANGLE LOCATION

ITT AUTOMOTIVE INC.
TOWN OF GATES, N.Y.

SITE LOCATION MAP

SITE #8-28-112



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FILE NO. 4655.31777.034
OCTOBER 2003

ENGINEERS INC.

PLOT DATE: 10/28/03

Appendix A

Site Page from NYSDEC's Registry of Inactive Hazardous Waste Disposal Sites

Inactive Hazardous Waste Disposal Report

April 1, 2003

Site Name: **ITT Automotive Fluid Handling Systems**
Site Code: **828112**
Class Code: **2** Region: **8** County: **Monroe**
EPA Id: **NYD002215184**
Address: **30 Pixley Industrial Parkway / Rochester, NY 14624 (Locality: Gates)**
Latitude: **43° 8' 29"** Longitude: **77° 42' 51"**
Site Type: **Structure** Estimated Size: **3 Acres**

Site Owner / Operator Information:
Current Owner(s) Name: **ITT Industries**
Current Owner(s) Address: **30 Pixley Industrial Parkway / Rochester, NY 14624**
Owner(s) during disposal: **ITT Industries**
Operator(s) during disposal: **Rochester Machine**
Stated Operator(s) Address: **30 Pixley Industrial Parkway / Rochester, NY 14624**
Hazardous Waste Disposal Period: **From: 1984 To: 1993**

Site Description:
ITT Automotive Fluid Handling System (ITT) is located in a commercial/light industrial section in the Town of Gates, Monroe County. There are no known private or public drinking water wells within 0.5 miles of the site. The site was formerly known as Rochester Form Machine, Inc. until 1994. ITT also owned and operated Rochester Form Machine where aluminum parts were produced using operations which included degreasing. 1,1,1-Trichloroethane (TCA) was used as a degreaser. Between 1984 and 1987, seven above ground TCA storage tanks were installed at the site. By the end of 1993, TCA was no longer used at the site. In 1991, ITT performed an environmental investigation at the site. The NYSDEC was not aware of the 1991 investigation until 1998 when the NYSDEC initiated its own site investigation. TCA was the primary organic compound detected during the 1991 investigation. The highest soil concentrations of TCA were detected outside the ITT building in the northeast corner of the ITT property in an area where steam cleaning operations were reportedly performed. The southwest corner of the property was also identified as an area of concern. In response to the 1998 NYSDEC site investigation, ITT initiated their own environmental investigation in 1999. The 1999 ITT investigation, performed without NYSDEC review, approval or oversight, indicated the widespread presence of TCA in the overburden at the northeast corner of the ITT property. Based on these results, ITT excavated 968 tons of soil from the northeast corner of their property. Additionally, the 1999 ITT investigation indicated TCA contaminated soils were present under the ITT building. Soils under the ITT building were not included in the soil removal. Groundwater sampling performed by the NYSDEC approximately 1 year after ITT's soil removal activities, indicated the presence of 1,1-dichloroethane contaminated groundwater in the southwest corner of the site and the continued presence of TCA contaminated groundwater at the northeast corner of the site and an adjacent off-site property.

Confirmed Hazardous Waste Disposal:	**Quantity:**
1,1,1-trichloroethane (F001 Waste)	unknown

Analytical Data Available for: **Groundwater Soil**
Applicable Standards Exceeded in: **Groundwater**
Geotechnical Information:
Soil/Rock Type: **Silt-rich clay mixed with sand and gravel.**
Depth to Groundwater: **Range: 5 to 15 feet.**

Legal Action: Type: Status:
Remedial Action: Nature of action:

Assessment of Environmental Problems:
Soil at the site is contaminated by chlorinated chemicals at levels exceeding TAGM 4046 recommended soil cleanup values. Groundwater at the site and at an adjacent downgradient property is contaminated by chlorinated chemicals at levels exceeding the 6 NYCRR Part 703 standards. The presence of dense non-aqueous phase liquids (DNAPLs) are also likely based on the high concentrations of chlorinated chemicals in the groundwater.

Assessment of Health Problems:
Exposures through drinking water are not expected because public water serves the area and there are no known drinking water wells in the vicinity. A site investigation at this site will further characterize the nature and extent of contamination and help to evaluate the potential pathways of human exposure.

Appendix B

Fact Sheets Explaining the Investigation and Cleanup Stages in the Hazardous Waste Site Program

New York State Department of
Environmental Conservation

Fact Sheet Preliminary Site Assessment (PSA)

More information from this division:

Division of Environmental Remediation
More Remediation Fact Sheets

The Department of Environmental Conservation (DEC), along with the Departments of Health (DOH) and Law (DOL), is responsible for ensuring the cleanup of inactive hazardous waste disposal sites across the state. Under New York State's Inactive Hazardous Waste Disposal Site Remedial Program, the process begins with the discovery of a potential hazardous waste site and follows a path of thorough investigation, remedy selection, design, construction and monitoring. This fact sheet highlights one stage in the comprehensive process, the ***Preliminary Site Assessment (PSA)****.*

DEC carries out a PSA to determine whether a site is a hazardous waste site, as defined by state law.

A Preliminary Site Assessment (PSA) is DEC's first investigation of a site where hazardous waste has or may have been disposed of illegally or improperly. The goal of the PSA is to determine whether a site meets the state's definition of a hazardous waste site by confirming the presence of hazardous waste and determining if the site poses a significant threat to public health or the environment. The PSA is performed by DEC or the potentially responsible party under DEC's oversight.

The PSA is a three-step investigation to determine if the site should be classified for remediation or delisted.

The PSA has three steps that combine the former Phase I and Phase II investigations:

1. **Records Search:** a thorough background review and record check into the past use and disposal activity at the site.
2. **Sampling/Surveys:** sampling of exposed wastes, drums, surrounding soil and surface water, performing geophysical and soil gas surveys.
3. **Groundwater Monitoring:** installing monitoring wells and analyzing water samples to check for subsurface contamination.

DEC evaluates PSA information to classify or delist a site.

Each PSA step ends with a decision point that can lead to one of two outcomes.

- If the presence of hazardous waste and the degree of health or environmental threat can be documented, a site is *classified* to:
  - Class 1 (imminent danger)
  - Class 2 (significant threat)
  - Class 3 (no significant threat)
- If hazardous waste cannot be documented, a site is *delisted*.

Built-in decision points help move sites through the remedial process.

The decision points allow DEC to classify or delist the site as soon as enough information exists to support or refute the state's criteria for defining a hazardous waste site. They provide a mechanism to move sites into remediation at the earliest opportunity. If DEC does not have enough information to make the decision to classify or delist, the PSA continues to the next step.

Complex sites may require all three PSA steps.

At complex sites where hazardous waste is difficult to confirm or where significant threat is difficult to determine, all three PSA steps may be required before DEC makes a decision to classify or delist.

The PSA concludes with a decision to classify or delist a site.

DEC reviews the documentation and makes a decision supported by input from local government agencies, the Department of Health (DOH), DEC regional offices and the public. The PSA ends when a site is classified or delisted.

DOH plays an important role in the investigation of hazardous waste sites.

DOH participates with DEC in the PSA process. Through its own early site investigation and health assessment, DOH identifies potential impacts on public health. DEC incorporates DOH information into the PSA to ensure that public health concerns are fully investigated. DOH also helps DEC identify priority sites, reviews work plans and reports and contributes to the decisions to classify or delist a site.

DEC prioritizes sites for further investigation and remediation.

Once DEC decides a site needs remediation based on the PSA findings, the site is ranked for further remedial investigation using the state's Priority Ranking System. DEC uses this system to first focus remedial and enforcement resources on the most serious problems.

Further study and cleanup may follow a PSA.

Sites that become Class 1 or 2 move to the next stage of the remedial process - the Remedial Investigation/Feasibility Study (RI/FS). During a RI/FS, the full nature and extent of contamination is defined. Sites may also be referred for Interim Remedial Measures (early cleanup actions that may not require a full-scale investigation and design). Delisted sites are removed from the registry. Some delisted sites may then be referred to other DEC programs or the Attorney General for action (e.g., closing construction and demolition debris sites or municipal landfills).

DEC can nominate a site for federal cleanup based on PSA findings.

Information collected during the PSA can also help DEC decide if a site should be nominated for the U.S. Environmental Protection Agency's National Priorities List (NPL). NPL site remediations may be paid for by the federal Superfund.

Preliminary Site Assessment Steps/Outcomes

- **Records Search:** background review to document previous disposal practices and activities. Information that describes how the waste was handled, stored, transported and disposed of comes from a wide variety of sources including: industry disposal records, site inspections, local or county investigations and interviews with local haulers, nearby residents and others who may have witnessed activities at a site.
    - ***Decision Point*** *- delist or classify and stop the PSA, or continue to the next step.*

- **Sampling/Surveys:** conduct surficial environmental sampling (surface water, soil, waste piles, drums, etc.) and geophysical/soil gas surveys. Samples are sent to laboratories for analyses.
    - ***Decision Point*** *- delist or classify and stop the PSA or continue to the next step.*

- **Groundwater Monitoring:** install and sample monitoring wells to determine if groundwater is contaminated; may conduct additional surficial sampling.
    - ***Decision Point*** *- delist or classify.*

For More Information

About Preliminary Site Assessments, contact the:

Bureau of Hazardous Site Control
Division of Environmental Remediation
625 Broadway, Albany, NY 12233-7014
telephone (518) 402-9551

For general questions about the Inactive Hazardous Waste Disposal Site Remedial Program, call DEC's 24-hour toll-free environmental remediation information line at **1 (800) 342-9296**.

For questions about the health impacts of hazardous waste sites, contact the Department of Health's Outreach Program at **1 (800) 458-1158**.
Fact Sheets produced by the
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Back to top of page

New York State Department of
Environmental Conservation

Services Programs Subject Index Search Highlights Contact Us Home

Fact Sheet Remedial Investigation/Feasibility Study (RI/FS)

More information from this division:

Division of Environmental Remediation
More Remediation Fact Sheets

The Department of Environmental Conservation (DEC), along with the Departments of Health (DOH) and Law (DOL), is responsible for ensuring the cleanup of inactive hazardous waste disposal sites across the state. Under New York State's Inactive Hazardous Waste Disposal Site Remedial Program, the process begins with the discovery of a potential hazardous waste site and follows a path of thorough investigation, remedy selection, design, construction and monitoring. This fact sheet highlights one stage in the comprehensive process, the **Remedial Investigation/Feasibility Study (RI/FS)**.

RI/FS begins when hazardous waste contamination is confirmed.

The RI/FS follows preliminary site investigations by DEC and DOH that verify hazardous wastes are present and that the wastes pose a significant threat to public health and the environment.

DEC and DOH gather detailed site information to work toward an effective remedial action.

DEC's Division of Environmental Remediation or the responsible party under an enforceable consent order carries out a Remedial Investigation (RI) to determine the nature and extent of contamination. DEC, along with DOH, uses the RI information to then perform a Feasibility Study (FS) that evaluates possible remedies. The FS becomes the basis for selection of a remedy that effectively eliminates the threat posed by contaminants at the site. The RI/FS results in a Record of Decision (ROD) describing the cleanup that will be carried out and documents the decisions that led to the chosen remedy.

The state initiates a variety of activities to inform and involve the public during the remedial process.

Throughout the remedial process, the state encourages public involvement. The public plays a key role in the RI/FS to help shape the remedy selection process.

Public meetings, newsletters, fact sheets, and project documents contribute to the exchange of information and provide opportunity for comment.

The state achieves successful hazardous waste remediation with the cooperation of many groups.

State engineers, geologists, chemists, and health specialists work with consultants, contractors, municipalities, potentially responsible parties, and citizens to investigate the contamination and select an appropriate remedy. The RI/FS process requires a detailed examination of a site to fully understand its impact on public health and the environment before deciding on a remedy. The process can take up to two years to complete.

The sections below describe how the state reaches a decision on a remedy.

Remedial Investigation (RI)

The RI defines the threat to public health and the environment.

The responsible party or DEC performs an RI at each Class 2 inactive hazardous waste disposal site after preliminary investigations have shown that contaminants pose a significant threat to public health or the environment. Through extensive sampling and laboratory analyses, the RI identifies the length, depth and width of contamination, defines the pathways of migration and measures the degree of contamination in surface water, groundwater, soils, air, plants, and animals. Information gathered during the RI fully describes the hazardous waste problem at the site so that the appropriate remedy can be selected.

DOH evaluates ways people may be exposed to hazardous waste.

DOH reviews and recommends activities that will be performed during the RI to ensure that a complete picture of potential health impacts is understood. Such activities include identifying the ways contamination can reach people, either through direct contact, eating, drinking, or breathing.

Feasibility Study (FS)

Remedial action choices are developed during the FS.

The Feasibility Study uses RI information to develop alternative remedies that will eliminate the threat to public health or the environment posed by the site. Wherever feasible, the state selects a remedy that permanently reduces or eliminates the contamination.

The state evaluates the remedial alternatives to reach a balanced decision that protects people and the environment.

The responsible party and DEC screen each alternative to make sure the remedy is technically suitable for the site. Following the initial screening, DEC and DOH weigh the remaining alternatives against a number of other conditions, including:

- overall protection of public health and the environment;
- reduction in toxicity, mobility and volume of hazardous waste (e.g., by thermal destruction, biological or chemical treatments or containment wall construction);
- long-term effectiveness and permanence;
- short-term effectiveness and potential impacts during remediation;
- implementation and technical reliability;
- compliance with statutory requirements;
- community acceptance; and
- cost.

DEC prepares the proposed remedial action plan for public comment.

The outcome of the selection process is the recommendation of a remedy that best satisfies a combination of these conditions. The remedy becomes part of a proposal that is presented to the public for comment.

Proposed Remedial Action Plan and Public Comment

The state presents the proposed remedial action plan to the public.

After the RI/FS is completed, DEC and DOH hold a public meeting to propose the remedial solution. The Proposed Remedial Action Plan (PRAP) summarizes the decision that led to the recommended remedial action by discussing each alternative and the reasons for choosing or rejecting it.

Public comment can make a difference in the remedial action plan.

The public is encouraged to review the PRAP and make comments either at the meeting or during the comment period that follows. The comments are reviewed and compiled in a Responsiveness Summary and modifications to the proposed remedial action plan may be made. Additional public notice is required if a modified remedial action plan differs significantly from the earlier selection.

The final remedial decision is documented in the record of decision.

DEC drafts a Record of Decision (ROD) which includes the selected remedial action, the Responsiveness Summary and a bibliography of documents that were used to reach the remedial decision. DOH and DOL have an opportunity to comment on the draft ROD before final DEC approval. When the ROD is finalized, remedial design and construction can now begin.

For a full explanation of the ROD, see the companion fact sheet, "Record of Decision".

For more information

- about the RI/FS, remedy selection process, or citizen participation activities, call DEC's 24-hour toll-free environmental remediation information line at **1 (800) 342-9296**.
- about the health impacts of a hazardous waste site, contact the Department of Health's Outreach Program at **1 (800) 458-1158**.

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Back to top of page

New York State Department of
Environmental Conservation

Services | Programs | Subject Index | Search | Highlights | Contact Us | Home

---

Fact Sheet Record of Decision (ROD)

More information from this division:

Division of Environmental Remediation
More Remediation Fact Sheets

The Department of Environmental Conservation (DEC), along with the Departments of Health (DOH) and Law (DOL), is responsible for ensuring the cleanup of inactive hazardous waste disposal sites across the state. Under New York State's Inactive Hazardous Waste Disposal Site Remedial Program, the process begins with the discovery of a potential hazardous waste site and follows a path of thorough investigation, remedy selection, design, construction and monitoring. This fact sheet highlights one stage in the comprehensive process, the ***Record of Decision (ROD).***

The ROD contains results of the remedial investigation and remedy selection process.

The Record of Decision (ROD) presents the remedial action plan for an inactive hazardous waste disposal site and documents the information and rationale used to arrive at the decision.

The ROD is the culmination of extensive investigations and a remedy selection that identifies a solution to remove the significant threat to the public health and the environment. (For more on this, see fact sheet *Remedial Investigation/Feasibility Study.*) It serves as the definitive record of the remedy selection process for the site and as a convenient reference to other documents that were developed during the remedy selection process.

DEC gives the final approval to the ROD.

The final ROD is approved by the Department following public comment and review of the proposed remedial action plan. The project then moves on to remedial design and construction.

ROD Contents

The ROD summarizes information used to select the remedial action.

Each ROD produced for an inactive hazardous waste disposal site contains information about the site that identifies the problem and describes the remedial solution. In addition, the decision-making process that yielded the remedial action plan is documented to demonstrate that the appropriate solution was selected. The ROD contains:

- *Site location, description and history:* provides valuable insight into the previous use of the site and identifies vulnerable areas in the surrounding environment, such as residential areas and protected wetlands, groundwater, etc.
- *Problem identification:* describes the nature and extent of contamination and the pathways through which contaminants move in the environment.
- *Status of enforcement actions:* provides the enforcement history and current status for the site.
- *Goals for remedial action:* describes the overall goal of remediation, protection of public health and the environment, and remedial goals specific to each site - for example, preventing contaminated groundwater migration.
- *Discussion of remedial alternatives:* presents each potential remedial action, including a "no action" alternative, to show that technical, legal, environmental and public concerns are met.
- *The selected remedial action:* describes the planned remedy.
- *Responsiveness Summary:* documents public comments about the selected remedy. Modifications to the remedial action plan based on public comment are identified in the summary.
- *Administrative Record:* references reports and other documents developed during investigation and remedy selection.

Amendments to the ROD

Amended remedial decisions require additional review and public input.

Changes to the final remedial action plan may occur in two cases:

1. if the ROD specifically provides for later addition of documents and reserves a portion of the decision to a later time; or,
2. if new and significant information is received or generated after the ROD is finalized.

An amended ROD must go through additional review and public comment periods.

For more information

- about the Record of Decision, remedy selection process, or citizen participation activities, call DEC's 24-hour toll-free environmental remediation information line at **1 (800) 342-9296.**
- about the health impacts of a hazardous waste site, contact the Department of Health's Outreach Program at **1 (800) 458-1158.**

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Back to top of page

New York State Department of
Environmental Conservation

Services | Programs | Subject Index | Search | Highlights | Contact Us | Home

---

Fact Sheet

Design and Construction

More information from this division:

Division of Environmental Remediation
More Remediation Fact Sheets

New York State's Inactive Hazardous Waste Disposal Site Remedial Program begins with the discovery of a potential hazardous waste site and follows a path of investigation, remedy selection, design, construction and monitoring. This fact sheet highlights the ***Design and Construction*** *phase of the program.*

The Remedial Design spells out the technical requirements of construction.

The remedial design details the size, scope and character of a site's remediation - the planned action that will, at a minimum, protect public health and the environment. It translates information from the Remedial Investigation/Feasibility Study, the Record of Decision and additional data gathered during design preparation into clear, precise facts and numbers.

Key participants are Responsible Parties (RPs), state and federal agencies.

RPs are legally responsible for site remediation. For many sites, remedial work is carried out by RPs with DEC oversight. The RPs are responsible for completion and long-term performance of the remedy. For other sites, remedial work is carried out by DEC or EPA.

DEC ensures that all remedial designs effectively protect the environment and conform to the recommendations of the Records of Decision and consent orders.

The NYS Department of Health (DOH) ensures that all remedial designs effectively protect the public and contain community health and safety considerations that must be implemented during construction.

Design elements include quality control, assurance and contingency plans.

Construction Quality Control (CQC)

A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC, usually carried out by the contractor, is necessary to achieve quality in the constructed system.

Construction Quality Assurance (CQA)

A planned system of activities to provide assurance to the owner and the permitting agency that all aspects of remedial construction meet design requirements. CQA includes inspections, verifications, audits, tests and evaluations of materials and workmanship to determine and document the quality of the remedial construction.

Contingency Plan

The contingency plan protects the local community which may be affected by an accident or emergency caused by remedial activities. Contingency plans may include:

- Name of person responsible for responding in an emergency.
- Schedule for meeting with local, state and federal agencies, the community, local emergency agencies and hospitals.
- First aid and medical information.
- Air monitoring plan if a human health risk exists through inhalation of specified pollutants.
- Spill control and countermeasures plan to prevent contamination of soil, water, air, structures, equipment or material from the discharge of wastes due to spills; to contain the spill and remove and properly dispose of media contaminated from the spill.

Citizen participation activities, which begin when the site is identified, continue through the Design and Construction phases.

When the remedial design is finalized, a fact sheet describing the proposed remedial action is distributed to the community and other interested people. The fact sheet also contains a construction schedule, explanations of the roles of the RP and DEC, details of the contingency plan and descriptions of potential inconveniences, such as excess traffic and noise. A public meeting or availability session may also be held to discuss schedules, changes in traffic patterns, location of monitoring equipment and how the public will be kept informed on progress. DEC staff ensure that all relevant documents about the site remediation are placed in repositories for public review.

At the completion of construction, another fact sheet announcing the end of construction and describing any Operation and Maintenance activities that may have been specified in the Record of Decision (ROD) is distributed to the community.

Remedial construction is carefully monitored.

Key Participants

DEC's remedial project manager attends progress meetings to discuss status of and changes in the project, test results, other findings and upcoming activities. The manager ensures that construction is not endangering public health, monitors quality assurance, coordinates remedial activities and promotes citizen participation.

The RP's or DEC's consulting engineer and inspectors test and inspect the constructor's work and confirm that test data are properly recorded and validated. Their main responsibility is to verify that construction conforms to the approved design documents.

DEC oversight ensures that the construction meets all the requirements of the approved design.

No work is performed at a site until DEC has approved the workplan. Oversight consists of two types - office and field. Office oversight includes the review, evaluation and comment on all submittals, reports, data, etc. generated by remedial activities. Field oversight is site dependent and includes consent order requirements, construction according to approved plan, public health and environmental concerns, public sensitivity and the potential for pollutant migration.

Final inspection ensures that all aspects of the design have been met by the construction.

Acceptance of the remedial work signals the next step in the remedial program - site reclassification.

Sites are often reclassified after remedial construction.

Site reclassification signals the conclusion of the remedial construction.

Following remediation, a site usually is reclassified from Class 2, which called for remedial action to protect public health or the environment, to:

- Class 4, requiring continued operation, maintenance and monitoring, or
- Class 5, requiring no operation, maintenance and monitoring.

or if all hazardous wastes have been removed, the site may be removed (delisted) from the Registry of Inactive Hazardous Waste Sites.

Operation and Maintenance may be included in the remedial program.

Included in some remedies are monitoring requirements which are included in Operation and Maintenance (O&M) Plans. O&M includes visual inspections and upkeep and can include sampling.

For more information

- about the Design and Construction for hazardous waste sites or citizen participation activities, call DEC's 24-hour toll-free environmental remediation information line at **1 (800) 342-9296**.
- about the health impacts of a hazardous waste site, contact the Department of Health's Outreach Program at **1 (800) 458-1158**.

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Back to top of page

New York State Department of
Environmental Conservation

Services Programs Subject Index Search Highlights Contact Us Home

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Fact Sheet Interim Remedial measures (IRM)

More information from this division:

Division of Environmental Remediation
More Remediation Fact Sheets

New York State's Inactive Hazardous Waste Disposal Site Remedial Program begins with the discovery of a potential hazardous waste site and follows a path of investigation, remedy selection, design, construction and monitoring. This fact sheet highlights the ***Interim Remedial Measure (IRM),*** *a remedial action.*

IRM defined.

An IRM is a discrete set of planned actions, used for both emergency and non-emergency situations, that can be conducted without the extensive investigation and evaluation of a Remedial Investigation/Feasibility Study (RI/FS).

An IRM can be part of or the full remediation of a site.

An IRM is designed to be a permanent part of the final remedy. Sometimes, an IRM achieves the remedial goal for a site and no further action is required. When an IRM constitutes the entire remedy, DEC drafts a Proposed Remedial Action Plan (PRAP) that proposes no further action at the site and solicits public comment.

An IRM provides a quick solution to a defined problem.

An IRM is extremely adaptable. It covers a variety of activities, large and small, to remediate an array of diverse, well-defined problems at a site. Some of these problems may be contaminated soils, surface and groundwater, debris, sediments and drinking water supplies and buried and abandoned drums of waste and bulk storage tanks.

Remedial activities carried out under an IRM include:

- Removing wastes and contaminated materials, including contaminated soil, sediments and groundwater.
- Erecting access controls, such as fences.

- Removing drums of waste and bulk storage tanks.
- Constructing diversion ditches, groundwater collection systems, leachate collection systems, gas venting systems.
- Pumping and treating contaminated groundwater.
- Treating contaminated soil on-site using innovative technologies such as soil vapor extraction.
- Installing individual drinking water filter systems.
- Demolishing and removing contaminated buildings.

IRMs provide better protection of public health and the environment.

Because of their versatility and the relative speed with which they are applied, IRMs accelerate remedial projects and the sooner sites are remediated, the sooner the public and the environment are protected. In addition, accelerated remedial projects often mean reduced remedial costs.

DEC discusses IRMs with the affected communities.

In emergencies, IRMs must be implemented quickly to be most effective, making it impractical to hold public meetings and comment periods prior to the IRM actions. For time critical IRMs, the Project Manager prepares a fact sheet describing the IRM for distribution to local officials. The fact sheet is sent to interested parties and residents adjacent to the site. If time does not permit mailing the fact sheet prior to implementation of the IRM, DEC staff may telephone the information to local officials and conduct door-to-door notifications to residents.

For non-time critical IRMs the Project Manager conducts an availability session or public information meeting to explain the proposed IRM and listen to comments from local officials and the public.

At the issuance of a Proposed Remedial Action Plan, DEC ensures that the document is available to residents and interested parties and invites them to comment on the proposed remedial action. A Responsiveness Summary is prepared and issued by DEC to reply to the public comments and the Record of Decision (ROD) is signed.

State and federal agencies and RPs carry out IRMs.

DEC carries out IRMs at State-funded sites. Responsible Parties (RPs) perform IRMs at their sites under consent orders. EPA (the federal Environmental Protection Agency) carries out IRMs, calling them Emergency Response Actions, at sites on the National Priorities List.

DEC also carries out emergency actions at non-registry sites.

DEC's emergency response actions, such as drum removals, are carried out to prevent, mitigate or remedy environmental damage at sites not listed in the registry of inactive hazardous waste disposal sites.

For more information

- about Interim Remedial Measures or citizen participation activities, call DEC's 24-hour toll-free environmental remediation information line at **1 (800) 342-9296**.
- about the health impacts of a hazardous waste site, contact the Department of Health's Outreach Program at **1 (800) 458-1158**.

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Back to top of page

New York State Department of Health

What is Exposure?

Information Sheet

Exposure is contact. No matter how dangerous a substance or activity, without exposure, it cannot harm you.

Amount of exposure:

More than 400 years ago, a scientist said "...nothing [is] without poisonous qualities. It is only the dose that makes a thing poison." The **dose** is the amount of a substance that enters or contacts a person. An important factor to consider in evaluating a dose is body weight. If a child is exposed to the same amount of chemical as an adult, the child (who weighs less) can be affected more than the adult. For example, children are given smaller amounts of aspirin than adults because an adult dose is too large for a child's body weight.

The greater the amount of a substance a person is exposed to, the more likely that health effects will occur. Large amounts of a relatively harmless substance can be toxic. For example, two aspirin tablets can help to relieve a headache, but taking an entire bottle of aspirin can cause stomach pain, nausea, vomiting, headache, convulsions or death.

Routes of exposure:

There are three major means by which a toxic substance can come into contact with or enter the body. These are called routes of exposure.

Inhalation (breathing) of gases, vapors, dusts or mists is a common route of exposure. Chemicals can enter and irritate the nose, air passages and lungs. They can become deposited in the airways or be absorbed through the lungs into the bloodstream. The blood can then carry these substances to the rest of the body.

Direct contact (touching) with the skin or eyes is also a route of exposure. Some substances are absorbed through the skin and enter the bloodstream. Broken, cut or cracked skin will allow substances to enter the body more easily.

Ingestion (swallowing) of food, drink, or other substances is another route of exposure. Chemicals that get in or on food, cigarettes, utensils or hands can be swallowed. Children are at greater risk of ingesting substances found in dust or soil because they often put their fingers or other objects in their mouths. Lead in paint chips is a good example. Substances can be absorbed into the blood and then transported to the rest of the body.

The route of exposure can determine whether or not the toxic substance has an effect. For example, breathing or swallowing lead can result in health effects, but touching lead is not usually harmful because lead is not absorbed particularly well through the skin.

Length of exposure:

Short-term exposure is called **acute exposure**. Long-term exposure is called **chronic exposure**. Either may cause health effects that are immediate or health effects that occur days or years later.

Acute exposure is a short contact with a chemical. It may last a few seconds or a few hours. For example, it might take a few minutes to clean windows with ammonia, use nail polish remover or spray a can of paint. The fumes someone might inhale during these activities are examples of acute exposures.

Chronic exposure is continuous or repeated contact with a toxic substance over a long period of time (months or years). If a chemical is used every day on the job, the exposure would be chronic. Over time, some chemicals, such as PCBs and lead, can build up in the body and cause long-term health effects.

Chronic exposures can also occur at home. Some chemicals in household furniture, carpeting or cleaners can be sources of chronic exposure.

Sensitivity:

All people are not equally **sensitive** to chemicals, and are not affected by them in the same way. There are many reasons for this.

- People's bodies vary in their ability to absorb and break down or eliminate certain chemicals due to **genetic differences.**
- People may become **allergic** to a chemical after being exposed. Then they may react to very low levels of the chemical and have different or more serious health effects than nonallergic people exposed to the same amount. People who are allergic to bee venom, for example, have a more serious reaction to a bee sting than people who are not.
- Factors such as **age, illness, diet, alcohol use, pregnancy and medical or nonmedical drug use** can also affect a person's sensitivity to a chemical. Young children are often more sensitive to chemicals for a number of reasons. Their bodies are still developing and they cannot get rid of some chemicals as well as adults. Also, children absorb greater amounts of some chemicals (such as lead) into their blood than adults.

For more information call:

New York State Department of Health.
2 University Place, Rm 240
Albany, NY 12203
1-800-458-1158 (ext. 402)

March 1996

Appendix C

Future Project Fact Sheets

REPORT

Health & Safety Plan
ITT Automotive, Inc.
Town of Gates, New York
(Site #8-28-112)

ITT Automotive, Inc.

May 2004

4655/31777

REPORT

Health & Safety Plan
ITT Automotive, Inc.
Town of Gates, New York
(Site #8-28-112)

ITT Automotive, Inc.

Steven J. Roland

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O'BRIEN & GERE
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Contents

List of Tables

List of Figures

List of Exhibits

1. Introduction

1.1. General

This Health and Safety Plan (HASP) has been developed to provide general procedures to be followed by engineering, construction and oversight personnel while performing the Remedial Investigation/ Feasibility Study (RI/FS) at the ITT Automotive Inc. (ITT) site located in the Town of Gates, New York. The adjacent former Alliance Metal Stamping and Fabricating (AMSF) property is presently considered an off-site property for purposes of the RI/FS, however due to the distribution of constituents of concern the combined ITT and AMSF properties are included in the scope of work and are presented in figures. A Site Plan is included as Figure 1.

This HASP describes the minimum safety requirements and general procedures to be met by employees of the ITT's consultants implementing the RI/FS (Engineer), the Engineer's subcontracted personnel, and those representatives designated by ITT or State and local governmental agencies, while on-Site. Accordingly, the HASP describes the responsibilities, training requirements, protective equipment, and procedures necessary to protect workers and visitors from exposure to potentially harmful materials. The HASP will be discussed with Site personnel and will be available on-Site for employee inspection and review while work activities are underway. A qualified Health & Safety Coordinator will be designated by the Engineer to implement the HASP during the investigations.

O'Brien & Gere Engineers, Inc. has been retained by ITT to prepare this HASP and the RI/FS for the ITT and offsite properties.

1.2. Site Background and Description

The Site and off-site properties (the ITT and AMSF facilities) are situated to the southeast of the intersection of I-490 and State Route 33 in the Town of Gates, New York. The ITT facility was constructed on vacant land in 1973 for Rochester Form Machine and was purchased by ITT-Higbie Baylock in 1979. The AMSF facility was constructed on vacant land around 1966. Prior land use for this area was observed as farmland.

1.3. Scope of Work

The following work activities are governed by this HASP.

The scope of work presented below for the Site and off-site is based on the information presented in the RI/FS Work Plan, ITT Automotive, Inc, Site # 8-28-112, November 2003 (O'Brien & Gere, 2003).

Site and off-site reconnaissance.
A Site and off-site reconnaissance was performed to gather information regarding current Site and off-site conditions for the development of the RI/FS Work Plan.

Marking of subsurface utilities.
Prior to initiation of intrusive activities, an underground facilities protective organization (UFPO) request will be made. A date and time will then be established for review of these utility locations with utility representatives at the Site and off-site to mark subsurface public utilities in the areas of proposed work. Representatives of ITT and for the AMSF property will also be contacted to locate private subsurface utilities.

Mobilization.
Prior to the initiation of the RI/FS fieldwork, subcontractors will be retained for drilling, surveying and analytical services. Field equipment needed to complete the work will be procured and arrangements will be made with the appropriate laboratories for sample containers. Access to non-ITT property will be obtained by ITT from the property owners.

Sub-slab soil vapor sampling.
Sub-slab soil vapor samples will be collected from the northwestern portion of the former AMSF building and the ITT building to assess the potential for migration of vapor to indoor air at concentrations that are incompatible with building uses and potential receptors.

Approach: This sampling method involves the collection of a sample of vapor from the unsaturated soil beneath the building foundation for analysis. The sample collection device is typically tubing constructed of Teflon. If the surface is covered by asphalt of concrete a nominal hole shall be drilled through the surface. A 1 to 2 inch diameter hole shall be completed to just below the concrete or asphalt slab using a slide hammer, drill or soil gas sampling device. Tubing is placed to the base of the hole and the annulus of the tubing is sealed. The tubing will be attached to the metering pump of the Summa canister.

Soil borings and bedrock coring
Advancement of soil borings and rock cores to further evaluate the vertical and horizontal profile of volatile organic compounds (VOCs) and 1,4-dioxane within overburden materials.

Approach. Soil borings will be advanced to bedrock. Borings will be installed using conventional hollow stem auger drilling techniques or direct push techniques. Soil samples will be collected continuously throughout the boring. For hollow stem auger drilling soil samples will be collected in accordance with ASTM Method D1586-84 using a 140-lb hammer and 2 ft split-barrel samplers. Drilling will be overseen by a geologist who will complete a boring log to document encountered subsurface strata and other pertinent observations. In addition, each soil sample will be screened using a photo-ionization detector (PID) and a UV light.

Soil samples will be used to characterize the nature and extent of residuals associated with the overburden material. Soil samples for laboratory analysis will be transferred to the appropriate laboratory containers and placed in a cooler containing ice. Samples will be submitted to a NYS-certified laboratory for analysis.

Shallow bedrock cores will be completed in the northern portion of the Site to a depth of 25 ft. The shallow bedrock core will be advanced by coring, using HQ wireline coring techniques, and using water as the drilling fluid. Each core run will be examined for lithology, mineralogy, degree of cementation and/or infilling, grain size, color, percent recovery, and rock quality designation. The cores will be screened for VOCs in the field using a PID, visual observations, and a UV light.

Monitoring well installation.
Objective. Installation and sampling of monitoring wells to provide better definition of ground water flow and chemical composition.

Approach. Shallow bedrock and deep bedrock monitoring wells will be installed at the Site. The installations will be conducted by advancing 6¼-inch inside diameter (ID) augers from the ground surface to the top of bedrock. During advancement of the 6¼-inch augers, continuous soil samples will be collected in continuous 2-ft intervals using 2-inch diameter split-barrel samplers in accordance with ASTM Method D1586-84. At locations where borings were previously completed samples will not be collected in duplicate intervals.

Upon reaching the top of bedrock, the boreholes for the shallow bedrock monitoring wells will be advanced approximately 2 ft into bedrock. The boreholes will be advanced using a 5-inch roller bit through the augers. A 4-inch diameter steel casing fitted with a plastic end cap will be lowered through the auger string. The annular space between the borehole wall and the 4-inch casing will be filled with cement/bentonite grout using a tremie pipe as the auger string is removed. The grout will be allowed to cure for a minimum of 12 hours prior to further borehole advancement.

Subsequent to curing the grout, air-hammer, odex, or coring drilling methods will be used to deepen the boreholes to the terminal depths. Cuttings that are carried to the ground surface will be managed according to section 4.9 IDW management.

The shallow bedrock wells will be completed as open hole bedrock wells, similar to the wells previously installed at the Site. Well completion will include the installation of a flush mounted protective casing/road box. A concrete pad will be installed around the well to direct precipitation away from the borehole.

Deep bedrock monitoring well installation will be advanced using a 6¼-inch ID hollow steam auger with continuous split-spoon sampling to the bedrock interface. The borehole for the deep bedrock monitoring well will be advanced approximately 2 ft below the bottom of the shallow bedrock monitoring wells. A 4-inch diameter steel casing fitted with a plastic end cap will be lowered through the auger string. The annular space between the borehole wall and the 4-inch casing will be filled with cement/bentonite grout using a tremie pipe as the auger string is removed. The grout will be allowed to cure for a minimum of 12 hours prior to further borehole advancement. Subsequent to curing grout, air-hammer, odex, or coring drilling methods will be used to deepen the boreholes to the terminal depths. The volume of drilling water lost to the bedrock formation will be recorded. Monitoring for explosive gases will be performed during the installation of the deep well.

Subsequent to the terminal depth for the borehole, a 2-inch diameter PVC well consisting of a 10-ft length of 0.010-inch slot screen flush-threaded to riser casing will be lowered through the 4-inch casing. The riser casing will be extended to ground surface. A sandpack suitable for use with the screen slot size will be installed within the annular space between the borehole and the well. The sandpack will extend from the bottom of the well to 2 ft above the top of the well screen. A 2 ft thick bentonite seal will be installed in the annular space above the sand pack. The remaining annular space will be filled with a Portland cement/bentonite grout through a tremie pipe to a maximum depth of 5-ft below grade. Well completion will include the installation of a flush mounted protective casing/road box. A concrete pad will be installed around the well to direct precipitation away from the borehole.

Following installation of the wells and prior to collection of ground water samples, each well will be developed to remove the fine material which may have settled in the monitoring wells, to remove introduced drilling fluids, and to provide better hydraulic communication with the surrounding formation. Development will consist of the removal of 5 well volumes using either a bailer or centrifugal pump. A 50 nephelometric turbidity unit (NTU) turbidity goal has been established. If this goal cannot be achieved, ITT's representative will coordinate with NYSDEC to establish a mutually agreeable development volume.

Development water will be contained in 55-gallon drums for subsequent disposal. The method of disposal will be selected based on ground water analytical results. Sampling will be conducted a minimum of seven days after well development.

Prior to the installation of the monitoring well screen and casing, a dual-inflatable packer testing apparatus will be utilized to measure the hydraulic conductivity of the isolated fracture intervals in the boring for the deep bedrock monitoring well. Fracture intervals for ground water sampling will be determined in the field during the drilling processes.

Hydraulic conductivity testing.
In-situ hydraulic conductivity tests will be performed in the newly installed monitoring wells, and existing wells not previously tested to estimate the horizontal hydraulic conductivity of sediments surrounding the well screen. Rising and falling head measurements will be obtained following both insertion and removal of a PVC slug into the well. Water level data will be monitored using a transducer.

Ground water sampling.
Objective: Ground water sampling will be completed to provide information regarding temporal variations in ground water elevations, flow patterns and chemical composition.

Approach: Ground water samples will be collected from newly installed and existing wells. Ground water samples will be collected using either bailing or low flow sampling techniques. Low flow purging involves inserting a stainless steel Grundfos® pump (or similar pump) and dedicated Teflon tubing within the screened interval of the well and purging at a maximum rate of 0.5 liters/minute. During purging, ground water quality parameters including pH, conductivity, temperature, eH, turbidity and dissolved oxygen will be monitored continuously using an in-line meter. Once the ground water quality parameters have stabilized, samples will be collected directly from the Teflon tubing. The pump will be decontaminated between wells in accordance with the procedures set forth in the QAPP. For sampling with a bailer, a dedicated or decontaminated bailer will be used to purge three well volumes from the well and then sample the well. During purging, ground water quality parameters including pH, conductivity, and temperature will be monitored using a Horiba U-10 water quality instrument. After removal of 3 well volumes, samples will be transferred directly from the bailer to the appropriate sample containers. Purged water will be contained in 55-gallon drums for subsequent disposal.

The ground water samples will be submitted to the laboratory for analysis by USEPA SW846 method (USEPA, 1996). The ground water samples will be analyzed for VOCs and 1,4-dioxane parameters using Method 8260.

1.4. Hazard Overview

Based on previous Site and off-site studies, the possible hazards associated with the above work activities are the inhalation of organic vapors and direct contact with ground water and soils containing volatile organic compounds. In addition, there is a potential to encounter explosive gases during drilling of the deep bedrock well.

Because the degree of hazard is largely location specific, the protective measures outlined in this plan focus on individual work activities rather than on site-wide levels of protection. These measures are consistent with applicable USEPA protocols and provisions of the Occupational Safety and Health Administration (OSHA) 29 CFR 1910 and 1926).

2. Project Personnel

2.1. General

While each person involved in the investigation implicitly has a part in implementing the overall project HASP, certain individuals have specifically designated responsibilities. These include the Project Manager, Project Supervisor, and the Health & Safety Coordinator.

2.2. Personnel

2.2.1. Project Manager

The Project Manager is responsible for the overall administration and technical execution of the project. The Project Manager is further responsible for the acquisition and delegation of resources necessary for project completion and HASP implementation.

2.2.2. Project Supervisor

The Project Supervisor reports to the Project Manager and is directly responsible for the technical progress and financial control of the project

2.2.3. Health & Safety Coordinator

The Health & Safety Coordinator is responsible solely for the Engineer's employees and the Engineer's subcontracted personnel, unless otherwise specified in this plan. Specifically, the Health & Safety Coordinator has the following responsibilities:

- Assuring that a complete copy of the HASP is available prior to the start of field activities and that workers are familiar with it.
- Conducting health and safety training and briefing sessions.
- Ensuring the availability, use and proper maintenance of personal protective equipment, decontamination equipment, and other safety or health equipment.

- Maintaining a high level of safety awareness among field personnel and communicating pertinent safety and health matters to them promptly.

- Assuring that field activities are performed in a manner consistent with Engineer's policy and this HASP.

- Monitoring for potentially hazardous conditions during field activities.

- Coordinating with emergency response personnel and medical support facilities.

- Notifying the Project Manager of the need to initiate immediate corrective actions in the event of an emergency, accident, health or safety problem, unsafe condition or exception to this HASP.

- Recommending improvements in safety and health measures to the Project Manager.

- Conducting safety and health performance and system audits.

- Selecting and inspecting personal protective equipment (PPE).

- Ensuring the daily Health and Safety Log is completed and available for review when requested by an ITT representative.

- Forwarding all accident/emergency reports to the ITT representative and the Associate for Health and Safety within 24 hours.

The Health & Safety Coordinator has the authority to recommend that the Project Manager take the following actions:

- Suspend field activities or otherwise limit exposures if the health or safety of any site worker appears to be endangered.

- Notify the Engineer or subcontractor personnel to alter work practices that are not properly protective to either workers or the environment.

- Suspend an individual from field activities for violation of the requirements of this HASP.

3. Health and Safety Hazards

3.1. General

Table 1 lists chemical compounds that may be present during work activities. Those compounds listed have been chosen to provide a frame of reference for the development of this HASP. . Site air monitoring action levels for volatile organic compounds (VOCs) are conservative relative to the OSHA Permissible Exposure Limits (PELs) for VOCs listed in Table 1.

Table 2 lists potential health and safety hazards that may be associated with general Site tasks. This list has been compiled based on scheduled activities and potential Site and off-site conditions.

Site Reconnaissance – Level D
Well Installation – Modified Level D
Soil Borings – Modified Level D

3.2. Subsurface Investigations

3.2.1. Operations and tasks to be performed

Subsurface soil and bedrock samples will be collected from borings to evaluate the physical and chemical characteristics. Borings will be advanced to evaluate the subsurface geology and allow for installation of monitoring wells. The samples will be visually characterized and field screened using a PID.

3.2.2. Potential health hazards and contaminants

During the handling of soil cores, the process of description and the field screening, the possibility exists for product splash from the sample onto workers and release of volatile materials into the worker's breathing zone. In addition, there is a potential to encounter explosive gases during drilling of the deep bedrock well.

3.2.3. Contaminant dispersion pathways

The contaminants may be spread through the air and through skin contact.

3.2.4. Contaminant control

The initial level of protection is modified Level D including, hard hat, eye protection (splash goggles or a face shield with safety glasses) and organic solvent resistant gloves. Workers must be able to write with the gloves selected.

3.2.5. Explosive gases control

At the proposed deep monitoring well location a 4-inch diameter Schedule 40 BIP will be grouted into the shallow bedrock. The casing will have a threaded connection at or above grade.

During drilling:

- Monitoring of oxygen and combustible/flammable gas levels will be performed while drilling and sampling below the bottom of the 4-inch casing. Following withdrawal of split spoon sampler, monitor for oxygen and combustible/flammable gas using a continuous monitoring instrument.
- Place the inlet for instrument approximately four inches above lip of the casing.
- The action levels will be 19.5% for oxygen and 5 % of the LEL for combustible/flammable gas for 30 seconds. (The PEL for confined spaces is 10% of LEL)

When an Action Level is exceeded or if natural gas is observed (based on odor, sound, rush of gas, or visible discharge of gas) to discharge from the well:

1. Stop drilling activities and turn off drill rig until it is safe to resume drilling, as per Steps 3 and 4.
2. If gas is discharging at a significant rate go to Step 6.
3. Monitor above the casing for oxygen and combustible/flammable gas for one minute.
4. If oxygen increases to above 19.5% and the LEL decreases to below 3% and remains within acceptable limits for one additional minute, resume drilling.
5. If the oxygen level stays below 19.5% or the LEL stays above 3%, wait five additional minutes and resample.
6. If, after five minutes, the oxygen level remains below 19.5% or the LEL level stays above 5%, withdraw drill rods, bits and samplers. Use sparkproof tools to attach the threaded cap to be installed on the 4" casing. This cap will be fitted with a 1" diameter ball valve to be used as a blow off valve or sampling port. If work at the Site is completed for the day and the well continues to vent, a 1-inch diameter standpipe will be connected to the well cap as an additional

safety measure. The standpipe will be a minimum of 8 ft in length and will be constructed of a thermoplastic material or a non-ferrous metal.

7. Work will not resume until notice to proceed is given by the site H & S officer. Drilling can resume when the oxygen level remains above 19.5% and the LEL remains below 3%. Use sparkproof tools to remove the threaded cap that was installed on the 4" casing.

3.3. Air Monitoring

3.3.1. Operations and tasks to be performed

Air samples will be collected to evaluate the potential for air transport of volatile compounds from the Site and off-site and to monitor air in the breathing zone of workers. VOCs will be monitored in accordance with the procedures set forth in Section 5.4. The breathing zone will be monitored using a PID (Section 5.2). In addition, an explosive gases monitoring will be performed during drilling of the deep bedrock well (See Section 3.2.5).

3.3.2. Potential health hazards and contaminants

There is a potential for levels to exceed the action levels established for other tasks.

3.3.3. Contaminant dispersion pathways

The contaminants may be spread through the air.

3.3.4. Contaminant control

Level D PPE will be utilized initially. Upgrades, as appropriate, depending on the level of exposure and the task being monitored will be considered. If explosive gases are detected, controls are described in Section 3.2.5.

3.4. Ground Water Monitoring

3.4.1. Operations and tasks to be performed

Ground water screening samples will be collected for quality characterization. Monitoring wells will be installed and ground water samples collected to evaluate ground water flow patterns and chemical composition.

3.4.2. Potential health hazards and contaminants

During the handling of ground water, the possibility exists for water or product splash from the sample onto workers and release of volatile materials into the worker's breathing zone. Traces of various compounds may be contained within water samples collected from the Site and off-site. The potential exists for release of these materials into the atmosphere at levels that may present an inhalation hazard. They may also generate an offensive odor at concentrations below the PEL.

3.4.3. Contaminant dispersion pathways

The contaminants may be spread through the air and absorbed through direct contact.

3.4.4. Contaminant control

The initial level of protection is modified Level D. Additional protection during the operations will be provided by wearing a hard hat, eye protection (splash goggles or face shield with safety glasses); and organic solvent resistant gloves. Workers must be able to write with the gloves selected.

4. Personal Protective Equipment

4.1. General

PPE will be worn at times as designated by this HASP. Levels of protective clothing and equipment have been assigned to specific work tasks at either basic Level D or modified Level D and Modified Level C. On-Site monitoring will be used to set task and point specific levels of personal protection. If field measurements or observations indicate that a potential exposure is greater than the protection afforded by the equipment or procedures specified in this HASP, efforts will be made to reduce the exposure and/or increase the level of protection provided.

Level D protection will be worn initially by workers engaged in performing the activities listed in Section 3, except where noted. Upgrades to Modified Level D or Level C protection will be determined by 1) exceedence of action levels described in Table 3, 2) observance of non-aqueous liquid (free product), or 3) at the discretion of the Health & Safety Coordinator. Downgrade from Modified Level D or Level C will be made only upon approval of the on-Site Health & Safety Coordinator.

Personnel will wear appropriate PPE and clothing. Each individual performing work on-Site will be properly trained in the use of this equipment prior to the start of field activities. Safety equipment and protective clothing shall be used as directed by the Health & Safety Coordinator. Such equipment and clothing will be cleaned and maintained in proper condition by project personnel. The Health & Safety Coordinator will monitor the maintenance of personnel protective equipment to ensure proper procedures are followed.

No excessive facial hair, which interferes with the effectiveness of a respirator, will be permitted on personnel required to wear respiratory protection equipment. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. Fit testing will be performed prior to respirator use to ensure a proper seal is obtained by the wearer. Respirators will be issued for the exclusive use of one worker and will be cleaned and disinfected after each use by the worker.

Contact with potentially contaminated surfaces should be avoided whenever possible. There may be no walking through puddles, mud, or other discolored surfaces; kneeling on the ground; leaning, sitting or placing equipment on drums, containers, vehicles, or the ground. If you make contact with contaminated fluids, clean up immediately using plenty of water.

PPE levels designated below are in conformance with OSHA and USEPA criteria for Level C, Modified Level D and Level D protection. Respiratory protective equipment used on-Site, if any, will be approved by the National Institute for Occupational Safety and Health (NIOSH). Respiratory equipment will be maintained in accordance with manufacturer's instructions and within the guidance of 29 CFR 1910.134. Other PPE will be purchased and maintained in accordance with the applicable provisions of Subpart I, 29 CFR 1910.

4.2. Level C Protection

The following Level C protection will be worn under the conditions stated in Table 3.

- NIOSH approved full-face or half face air purifying respirator equipped with P100 dust filters and organic vapor and acid gas cartridges; potential users must be trained and medically approved to use respiratory protection. Cartridges for air-purifying respirators in use will be changed daily at a minimum.
- Hard hat.
- Chemical-resistant clothing: overalls, chemical-splash suit, disposable chemical-resistant overalls (one piece suits with elastic wrist bands).
- Chemical resistant outer gloves (nitrile gloves taped to suit).
- Chemical resistant inner gloves (nitrile gloves).
- Chemical resistant outer boots with steel toe and shank (leather, steel-toe boots with rubber overboots taped to suit).

Optional items include:

- Coveralls.
- Chemical resistant boot covers.
- Face shield with safety glasses or safety glasses when wearing a half face respirator.

- Hearing protection when working in noise hazardous areas.

4.3. Modified Level D Protection

Modified Level D protection, consisting of Level C protective equipment without the use of a respirator, will be worn during soil investigations. However, as stated above, a NIOSH approved full-face or half face air purifying respirator equipped with P100 dust filters and organic vapor cartridges must be available for immediate use. Potential users must be trained and medically approved to use respiratory protection.

For this level of protection, chemical resistant clothing (polyethylene-coated suits) will be required. Suits will be one piece with elastic wristbands. The Health & Safety Coordinator may require the use of suits with hoods.

Options as required:

- NIOSH approved full-face or half-face air purifying respirator equipped with P100 dust filters and organic vapor and acid gases cartridges available for immediate use. Potential users must be trained and medically approved to use respiratory protection.
- Level C clothing/protection must be readily available.
- Hearing protection.
- Escape mask.

4.4. Level D Protection

The following Level D protection will be worn during sampling of ground water in areas where the action levels specified in Table 3 are not exceeded.

- Coveralls or other skin protective clothing (long sleeve shirts and long pants).
- Safety glasses with side shields, chemical splash goggles or face shield with safety glasses.
- Hard hat.
- Water resistant work gloves.
- Chemical resistant boots or shoes with steel toe and shank (leather, steel-toe boots with rubber overboots).

4.5. Heavy Machinery/Equipment

Site employees must remain aware of those activities that involve the use of heavy equipment and machinery. Respiratory protection and protective eyewear may be worn during Site activities. This protective equipment significantly reduces peripheral vision of the wearer. Therefore, it is essential that employees exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

The primary piece of heavy equipment associated with activities covered by this HASP is a drill rig. Although the drill rig owner/operator is primarily responsible for the safe setup and operation of the drill rig, the following basic safety precautions should be observed:

1. Operate drill rigs with all guards, safety alarms, and other safety devices in place and functional.
2. Do not move the drill rig with the mast raised.
3. Workers must not be on the mast when the drill rig is in motion or when the driller is making the initial pull on the rods.
4. Rotating parts should never be greased or contacted in any manner while the drill rig is in motion.
5. Evacuate the area upon observation of lightning strikes or the development of storm conditions with a potential for lightning strikes.

4.6. Protective Equipment Failure

If any equipment fails and/or any employee experiences a failure or other alteration of their protective equipment that may affect its protective ability, that person and his/her partner will immediately leave the work area. Re-entry will not be permitted until the equipment has been repaired or replaced and the cause of the failure identified. The Project Manager and the Health & Safety Coordinator will be notified and, after reviewing the situation, will evaluate the effect of the failure on the continuation of ongoing operations. If the failure affects the safety of personnel, the worksite or the surrounding environment, personnel will be evacuated until appropriate corrective actions have been taken.

5. Site Air Monitoring

5.1. General

Field activities associated with the investigation may cause potentially hazardous conditions, through the volatilization of hazardous substances. These substances may be in the form of vapors, dusts, or mists that can enter the body through ingestion, inhalation, adsorption and direct contact. Monitoring of these substances will be performed to ensure appropriate personal protective measures are employed during Site activities.

The following describes the monitoring parameters to be evaluated during the investigation. Recommended instruments to be used are also provided in the discussion. These instruments will meet the established requirements set forth by OSHA, MSHA, NIOSH, and state agencies where applicable. These instruments must be properly maintained. Conditions can change quickly if subsurface areas of contamination are penetrated. Table 4 lists the activities and the associated Site monitoring.

Action levels have been established for activity cessation, site evacuation, emergency response, and determination of personal protection levels. Section 3 discusses the minimal personal protection required for specific Site activities. Table 3 lists action levels, airborne concentrations, and associated personal protection levels. Changes to these specified levels are dependent on the results of air monitoring, as described below and must be approved by the Health & Safety Coordinator.

5.2. Monitoring

5.2.1. Organic vapor

Organic vapor concentrations will be monitored at the start and at 15-minute intervals during specified activities listed in Table 4 using Foxboro organic vapor meter model 128 (FID), Photovac TIP II (PID) or HNu P1-101. The instrument used will be calibrated according to the manufacturer's instructions using a benzene, toluene, xylene standard. Tasks not otherwise specified in Table 4 will be monitored hourly for the first 2 hours. Organic vapor concentrations will be used as action level criteria for upgrading or downgrading protective equipment (See Section 4) and for implementing additional precautions or procedures.

5.3. Action Levels

Action levels have been designated for monitoring the breathing space of workers on the Site. The action levels are based on the OSHA PELs for the specific compounds detected during on-site monitoring.

The approach for air monitoring is as follows:

1. The direct-reading PID will be calibrated to most accurately reflect the scope of volatiles previously identified.

2. Using the PID, work activities will be monitored for organic vapors.

5.4. Community Air Monitoring Plan

All action levels identified in the following sections are assumed to be above background.

5.4.1. Monitoring requirements

Real-time air monitoring for VOCs will be performed in the work zone. If the 15-minute average VOCs level exceeds 5 ppm above background, the downwind perimeter of the exclusion zone at the Site will be monitored periodically during intrusive work. The organic vapor meter will monitor total organic vapors. The monitor will be equipped with audible and visual alarms, have recorders and display the average level for the previous 15 minutes. All readings must be available for New York State Department of Health (NYSDOH) and NYSDEC personnel to review.

5.4.2. Organic vapors

Organic vapor action levels.
When the 15-minute average VOCs level remains below 5 ppm above background, intrusive work activities may continue.

When the 15-minute average VOCs level exceeds 5 ppm above background, intrusive work activities will be suspended. Monitoring will continue under the provisions of the Vapor Emission Response Plan described below.

When the 15-minute average VOCs level exceeds 25 ppm above background, intrusive work will be stopped and the Major Vapor Emissions Plan described below will be activated. Monitoring will continue under the provisions of the Major Vapor Emission Plan described below.

Vapor emission response plan.
If the vapor levels increase above 5 ppm over background at the downwind perimeter of the exclusion zone but remain below 25 ppm above background, work can resume provided:

- The source of the vapors has been identified and corrective actions have been taken to abate the emissions. These actions must reduce the exclusion zone perimeter emissions below 5 ppm.

- The organic vapor level 200 feet downwind of the work area or half of the distance to the nearest residential or commercial structure, whichever is less, is less than 5 ppm over background. If the distance to the nearest occupied building is less than 20 feet, the monitor will be placed at the perimeter of the work area.

- Continuous monitoring continues.

Major vapor emission plan.
If organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half of the distance to the nearest residential or commercial property, whichever is less, all work activities at the site will be halted.

If, following the cessation of the work activities, the downwind organic levels persist above 5 ppm above background, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20-Foot Zone).

If efforts to abate the emission source are unsuccessful and if organic vapors persist at levels ≥5 ppm for more than 30 minutes or any level ≥10 ppm in the 20-foot Zone, then the following actions will be taken:
1. Monitoring will be conducted continuously in the “20 foot zone” until VOC levels are below 5 ppm. All intrusive site activities will be halted during this time.
2. The site owner will be notified.
3. The NYS DEC will be notified.

6. Site Access and Site Control

6.1. Site Access

Access to the areas to be investigated will be limited to the trained authorized personnel governed by this plan. Such personnel are anticipated to include the Engineer's employees, ITT employees, designated subcontracted equipment operators, and those representatives as designated by ITT or State and local agencies.

Personnel and equipment in the work areas should be minimized, consistent with effective Site operations.

Activities in the exclusion zone will be conducted using the "Buddy System". A buddy is another worker fully dressed in the appropriate PPE, who can perform the following activities:

- Provide his/her partner with assistance;
- Observe his/her partner for sign of chemical or heat exposure;
- Periodically check the integrity of his/her partner's PPE; and
- Notify others if emergency help is needed.

6.2. Site Control for Sampling

Work zones will be established at each sampling location by the Health & Safety Coordinator. Three categories of work zones, an exclusion/contaminated work zone, a contamination reduction/buffer zone and a support/clean zone, will be established. These zones will be monitored by the Health & Safety Coordinator (or designee) to ensure only personnel that have been trained and are wearing appropriate PPE are allowed to enter. These zones are described in the following sections.

6.2.1. Exclusion/contaminated work zones

The exclusion/contaminated work zones will be limited to the areas around the sampling point. These areas should only be large enough to contain the sampling apparatus and necessary ancillary equipment and personnel. Access to the established exclusion zones will be limited to those authorized personnel wearing appropriate PPE. Exclusion zones will be marked by traffic cones or caution tapes.

6.2.2. Contamination reduction/buffer zones

The contamination reduction zones, where personnel and equipment are decontaminated, should be located upwind of the active work zone. These zones will only contain equipment and personnel necessary to ensure that potentially contaminated soils are not removed from the sampling location. The contamination reduction area for the Site will be defined as a zone immediately around the drill rig. The contamination reduction zone will be marked by traffic cones or caution tapes.

6.2.3. Support/clean zone

The support zones will be located upwind of the active work zones. These zones will contain the additional personnel and equipment necessary to manage and conduct the Site investigations. Personal hygiene facilities meeting at least the minimum requirements of 29 CFR 1910.120 will be provided in the support zones. The designated support zones will be the surrounding Site not considered the contamination reduction/buffer zone.

6.3. Housekeeping

The work zones shall be maintained in a clean and orderly condition at all times. Construction areas shall be free of waste materials, debris, and rubbish to the extent feasible. Materials and equipment shall not obstruct traffic or emergency response activities. Waste materials, debris, and rubbish shall periodically be removed from the Site and properly disposed off-site as required by site conditions and activities.

6.4. Site Access

Work zones security and control shall be maintained by the Project Supervisor and/or his designee and the Health & Safety Coordinator and/or his designee. Their duties include limiting access to the work zones to authorized personnel, oversight of project equipment and materials, and general oversight of work zone activities. The Project Supervisor and/or his designee will maintain a log-in sheet for Site workers and guests. The log-in sheet will include, at the minimum, personnel on the Site, their arrival and departure times and their destination on the Site.

The following procedures will be followed to ensure suitable site access and control so that those persons who may be unaware of Site conditions are not exposed to inherent Site hazards.

1. Well caps will be secured by padlocks to prevent unauthorized access.

2. Upon completion of the day's drilling activities, heavy machinery and equipment will be stored securely at locations selected by the Health & Safety Coordinator and personnel from ITT.

7. Medical Monitoring

7.1. Medical Surveillance Program

OSHA has established requirements for medical surveillance programs designed to monitor and reduce health risks by employees potentially exposed to hazardous materials (29 CFR 1910.120). This program has been designed to provide baseline medical data for each employee involved in hazardous waste operations including field activities, and to determine his/her ability to wear PPE, such as chemical resistant clothing and respirators. Employees who wear or may wear respiratory protection must be provided respirators as regulated by 29 CFR 1910.134. This standard requires that an individual’s ability to wear respiratory protection be medically certified before he/she performs designated duties. Where medical requirements of 29 CFR 1910.120 overlap those of 29 CFR 1910.134, the most stringent of the two will be enforced.

The medical examinations are administered on a pre-employment and annual basis and as warranted by symptoms of exposure or specialized activities. O’Brien & Gere and ITT have obtained the necessary medical monitoring and training for their employees pursuant to 29 CFR 1910.120. The examining physician(s) have made reports to O’Brien & Gere and ITT of any medical condition that would place employees at increased risk of wearing a respirator or other PPE. O’Brien & Gere and ITT will maintain site personnel medical records as regulated by 29 CFR 1910.120 and 29 CFR 1910.1020 where applicable.

7.2. Heat/Cold Stress

The timing and location of this project may be such that heat/cold stress could pose a threat to the health and safety of site personnel. Work/rest regimens will be employed as deemed necessary by the Health & Safety Coordinator so that Site workers do not suffer adverse effects from heat/cold stress. Special clothing and an appropriate diet and fluid intake will be recommended to on-Site personnel to further reduce these temperature-related hazards. The work/rest regimens will be developed following the guidelines in the American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values and Biological Exposure Indices for 1999. Site workers should stop work and notify the Health & Safety Coordinator if they observe symptoms of heat/cold stress in themselves or others.

7.2.1. Cold stress

Work/rest schedules must be altered to minimize the potential for cold stress. Cold stress is defined as a decrease in core body temperature to 98.8°F and/or cold injury to body extremities. Decreases in core body temperature are associated with reduced mental alertness, reduction in rational decision making, or loss of consciousness in severe cases.

Symptoms of cold stress include pain in extremities (i.e. hands and feet) and severe shivering. If workers experience these symptoms, they must stop work and implement one of the following controls:

- Change into adequate dry insulated clothing,

- Adjust the work/rest schedule to increase the amount of rest/rewarming time.

Toolbox safety meetings discussing symptoms of cold stress, clothing requirements and work breaks must be held when the ambient temperature drops below 0°F and when the wind chill temperature is below –25°F.

Wind chill temperatures are a combination of actual air temperature and wind speed as shown in Appendix A. Wind chill temperatures below -25°F are extremely dangerous. Workers must protect any exposed skin, especially the face, ears and fingers.

7.2.2. Heat stress

Heat stress monitoring and control of personnel wearing protective clothing should be considered when the ambient temperature is 70°F or above. One of the following methods should be employed:

- Measure the heart rate by the radial pulse for a 30 second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following cycle by one-third.

- Measure oral temperature at the end of the work period and before drinking. If oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period. If the oral temperature still exceeds 99.6°F at the beginning of the next rest period, shorten the next work cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when his/her oral temperature exceeds 100.6°F.

The timing and location of this project may be such that heat/cold stress could pose a threat to the health and safety of Site personnel. Work/rest regimens will be employed as deemed necessary by the SSHC so that O'Brien & Gere and subcontracted personnel do not suffer adverse effects from heat/cold stress. Special clothing and an appropriate diet and fluid intake will be recommended to all on-Site personnel to further reduce these temperature-related hazards. Site workers should stop work and notify the SSHC when they observe symptoms of heat/cold stress in themselves or co-workers.

All O'Brien & Gere and subcontracted personnel should review Exhibit 3 – Heat Stress Prevention Plan.

7.3.1. Monitoring

Heat stress monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70°F or above. To monitor the worker, one of the following methods should be employed:

1. Heart rate should be measured by the radial pulse for a 30 second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following cycle by one-third.

2. Oral temperature should be measured at the end of the work period (before drinking). If oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period. If the oral temperature still exceeds 99.6°F at the beginning of the next rest period, shorten the next work cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when his/her oral temperature exceeds 100.6°F.

7.3.2. Cold Stress Work/Rest Schedules

Work/rest schedules must be altered to minimize the potential for cold stress. Cold stress is defined as a decrease in core body temperature to 96.8°F and/or cold injury to body extremities. Decreases in core body temperature are associated with reduced mental alertness, reduction in rational decision making, or loss of consciousness in severe cases. Symptoms of cold stress include pain in extremities (i.e., hands and feet) and severe shivering. If workers experience these symptoms, then stop work and implement the following controls

1. Workers must don adequate dry insulating clothing; and

2. Adjust the work/rest schedule to increase the amount of rest/rewarming time.

3. Toolbox safety meetings discussing symptoms of cold stress, clothing requirements, and work breaks must be held when the wind chill temperature (see Appendix A) drops below 0°F and EACH DAY the wind chill temperature is below 25°F.

NOTE: Wind chill temperatures are a combination of actual air temperature and wind speed as shown below. The wind chill index provided below shows the effective cooling on exposed skin. When the wind blows across the skin, it removes the insulating layer of warm air adjacent to the skin. When all factors are the same, the faster the wind blows, the greater the heat loss, which results in a colder feeling. Wind chill temperatures more than 25°F below zero are extremely dangerous. Workers must protect any exposed skin, especially the face, ears, and fingers.

Wind Speed-mph							
Calm	5	10	15	20	25	30	35
Temperature (Degrees F)	**Wind Chill**						
45	43	34	29	26	23	21	20
40	37	28	23	19	16	13	12
35	32	22	16	12	8	6	4
30	27	16	9	4	1	-2	-4
25	22	10	2	-3	-7	-10	-12
20	16	3	-5	-10	-15	-18	-20
15	11	-3	-11	-17	-22	-25	-27
10	6	-9	-18	-24	-29	-33	-35
5	0	-15	-25	-31	-36	-41	-43
0	-5	-22	-31	-39	-44	-49	-52
-5	-10	-27	-38	-46	-51	-59	-64
-10	-15	-34	-45	-51	-59	-64	-67
-15	-21	-40	-51	-60	-66	-71	-74
-20	-26	-46	-58	-67	-74	-79	-82
-25	-31	-52	-65	-74	-81	-86	-89

If you would like to calculate the wind chill index for combinations of temperature and wind other than those given in the table above, you can use the formula:

$$WC = 91.4 - (0.474677 - 0.020425 * V + 0.303107 * SQRT(V)) * (91.4 - T)$$

where: WC = wind chill index; V = wind speed (mph); T = temperature (° F)

8. Personnel Training

8.1. General

Employees must, at a minimum, have received training that meets the requirements specified in 29 CFR 1910.120. Subcontractor personnel will document their compliance with training and medical program requirements.

Site personnel involved in field activities will have received the appropriate basic training and any additional activity-specific training where required, prior to initiation of the said activities. This HASP must be distributed to subcontractors prior to the start of field activities. A pre-operation meeting will be held to discuss the content of the Plan. Specialty training will be provided as determined by task and responsibility. Personnel training will be conducted under the supervision of the Health & Safety Coordinator.

Site workers

O'Brien & Gere employees performing the activities listed in the Statement of Work (SOW) must have completed a training course of at least 40 hours meeting the requirements of 29 CFR 1910.120(e) for safety and health at hazardous waste operations. If the course was completed more than 12 months before the date of site work, completion of an approved 8-hour refresher course on health and safety at hazardous waste operations is required.

O'Brien & Gere employees must comply with the O'Brien & Gere Quality Assurance Manual (QAM). The respiratory protection program is specified in Section 004.2 of Vol. 3. The Hazard Communication Program is specified in Section 003 of Vol. 3. The Audit Program is specified in Section 019 of Vol. 3. The Confined Spaces Entry Program is specified in Section 008 of Vol. 3.

Management and leaders

In addition to the requirements described in section 3.1 for O'Brien & Gere site workers, O'Brien & Gere field leaders must have completed an off-site training course of at least 8 hours meeting the requirements of 29 CFR 1910.120(e) on supervisor responsibilities for safety and health at hazardous waste operations.

Emergency response personnel

O'Brien & Gere employees who respond as good samaritans to emergency situations involving health and safety hazards must be trained in how to respond to such emergencies in accordance with the provisions of 29 CFR 1910.120(l). Skills such as cardiopulmonary resuscitation (CPR), mouth-to-mouth rescue breathing, avoidance of blood-borne pathogens, and basic first aid skills may be necessary.

8.2. Site-Specific Training

Employees will undergo Site-specific training prior to the start-up of each project or task. As Site activities change, supplemental training will be provided on the following topics:

- Recognition and control of general Site hazards and specific hazards (including heat and cold hazards) in the work areas,
- Selection, use, testing and care of the PPE required and the limitations of each,
- Decontamination procedures for Site workers, their PPE and other equipment used on-Site,
- Emergency notification procedures (including hand signals) and evacuation routes to be followed,
- Emergency response procedures and requirements, and
- Procedures for obtaining emergency assistance and medical attention.

8.3. Specialized Training

Specialized training will be provided as dictated by the nature of Site activities. Specialized training will be provided for activities such as the handling of unidentified substances. Employees involved in these types of activities will be given off-Site instruction regarding the potential hazards involved with such activities and the appropriate health and safety procedures to be followed. Specialized instruction will take place in an area where employees will not be exposed to Site hazards.

8.4. Training Certification

A record of employee training completion will be maintained on-Site by the Health & Safety Coordinator. This record will include the dates of completion of worker training, supervisor training, refresher training, emergency response training and Site-specific training for Site workers as appropriate.

9. Decontamination

9.1. Personnel Decontamination Procedures

In general, decontamination involves scrubbing with a non-phosphate soap/water solution followed by clean water rinses. Disposable items will be disposed of in a dry container. Decontamination wastewaters will be contained in 55-gallon drums for subsequent off-site disposal. This will be done at the direction of the Project Manager or Project Supervisor.

In addition to being decontaminated, all respirators, non-disposable protective clothing, and other personal articles must be sanitized before they can be used again unless they are assigned to individuals. The manufacturer's instructions should be followed in sanitizing the respirator masks. The Health & Safety Coordinator (or designee) will be responsible for supervising the proper use and decontamination of protective equipment.

The highest level of protection used for this investigation will be Level C. Based on this level of protection, the following decontamination protocol will be used:

Station 1: Equipment Drop.
Deposit equipment used in the work zone (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area.

Station 2: Outer Garment, Boots, and Gloves Wash and Rinse.
Scrub outer boots, outer gloves and splash suit with detergent water. Rinse off using copious amounts of water.

Station 3: Outer Boot, Glove and Canister (or Mask) Removal.
3a. Remove outer boots and gloves. Deposit in container with plastic liner. If boots are to be reused (e.g., when the worker is donned in Level D or modified Level D protection), place in a secure on-Site location, preferably in plastic.

3b. If a worker leaves the exclusion zone to change his/her canister (or mask), this is the last step in the decontamination procedure. At this station, the worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.

Station 4: Boots, Gloves and Outer Garment Removal.
Remove and deposit boots, chemical-resistant splash suit, and inner gloves in separate containers lined with plastic.

Station 5: Face Piece Removal.
Face piece is removed. Avoid touching face with fingers. Deposit face piece on plastic sheet.

Station 6: Inner Glove Removal
Remove and dispose of inner gloves. Deposit them in a container with a plastic liner. If gloves are to be reused (e.g., when the worker is donned in Level D or modified Level D protection), place in a secure on-Site location, preferably in plastic.

Station 7: Field Wash.
Wash hands and face thoroughly. Shower if body contamination is suspected.

9.2. Equipment Decontamination

Decontamination will be applicable to drilling and sampling activities. Drilling equipment mobilized to the Site will receive initial decontamination before use and also be decontaminated before leaving the site. Decontamination will consist of steam cleaning of the rig to the satisfaction of the Project Supervisor or the Health & Safety Coordinator. Dirt, oil grease or other foreign materials that are visible will be removed from metal surfaces. Scrubbing with a wire brush may be required to remove materials that adhere to the surfaces.

Drilling equipment will be stored on plastic sheeting above ground, either on the drill rig at the drill site or on wooden supports. Equipment not in use will be covered with plastic and stored in a designated storage area separated from PPE.

The rear portion of the drill rig will be decontaminated by steam cleaning between test borings and/or monitoring well installations. In addition, equipment entering a monitoring well but not used for sample collection will be decontaminated by a steam cleaning.

Non-dedicated sample collecting equipment will be decontaminated after each use by a low phosphate detergent brushing followed by a clean water rinse. The field decontamination wastes will be collected in drums and disposed of in accordance to IDW management.

It may be necessary to insert hoses and/or narrow diameter pipe into test borings and wells during installation, development, purging, and sampling. These items will also be decontaminated initially, and after each use. The outside of the hose or pipe will be decontaminated as specified above for any item entering a well boring. The inside will be cleaned with soapy water and rinsed with water.

9.3. Investigation Derived Wastes Disposal

Investigation derived waste will be managed in accordance with the procedures described in the work plan. Site refuse will be contained in appropriate areas or facilities. Trash from the project will be disposed properly.

10. Emergency Response

10.1. Notification of Site Emergencies

In the event of an emergency, Site personnel will signal distress either verbally or with three blasts from a horn (vehicle horn, air horn, etc.) and contact the on-Site Health & Safety Coordinator. Site personnel will immediately withdraw from a hazardous situation to reassess procedures and consult with the Health & Safety Coordinator. Appropriate authorities will then be immediately notified of the nature and extent of the emergency.

Table 5 contains Emergency Response Telephone Numbers. This table and directions to the hospital will be maintained at the work site by the Health & Safety Coordinator. The location of the nearest telephone will be determined prior to initiation of on-Site activities.

Should someone require transportation to a hospital or doctor, a copy of this HASP must accompany him/her.

The Health & Safety Coordinator will direct notification, response, and follow-up actions to emergencies with the concurrence of ITT. Contacts with any outside response personnel (ambulance, fire department, etc.) will be done at the direction of the Health & Safety Coordinator, again with the concurrence of ITT.

Follow-up activities must be completed before on-Site work is resumed following an emergency. Used emergency equipment must be recharged, refilled or replaced. Government agencies must be notified as appropriate. An investigation of the incident must be conducted as soon as possible. The resulting report must be accurate, objective, complete, signed and dated. Copies must be submitted in accordance with the O'Brien & Gere QAM.

10.2. Responsibilities

The Health & Safety Coordinator (or designee) will be responsible for responding to emergencies. In addition, the Health & Safety Coordinator will:

1. Notify appropriate individuals, authorities and/or health care facilities of the potentially hazardous activities and potential wastes that may develop as a result of the investigation;

2. Have working knowledge of safety equipment available at the Site; and

3. Ensure a map that details the most direct route to the nearest hospital is prominently posted with the emergency telephone numbers.

The Project Supervisor will ensure that the following safety equipment is available at the Site: eyewash station, first aid supplies, and fire extinguishers.

10.3. Accidents and Injuries

In the event of a safety or health emergency at the Site, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed and to protect others from hazards (See Figure 2 for the location of area hospitals in relation to the Site). The Health & Safety Coordinator will be immediately notified. The Health & Safety Coordinator will then contact the appropriate emergency response personnel, who will, according to the seriousness of the accident, provide recommended medical diagnosis and, if necessary, treatment. Personnel trained in first aid procedures will be present during Site activities to provide appropriate treatment of injuries or illnesses occurring during operations.

The Project Manager, Project Supervisor, and ITT will be immediately informed of any injuries or incidents. If an individual is transported to a hospital or doctor, a copy of this Health & Safety Plan must accompany the individual. The Project Supervisor and the Health & Safety Coordinator will conduct an investigation to determine whether and at what levels exposure actually occurred, the cause of such exposure, and the means to be taken to prevent the incident from recurring.

An exposure-incident report will be completed by the Health & Safety Coordinator, the Project Supervisor and the exposed individual. The form will be submitted to O'Brien & Gere in accordance with the O'Brien & Gere QAM. A copy will be filed with the employee’s medical and safety records to serve as documentation of the incident and the actions taken.

10.4. Site Communications

Cellular telephones and/or two-way radios will be available for use in the field for emergency response and office communications. Hand signals will be utilized where phones/radios are impractical or unsafe. The locations of public telephones will be identified prior to the start of activities. These will provide back up for the cellular telephones.

10.5. Safe Refuge

The project personnel's vehicles shall serve as the immediate place of refuge in the event of an emergency. If evacuation from the area is necessary, the vehicles will be used to transport on-Site personnel to safety.

10.6. Emergency Evacuation

A safe refuge location will be selected each day and the employees working on site will be told its location. In case of an emergency, Site personnel should evacuate to the identified safe refuge location, both for their own personal safety and to prevent hampering response/rescue efforts. The Health & Safety Coordinator will account for all personnel. A log of individuals entering and leaving the Site will be kept so that everyone can be accounted for in an emergency.

10.7. Fire fighting Procedures

A fire extinguisher, intended only for small fires, will be available in the Project Supervisor's (or his designee's) vehicle during on-Site activities. When the fire cannot be controlled with the extinguisher, the area should be evacuated immediately. The Health & Safety Coordinator (or designee) will determine the time to contact fire department response personnel.

10.8. Emergency Decontamination Procedures

The extent of emergency decontamination depends on the severity of the injury or illness and the nature of the contamination. Minimum decontamination will consist of detergent washing, rinsing and removal of contaminated outer clothing and equipment. If the emergency is such that there is insufficient time to complete all of these actions, it is acceptable to remove the contaminated clothing without washing it. If the situation is such that the contaminated clothing can not be removed, the person should be given required first aid treatment, and then wrapped in plastic or a blanket prior to transport to medical care. If heat stress is a factor in the victim's illness/injury, the outer protective garment must be removed from the victim immediately.

10.9. Emergency Equipment

On-Site equipment for safety and emergency response shall be maintained, as follows:

- fire extinguisher
- first aid kit
- eye wash station (wash bottles at a minimum)
- extra copy of the HASP

These will be located in the field vehicle of the on-Site Project Supervisor and/or the Health & Safety Coordinator.

10.10. Review Procedures

The plan will be reviewed to ensure its applicability for the planned day's operations.

11. Special Precautions and Procedures

11.1. General

This investigation poses potential exposure to chemical and physical hazards. The chemical risks have been explained in detail in the previous sections. The potential for chemical exposure to hazardous substances will be significantly reduced through the use of air monitoring, personal protective clothing, engineering controls, and implementation of safe work practices.

11.2. Construction Materials and Site Refuse

Construction materials and Site refuse will be contained in appropriate areas or facilities. Site personnel should make certain that cement, drill cuttings, etc. are not scattered throughout the area of activity and that trash and scrap materials are immediately and properly disposed of.

11.3. Additional Safety Practices

The following are important safety precautions that will be enforced during this investigation:

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases that probability of hand-to-mouth transfer and ingestion of material is prohibited in the exclusion and decontamination zones.

2. Smoking in exclusion and decontamination zones is prohibited.

3. Hands and face must be thoroughly washed upon leaving the exclusion and decontamination zones and before eating, drinking, or any other activity.

4. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

5. No jewelry except medical alert IDs may be worn. Watches should be carried in a pocket. This requirement may be modified at the discretion of the Health & Safety Coordinator.

6. Medicine and alcohol can mask the effect from exposure to certain compounds. Controlled substances and alcoholic beverages must not be consumed by personnel involved in the project. Consumption of prescribed drugs must be at the direction of a physician familiar with the person's work.

7. Unsafe equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag.

8. In any unknown situation, always assume the worst and act accordingly.

11.4. Daily Log Contents

The Project Manager and the Health & Safety Coordinator will establish a system appropriate to the Site, the work and the work zones that will record, as a minimum, the following information:

1. Work zones,
2. Air monitoring equipment calibrations,
3. Personnel on site,
4. Health and Safety status reports.

References

GeoServices, Ltd. 1992. *Characterization of Soil and Groundwater Quality at the Alliance Metal Stamping and Fabricating Property.* Gates, New York.

GeoServices, Ltd. 1994. *Report of June 1993 Site Testing and May 1994 Site Remediation Work.*

Golder Associates Inc. 2000. *Supplemental Subsurface Investigation, Risk Assessment, Natural Attenuation Evaluation, and Soil Remediation*. Rochester*, New York*.

Golder Associates Inc. 2000. *Groundwater Investigation*. Rochester*, New York*.

Table 1. ***Potential Site Compounds and Associated Exposure Information.***

Contaminants	OSHA PEL	ACGIH TLV	Characteristics	Route of Exposure	Symptoms of Overexposure *	Target Organs
1,1,1-Trichloroethane	350 ppm	None Listed				eyes, skin, liver, CNS, CVS
Tetrachloroethene	100 ppm	25 ppm	Colorless liquid with a sweet, chloroform-like odor	inhalation, ingestion, contact		eyes, skin, respiratory system, liver, kidneys, CNS
Trichloroethene	100 ppm	50 ppm	Colorless liquid (unless dyed blue) with a chloroform-like odor	inhalation, ingestion, adsorption, contact		eyes, skin, respiratory system, heart, liver, CNS
1,2-Dichloroethene	200 ppm	none	Colorless liquid with a slightly acrid chloroform-like odor	inhalation, ingestion, contact		eyes, respiratory system, CNS
1,1-Dichloroethene	none	5 ppm				eyes, skin, respiratory system, liver, kidneys, CNS
p-Dichlorobenzene	75 ppm	10 ppm	White crystals or flakes, aromatic mothball odor	inhalation, ingestion, eye irritation	1, 2, 3, 4	lung, liver, kidney, eyes
Toluene	200 ppm	50 ppm	Colorless liquid, aromatic odor	inhalation, ingestion, adsorption, contact	1,2,3,6	eyes, skin, respiratory system, liver, kidneys, CNS
Methyl Ethyl Ketone	200 ppm	200 ppm				skin, respiratory system, CNS
Xylene	100 ppm	100 ppm	Colorless liquid, mild sweet odor	inhilation, ingestion, contact	1,2,3,4,5	eyes, skin, respiratory system, kidneys, liver, CNS, gastrointestinal tract, blood
Acetone	1000 ppm	500 ppm	Colorless liquid with a fragrant mint-like odor	inhilation, ingestion, contact		eyes, skin, respiratory system, CNS
Hydrofluoric Acid	3 ppm	3 ppm				eyes, skin, respiratory system, CNS
Hydrochloric Acid	5 ppm	2 ppm				eyes, skin, respiratory system
Chromium	1 mg/m^3	0.05 mg/m^3				eyes, skin, respiratory system
Mercury	0.1mg/m^3 (vapor)	0.01mg/m^3 (skin)				eyes, skin, respiratory system
Lead	0.05 mg/m^3	0.15 mg/m^3				gastrointestinal tract, CNS, kidneys, blood, gingival tissue
Nickel	1 mg/m^3	0.5 mg/m^3				nasal cavities, lungs, skin
Silver	0.01 mg/m^3	0.01 mg/m^3				nasal spectum, skin, eyes

NOTES:

PEL – Permissible exposure limits (OSHA) – 8 hour exposure

PELs were obtained from 29 CFR 1910 Subpart Z Tables Z-1 and Z-2 (last revised June 30, 1993), except for benzene which was obtained from 29 CFR 1910.1028.

TLV – Threshold limit value (ACGIH) – 8 hour exposure

TLVs were obtained from the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Physical Agents (2003)

Symptoms of Overexposure:
*Symptoms may include any or all listed depending upon concentration, duration and route of exposure
1) Eye, nose, throat, skin irritation or burns
2) Headache, fatigue, nausea
3) Lightheaded, some nausea, dull visual and audio response
4) CNS disorder, convulsions, sweating
5) CVS disorder
6) Potential or known carcinogens

Table 2. ***Health and Safety Hazards*****.**

Hazard	Description	Location	Procedure Used to Monitor/Reduce the Hazard
Heavy equipment/construction activity	Drill rigs, machinery, backhoes	Throughout site	Personnel maintain eye contact with operators; hard hats, safety shoes and eye protection worn during equipment operation.
Overhead/underground utilities	Electrical, sewer, gas, water	To be determined	Locate existing utilities prior to site operations. Design installation of additional utilities so that they do not interfere with site operations.
Heat producing / electrical equipment	Generators / drill rigs	Throughout site	Operate equipment away from vegetation and other materials that may ignite. Maintain fire-fighting equipment in the vicinity of operating equipment.
Heat / cold stress	Personnel working under extreme temperature are subject to adverse temperature related effects	Throughout site	Employ buddy system. Each worker is responsible for visually monitoring his/her partner for signs of heat / cold stress. Site safety personnel will also monitor worker's conditions and establish work/rest regimens and recommend appropriate diet.
Chemical exposure	Personnel can be exposed to various compounds associated with the site	Throughout site	Follow guidelines in Safety Plan. Be familiar with signs and symptoms of exposure and first aid procedures. Report suspected over-exposure to supervisor immediately.
Elevated noise	Operating heavy equipment and generators	Throughout site	Wear hearing protection. Avoid exposure.

Table 3. Action Levels

Benzene Not Present - Unknown Organic Vapor Concentrations	Level of personal protection
< 5 ppm	Level D and Modified Level D.
5 to 50 ppm	Level C clothing with fullface respirator and cartridges appropriate for organic vapors, dust, mists, and acid gases; engineering controls to decrease vapor levels.
>50 ppm	Cessation of Site activities until engineering controls are implemented to decrease vapor levels.

NOTE – Full Face respirators with qualitative fit testing are limited to a protection factor (PF) of 10 per 29CFR1910.134. Full face respirators with quantitative fit testing may be assigned the full OSHA PF of 50.

Table 4. ***Air Monitoring***

Task	Environmental Monitoring for Personal Protection
Ground water sampling	PID
Subsurface investigations	PID
Deep well installation	PID, Explosive gases meter
Water level measurement	PID
Air sampling	PID, DusTrac air particulate monitor and Draeger tube quantification, if necessary

Note: Monitoring results will be recorded in a field log book.

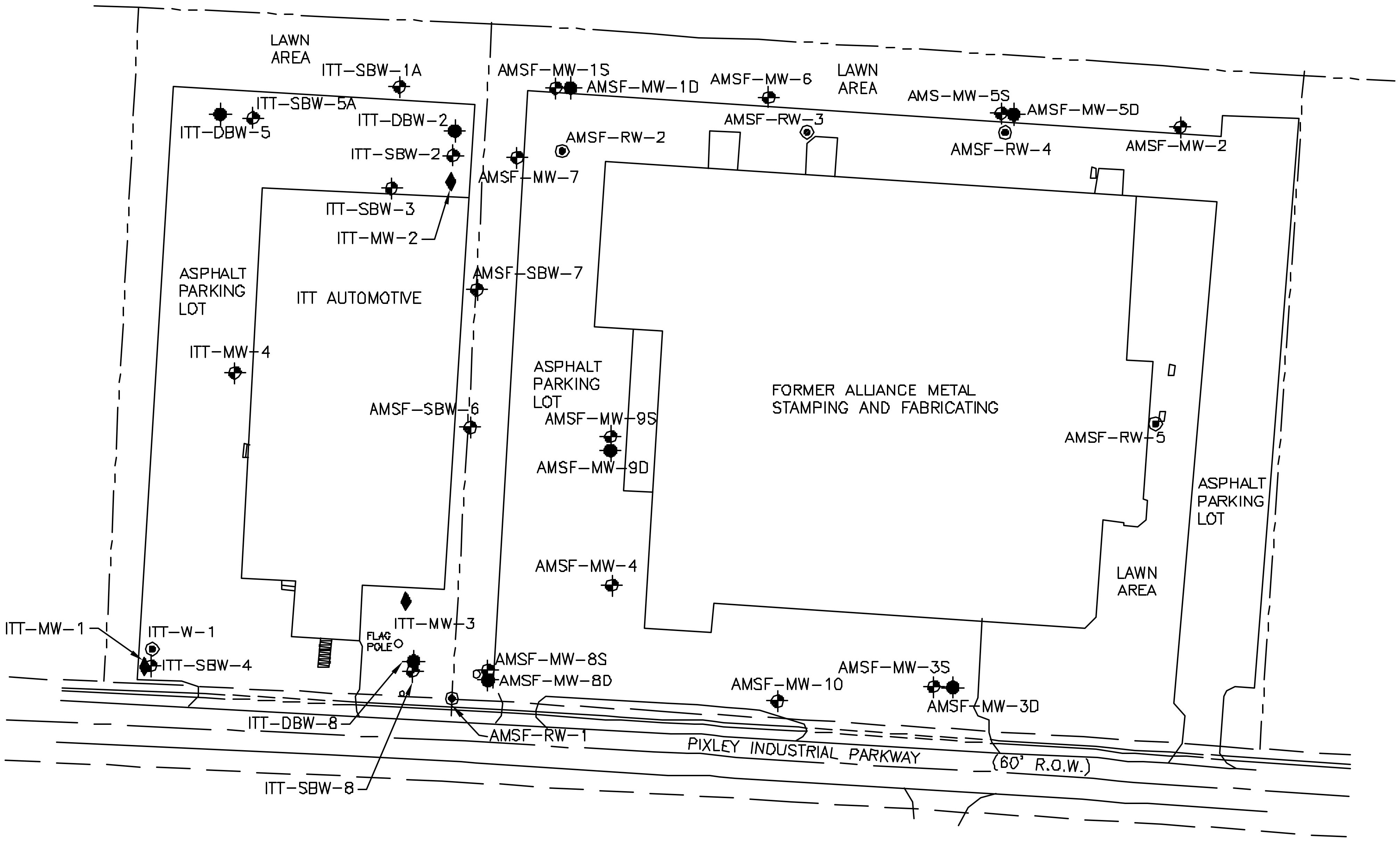
Table 5. ***Emergency Response Telephone Numbers.***

Agency	**Address**	**Telephone Number**
Fire Department	NA	911
Police	NA	911
ITT	Bennett A. Leff – Motion and Flow Control. ITT Industries 10 Mountain View Road Upper Saddle River, NJ 07458	201- 760-5768
Ambulance	NA	911
Strong Memorial Hospital	601 Elmwood Avenue Rochester, New York	716-275-2100 or 911
FF Thompson	350 Parish Street Canandaigua, New York	716-396-6000 or 911
New York State Department of Environmental Conservation	6274 East Avon-Lima Road Avon, New York	716-226-2466
New York State Department of Health	Bevier Building 42 South Washington Street Rochester, New York 14608	716-274-8071
O'Brien & Gere Engineers, Inc.	5000 Brittonfield Pkwy East Syracuse, NY 13057	315-420-0554 (Ed Wilson – cell) 315-437-6100 (Ed Wilson – office) 315-437-6100 (Guy Swenson – office)

DWG PATH: I:\DIV71\PROJECTS\4655\31777\DWG\043.DWG SF-100

PLOT DATE: 10/30/03

FIGURE 1



NOTE:

FIGURE BASED ON NYSDEC DECEMBER 2001 FIGURE 3

LEGEND

⊕ SHALLOW BEDROCK MONITORING WELL

● DEEP BEDROCK MONITORING WELL

◎ RECHARGE WELL

◆ OVERBURDEN MONITORING WELL

- - - - PROPERTY LINE

— — — CENTER OF ROADWAY

ITT AUTOMOTIVE INC.
TOWN OF GATES, NEW YORK
SITE #8-28-112

SITE PLAN

100 0 100

FILE NO. 4655.31777.043
OCTOBER 2003

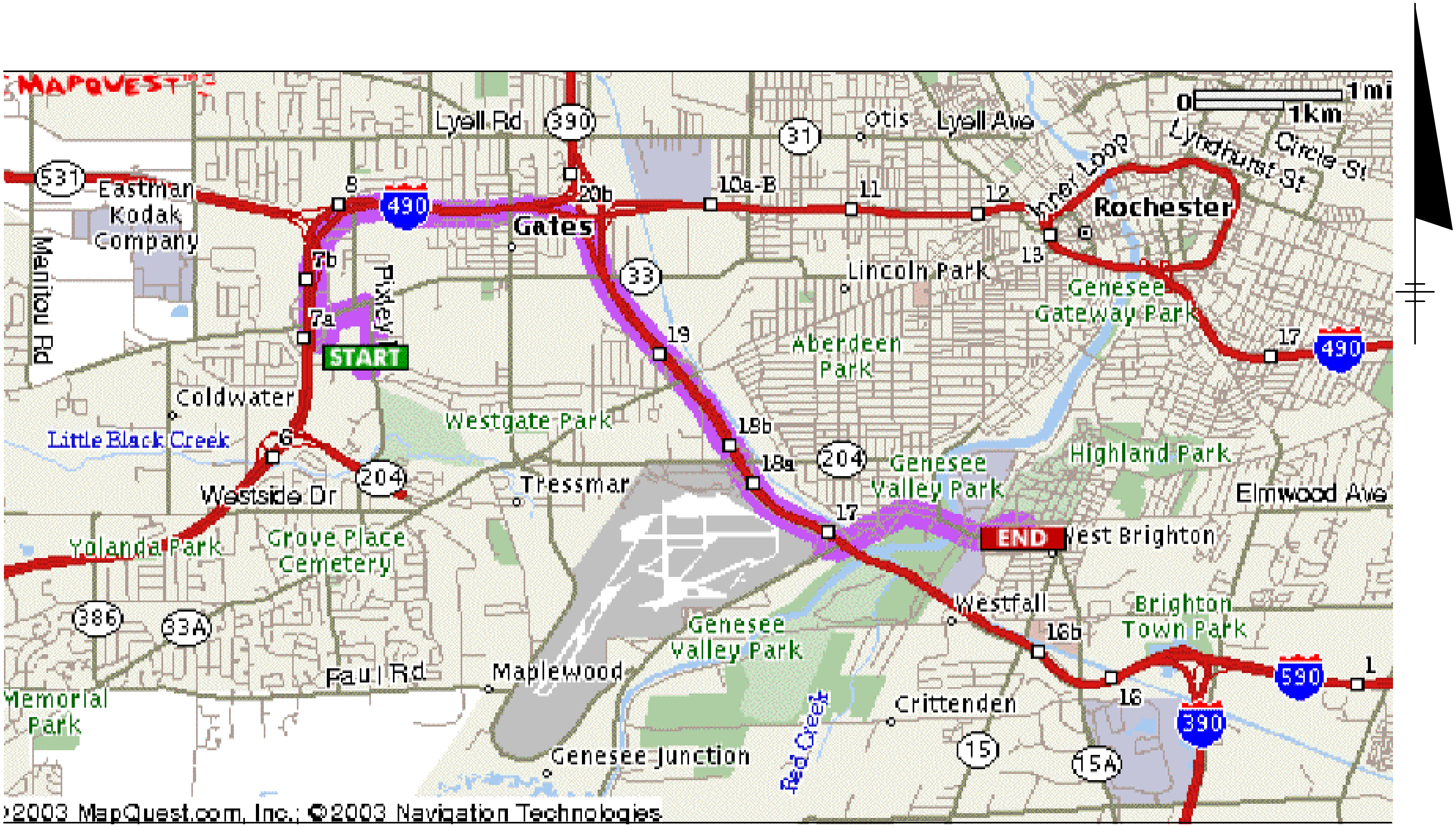
O'BRIEN & GERE
ENGINEERS INC.

PLOT DATE: 10/30/03

PATH: I:\DIV71\PROJECTS\4655\31777\DWGS\042.DWG

FILE NO. 4655.31777.042

OCTOBER 2003



O'BRIEN & GERE ENGINEERS INC.

ITT AUTOMOTIVE INC.
TOWN OF GATES, NEW YORK
SITE #8-28-112

HOSPITAL EVACUATION ROUTE MAP

FIGURE 2

EXHIBIT 1

SUBCONTRACTOR OCCUPATIONAL SAFETY AND HEALTH CERTIFICATION

PROJECT: ______________________________

SUBCONTRACTOR: ______________________________

1. Contractor certifies that the following personnel to be employed during the Site Investigation (ITT and AMSF) have met the following requirements of the OSHA Hazardous Waste Operations Standard (29 CFR 1910.120) and other applicable OSHA standards, as required by O'Brien & Gere Engineers, Inc.

Subcontractor Personnel	Training	Respirator Certification	Medical Exam

2. Subcontractor certifies that it has received a copy of the Site Safety and Health Plan and will ensure that its employees are informed and will comply with its requirements.

3. Subcontractor further certifies that it has read and understands and will comply with all provisions of its contractual agreement.

REPORT

Quality Assurance Project Plan Remedial Investigation/Feasibility Study
ITT Automotive, Inc.
Town of Gates, New York

(Site #8-28-112)
ITT Automotive, Inc.

May 2004

4655/31777

REPORT

Quality Assurance Project Plan – Remedial Investigation/Feasibility Study
ITT Automotive, Inc.
Town of Gates, New York
(Site #8-28-112)

ITT Automotive, Inc.

Steven J. Roland

Steven J. Roland, P.E.
Executive Vice President

May 2004

O'BRIEN & GERE
ENGINEERS, INC.

Contents

List of Tables

List of Exhibits

Distribution List

Bennett Leff – ITT Industries
Project Manager

Guy Swenson - O'Brien & Gere Engineers, Inc. (O'Brien & Gere)
Project Manager

Yuri Veliz - O'Brien & Gere Engineers, Inc. (O'Brien & Gere)
Site Supervisor

Monika Santucci – O'Brien & Gere Laboratories, Inc.
Laboratory QC Coordinator

Mike Challis – PSC Analytical Services
Laboratory QC Coordinator

List of Acronyms/Abbreviations

%D	Percent difference
%R	Percent recovery
ACS	American Chemical Society
APHA	American Public Health Association
ASP	Analytical Services Protocol
AWWA	American Water Works Association
BFB	Bromofluorobenzene
CLP	Contract laboratory program
DFTPP	DecafluorotriphenylphosphineDQO Data quality objective
DSR	Duplicate sample result
GC/MS	Gas chromatograph/mass spectrometer
ICAP	Inductively coupled plasma
ICSAB	Interference check sample
IDL	Instrument detection limit
LCS	Laboratory control sample
MDL	Method detection limit
MS	Matrix spike
MS/MSD	Matrix spike/matrix spike duplicate
MSD	Matrix spike duplicate
NYSDEC	New York State Department of Environmental Conservation
NIST	National Institute of Standards and Technology
OSR	Original sample result
PID	Photoionization detector
PFK	Perfluorokerosene
PM	Project Manager
ppb	Parts per billion
PQL	Practical quantitation limit
QA/QC	Quality assurance/quality control
QAM	Quality assurance management
QAO	Quality assurance officer
QAPP	Quality assurance project plan
RI/FS	Remedial Investigation / Feasibility Study
RPD	Relative percent difference
RRFs	Relative response factors
RSD	Relative standard deviation
SDG	Sample delivery group
SOP	Standard operating procedure
SOW	Statement of work
SR	Sample result
SVOC	Semivolatile organic compounds
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
WPCF	Water Pollution Control Federation

1. Introduction

1.1. General

This Quality Assurance Project Plan (QAPP) has been developed by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) for ITT Automotive, Inc. (ITT) as part of the O'Brien & Gere Remedial Investigation/Feasibility Study (RI/FS) Work Plan (O'Brien & Gere 2003). It provides quality assurance/quality control (QA/QC) criteria for work efforts associated with the sampling of environmental media as part of the RI/FS at the ITT site (Site #8-28-112) located at 130 Pixley Industrial Parkway in the Town of Gates, New York. The adjacent former Alliance Metal Stamping and Fabricating (AMSF) property is presently considered an off-site property for purposes of the RI/FS, however due to the distribution of constituents of concern the combined ITT and AMSF properties are included in this QAPP. The RI/FS is being performed pursuant to the Order on Consent (B8-0614-02-05) between the New York State Department of Environmental Conservation (NYSDEC) and ITT Automotive, Inc. dated August 28, 2003 (Consent Order).

The RI/FS will be conducted in accordance with the Field Sampling Plan (FSP), which is provided in Section 4.4 of the RI/FS Work Plan.

This QAPP provides QA/QC criteria for work efforts associated with sampling and analysis of environmental media.

This document has been prepared utilizing the guidance and format provided in the following document:

- United States Environmental Protection Agency (USEPA), *EPA Requirements For Quality Assurance Project Plans For Environmental Data Operations,* EPA QA/R-5 (USEPA 2001a).

This QAPP will assist in generating data of a known and acceptable level of precision and accuracy. The QAPP provides information regarding the project description and personnel responsibilities, and sets forth specific procedures to be used during sampling of relevant environmental matrices, other field activities, and the analyses of data. The procedures in this QAPP will be followed by personal participating in the field investigation and in the laboratory analyses of environmental samples.

The following quality assurance topics are addressed in this QAPP:

- Project organization and responsibilities
- Project background and definition
- Project description and schedule
- Data quality objectives and criteria
- Special training requirements
- Documentation
- Sampling design
- Sampling method requirements
- Sample handling and custody
- Analytical method requirements
- Quality control requirements
- Instrumentation/equipment testing and maintenance
- Calibration and frequency
- Inspection requirements for supplies
- Data acquisition requirements
- Data management
- Assessments and response actions
- QA reports to management
- Data review, validation, verification, and management
- Data validation and usability
- Reconciliation with user requirements

2. Project Organization and Responsibility

2.1. Project organization

While each person involved in the investigation and in the generation of data is implicitly part of the QA program for the project, certain individuals have specifically designated responsibilities. These are the Project Officer, Project Manager, Site Superintendent, Technical Coordinator, Quality Assurance Officer, Data Validator, and sampling personnel. The O'Brien & Gere project organization for the RI/FS is presented below. O'Brien & Gere Laboratories, Inc. (O'Brien & Gere Labs) of Syracuse, New York, and PSC Analytical Services of Ontario, Canada will provide analytical services for the samples. Laboratory personnel with QA/QC responsibilities include the Laboratory Quality Assurance Coordinator and Laboratory Sample Custodian. Table 2-1 contains the primary contacts for the project.

2.2. Project officer

Steven J. Roland, P.E. will serve at the Project Officer for the RI/FS. As Project Officer, he is responsible for the overall corporate management of the investigation and for the completion of work specified in the RI/FS Work Plan. It will be his responsibility to provide for the allocation of staff and other resources required to complete the project within the specified schedule and budget.

2.3. Project manager

Guy A. Swenson, C.P.G., of O'Brien & Gere, will serve as the Project Manager. As such, he will have responsibility for the implementation and completion of the work associated with this Site. He will manage the administrative aspects of the project, and will report to the Project Officer. The Project Manager will also distribute the current approved version of the QAPP to the laboratories, the Site Superintendent, and the Quality Assurance Officer.

2.4. Site superintendent

Yuri Veliz, of O'Brien & Gere, will serve as the Site Superintendent. As such, he will function as the firm's principal client and regulatory contact at the Site during the field elements of this project. The Site Superintendent will report to the Project Manager.

2.5. Technical coordinator

Guy A. Swenson, C.P.G., will also serve as the Technical Coordinator. As such, he will have responsibility for the technical aspects of the project and will report to the Project Officer.

2.6. Quality assurance officer

Karen A. Storne, of O'Brien & Gere, will serve as the QA Officer (QAO). As such, she will be responsible for overall project QA. She will review project plans and revisions to such plans to maintain proper QA throughout the investigation. In addition, the QAO, or her designee, will be responsible for performance and system audits, data processing activities, data processing QC, data quality review, corrective actions, and coordinating the QA/QC efforts between O'Brien & Gere Engineers and the laboratory. The QAO will report to the Project Manager.

2.7. Data validator

O'Brien & Gere data validators will be responsible for reviewing and validating laboratory analytical data. Validation reports will be submitted to the QAO for review. The QAO will have overall responsibility for data validation, and the data validators will report to the QAO.

2.8. Sampling personnel

Sampling tasks required by this investigation will be conducted by experienced chemists, engineers, geologists, hydrogeologists and/or environmental technicians. Their responsibilities will include the documentation of the proper sample collection protocols, sample collection, field measurements, equipment decontamination and chain of custody documentation. The sampling personnel will report to the Site Superintendent.

2.9. Laboratory QA coordination

Monika Santucci, of O'Brien & Gere Laboratories, Inc., and Mike Challis, of PSC Analytical Services will serve as the Laboratory QC Coordinators. The Laboratory QC Coordinator will be responsible for the individual laboratory's QA/QC activities associated with the project. The specific duties of the Laboratory QC Coordinator include determining whether analyses are conducted within the appropriate holding times and that laboratory custody procedures are followed. Moreover, the Laboratory QC Coordinator monitors daily precision and accuracy records, maintains detailed copies of all procedures, reschedules analyses based upon unacceptable data accuracy or precision, and identifies and implements corrective actions necessary to maintain QA standards. The Laboratory QC Coordinator or their designee will conduct initial validations and assessments of analytical data results and report the findings directly to the QAO.

2.10. Laboratory sample custodian

Heather Scott, of O’Brien & Gere Laboratories, Inc., and Kelly Carcuro, of PSC Analytical Services will serve as the Laboratory Sample Custodians. The Laboratory Sample Custodian responsibilities include verifying proper sample entry and sample handling procedures by laboratory personnel. The laboratory sample custodian will report to the Laboratory QC Coordinator.

3. Project Background and Definition

3.1. Site history and description

The project description and Site history are presented in the RI/FS Work Plan. Specific project objectives for this phase of the data gathering process are also presented in the RI/FS Work Plan and the individual tasks of this project are presented in the FSP (Section 4.4 of the RI/FS Work Plan).

3.2. Scope of work

The project scope is presented in the RI/FS Work Plan. Specific project objectives for this phase of the data gathering process are also presented in the RI/FS Work Plan and the individual tasks of this project are presented in the FSP (Section 4.4 of the RI/FS Work Plan).

4. Project Description and Schedule

4.1. Project description

The RI/FS will include the collection of soil samples, ground water samples and soil gas samples at the Site. The RI/FS will collect data sufficient to support the FS and determine a remedial alternative.

Field analyses for volatile organic compounds (VOCs) for soil will be conducted using a photoionizing detector (PID). Field analyses for pH, temperature, and conductivity for ground water will be conducted.

Samples to be collected during the RI/FS and the associated analysis to be performed are presented in Table 5-3.

The sample locations are presented in the FSP of the RI/FS Work Plan. The sample custody requirements are presented in Section 10 of this QAPP.

The environmental samples will be submitted to O'Brien & Gere Laboratories, Inc. (O'Brien & Gere Labs) for analysis of VOCs and 1,4-dioxanein ground water and VOCs, SVOCs (including 1,4-dioxane), metals, and cyanide in soil samples. Environmental air samples will be submitted to PSC Analytical Services for analysis of VOCs.

The analytical methods to be used in this investigation are listed in Table 5-2. Analyses will meet the requirements listed in the analytical methods listed in Table 5-2, the quality control requirements and corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4 and additional requirements listed in this QAPP. The most recent laboratory control limits will be used to evaluate the sample data.

The laboratory will report non-detected sample results to the practical quantitation limits (PQLs). Results that are less than the PQLs but greater that the method detection limits (MDLs), will be reported by the laboratory using the "J" flag. The laboratory-generated MDLs, which are applicable at the time of analysis, will be provided by the laboratory along with the sample results. The PQLs listed in Tables 5-4, 5-5, 5-6, 5-7, 5-8 and 5-9, or the most recent detection limits, will be reported by the laboratory. These tables also present the applicable screening criteria that will be used to evaluate analytical data for the RI/FS.

In the case of matrix interference, the laboratory will perform sample cleanup as provided by the methods. Interferences will be identified and documented. Samples may be diluted only if analytes of concern generate responses in excess of the linear range of the instrument. When matrix interferences are present, samples will be cleaned up during the extraction processes from appropriate methods. The clean-up, extraction and sample preparation methods will be listed in the data package case narrative. If the laboratory has taken appropriate actions and matrix interferences prevent the laboratory from achieving the specified detection limits, the Project Manager will be contacted as soon as the situation is identified. The Laboratory QC Coordinator will document in the data package case narrative how the laboratory demonstrated good analytical practices in order to attempt to achieve the specified reporting detection limits.

Communications with the QAO or the Project Manager will be documented by the laboratory in the data packages.

The data results will be reported to O'Brien & Gere in NYSDEC Analytical Services Protocol (ASP) Category B deliverable format, including the forms described in the NYSDEC guidance, in both hardcopy and electronic data format.

Data validation will be performed on the data from the samples collected for the RI/FS. Current USEPA data validation guidance documents and professional judgment will be used as guidance by the data validators to evaluate the analytical data. Upon request by the data validator, the laboratory will provide additional or supplemental information within 3 working days of the request. NYSDEC Data Usability Summary Report (DUSR) guidance will be utilized.

At the discretion of the Project Manager, one field audit and one laboratory audit for each laboratory will be performed during the investigation. Additional audits may be required if issues that would severely limit the use of the sample data are identified during the investigation, and will be performed at the discretion of the Project Manager. Corrective action procedures will be implemented based on unacceptable audit results, as defined herein.

Data usability with respect to the data quality objectives and data uses will be compared to the project requirements. In the event that the completeness objective of 90% is not achieved, samples will be recollected at the discretion of the O'Brien & Gere Project Manager.

The laboratories will provide two copies of the data packages within 30 days from the receipt of the last sample at the laboratory. The field logs, data packages, and records will be included in the O'Brien & Gere project file. The project files will be archived by O'Brien & Gere for a period of 10 years.

4.2. Project schedule

The project schedule is presented in the RI/FS Work Plan.

5. Data Quality Objectives and Criteria

Data quality objectives (DQOs) are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision making process. DQOs define the total acceptable uncertainty in the data for each specific activity conducted during the RI/FS. The uncertainty includes both sampling error and analytical error. Ideally, zero uncertainty is the intent. However, the variables associated with the process (field and laboratory) inherently contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data. The QA/QC requirements have been established such that there will be a high degree of confidence in the measurements.

The principal DQOs of this investigation include the following:

- Collect the data necessary to determine the nature and extent of Site-related VOCs, SVOCs, metals, cyanide, and 1,4-dioxane.

- Collect the data necessary to determine the potential residual migration pathways for VOCs, SVOCs, metals, cyanide, and 1,4-dioxane and the potential exposure to VOCs and 1,4-dioxane by human receptors.

- Collect data necessary for identification of remedial action objectives and to support the Feasibility Study.

- Select a remedial alternative that provides protection to human health and the environment, complies to extent practicable with applicable standards, criteria and guidance (SCGs), and reduces the mobility and/or toxicity of Site-related VOCs, SVOCs, metals, cyanide, and 1,4-dioxane.

In order to achieve these DQOs, the process of data generation was designed to develop a body of analytical data of sufficient quality to be used to support conclusions made as a result of this investigation. Specific data quality requirements such as criteria for precision, accuracy, representativeness, completeness, comparability, and sensitivity are specified in this document.

Analytical levels as defined in USEPA guidance are as follows:

Screening Data: Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data provide analyte identification and quantitation, although the quantitation may be relatively imprecise. At least 10% of the screening data should be confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not considered to be data of known quality. For this investigation, the field measurements include temperature, specific conductance, pH, and VOCs.

Definitive Data: Definitive data are generated using rigorous analytical methods, such as ASP/CLP methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined. The level of QC that will be performed for the definitive data involves the QC efforts described in Section 12, the calibration procedures described in Section 14, the analytical methods listed in Table 5-2, the quality control requirements and corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4 and the most recent laboratory control limits.

Table 5-1 contains sampling efforts, objectives, analyses, data uses, and analytical levels.

In order to assess adherence to DQOs, O'Brien & Gere has developed the QA/QC program described in this QAPP. The remainder of this QAPP describes the specific approaches that will be taken to achieve the required DQOs.

Precision describes the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements that have been made in an identical manner, compared to their average value. Precision can be expressed in a variety of manners, including absolute methods such as deviation from the mean or median values, standard deviation and variance, or relative methods, such as relative deviation from the mean or median. The overall precision will be determined through the analysis of field duplicate, laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples.

Accuracy is defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement is. Accuracy is expressed in terms of absolute or relative error. Accuracy will be determined through analysis of spiked samples and the analysis of standards with known concentrations.

Representativeness refers to the degree to which a sample taken from a site accurately reflects the matrix at the site. It is a qualitative parameter that is most concerned with the design of the sampling program. Factors that should be considered in the determination of representativeness include appropriateness of sampling and analytical methodologies, representativeness of the selected media, and representativeness of the selected analytical procedures. Representativeness will be achieved by the use of procedures for the collection and preservation of samples as described in the RI/FS Work Plan and the methods in this QAPP.

Comparability refers to the use of consistent procedures, second source reference standards, reporting units, and standardized data format with document control. Adherence to standard procedures and the analysis of external source standard materials maximizes the probability that data generated from a particular method at a given laboratory can be validly compared to the data of another. This QAPP has been written to provide data that will be comparable to other data collected, as standard methods will be utilized for this investigation.

Completeness refers to the process of obtaining the required data as outlined in the RI/FS Work Plan. Completeness is also defined as the percentage of measurements judged to be useable. Samples for which the critical data points fail completeness objectives will require reanalysis of samples (within the specified holding times) until the DQOs are met. The completeness goal has been specified at 90% for this investigation.

Sensitivity refers to a measurable concentration of an analyte that has an acceptable level of confidence. Method detection limits (MDLs) are the lowest concentration of an analyte that can be measured with 99% confidence that the analyte concentration is greater than zero. Practical Quantitation Limits (PQLs) are levels above the MDLs at which the laboratory has demonstrated the quantitation of analytes. The laboratory-generated MDLs, which are applicable at the time of analysis, will be provided by the laboratory along with the sample results. The PQLs listed in Tables 5-4, 5-5, 5-6, 5-7, 5-8, and 5-9 or the most recent detection limits, will be reported by the laboratory. These tables also present the applicable screening criteria including NYSDEC water and soil standards that will be used to evaluate analytical data for the RI/FS.

5.2. Field sampling

The objective of field sampling procedures is to obtain samples that represent the environmental matrix being investigated. This will be accomplished using proper sampling techniques and equipment as presented in the RI/FS Work Plan.

Certain field investigation activities do not require sample collection, but nonetheless involve measurements for which QA concerns are appropriate. Such activities include measurement of pH, temperature, specific conductance and VOCs. The primary QA objective of these activities is to obtain reproducible measurements to a degree of accuracy consistent with the intended use of the measurements and to document measurement procedures.

5.3. Laboratory analyses

To obtain data of a quality sufficient to meet the applicable project DQOs, the following methods will be performed:

- VOCs analysis by gas chromatography/mass spectrometry (GC/MS)
- SVOCs analysis, including 1,4-dioxane, by GC/MS

- Metals analysis by inductively coupled plasma (ICP)

- Cyanide analysis by spectrophotometer

- Mercury analysis by cold vapor atomic absorption
-

The specific methods, analytical QA/QC and data reporting will adhere to the analytical methods listed in Table 5-2 as applicable to chemical analyses.

6. Special Training Requirements

As described in the Health and Safety Plan (HASP) developed for this RI/FS, field investigation personnel must comply with the training requirements for hazardous waste operations, codified in 29 CFR 1910.120(e). Each individual must have successfully completed a 40-hour (or 24-hour) course appropriate to the level of work that they perform. In addition, each individual must have completed an 8-hour refresher course within the last 12 months if the initial training was more than 12 months ago. Personnel acting in the capacity of an on-site supervisor, directly responsible for supervising employees engaged in hazardous waste operations, shall also have successfully completed an 8-hour Supervisor training course. Field investigation personnel must have documentation (copies of certificates, or I.D. cards) available on-site as proof of compliance with these training requirements.

7. Documentation

At the discretion of the Project Manager, this QAPP will be amended as necessary when guidelines and regulatory documents are revised or if Site requirements necessitate such changes. Whenever the QAPP is amended, the project personnel will receive the amended copy of the QAPP and outdated copies will be removed from circulation. A distribution list is provided in this document.

The analytical data generated for this project will be reported to O'Brien & Gere in NYSDEC ASP Category B deliverable format, including a comprehensive case narrative, which describes the following:

- A cross reference list which includes the field sample identification (ID) name, the laboratory ID number, and sampling dates for each sample in the sample delivery group (SDG) included in the data package;

- Documentation of the methodologies utilized to prepare and analyze the samples and references;

- Detailed documentation of QC, sample shipment, and analytical problems encountered in processing the samples for the data package;

- Documentation of re-analyses, internal QC processes used (for example, data provided in the data package but not used to generate sample results), corrective actions taken, and the resolution of the corrective actions taken; and

- Documentation of communications made with project personnel during the data generation process.

The laboratories will provide complete data packages within 30 days of receipt of the last sample in a sampling event at the laboratory. The field logs, data packages, and records will be included in the Engineer's project files. The project files will be archived by the Engineer for a period of 10 years.

8. Sampling Design

8.1. Objectives

The objective of the sampling program is to obtain environmental media of sufficient quality to support both qualitative and quantitative information as to the identity, location, and amount of contamination in the soil, soil gas, and ground water samples, as defined in the RI/FS Work Plan. Sampling procedures and practices that will be used in the RI/FS are presented in the FSP.

8.2. Sampling network

The types of parameters, methods, matrix, and numbers of samples to be collected for this project are presented in Table 5-3. The specific parameters for each method, and the PQLs are listed in Tables 5-4, 5-5, 5-6, 5-7, 5-8, and 5-9.

8.3. Sampling locations

Sampling locations for the RI/FS are described in the RI/FS Work Plan.

8.4. Sampling numbering system

A sample numbering system will be used to uniquely identify each sample collected during the investigation and to allow retrieval of sample specific information.

8.5. Sample matrices

Soil, ground water and soil gas will be sampled during this investigation.

9. Sampling Method Requirements

9.1. Sampling procedures

Protocols for the various sampling activities are described in the FSP provided in the RI/FS Work Plan.

9.2. Decontamination of sampling equipment

Protocols for the decontamination of sampling equipment are described in the FSP of the RI/FS Work Plan.

10. Sampling Handling and Custody

10.1. Sample custody and procedures

Chain-of-custody procedures will be instituted and followed throughout the RI/FS. Custody is one of several factors necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory activities, and final evidence files. Final evidence files, including laboratory reports and purge files, are maintained under document control in a secure area. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The Project Manager must be prepared to produce documentation that traces the samples from the field to the laboratory and through analyses.

The USEPA has defined custody of evidence as follows:

- In actual physical possession
- In view after being in physical possession
- In a locked laboratory
- In a secure, restricted area

10.2. Field custody procedures

The field sampler is personally responsible for the care and custody of the sample until transferred. In the field sampler's individual bound field notebook, samplers will note, with permanent ink, meteorological data, equipment employed for sample collection, calculations, information regarding collection of QA/QC samples, and any observations. All entries will be signed and dated, and any entry that is to be deleted shall use a single cross out, which is signed and dated. The following physical information will be recorded in the field notebook by the field sampling team:

- Sample number
- Project identification
- Sampling location
- Required analysis
- Date and time of sample collection
- Type and matrix of sample

- Sampling technique
- Preservation used if applicable
- Sampling conditions
- Observations
- Initials of the sampler

The following information will be recorded on the chain-of-custody by the field sampling team:

- Project identification and number
- Sample description/location
- Required analysis
- Date and time of sample collection
- Type and matrix of sample
- Number of sample containers
- Analysis requested/comments
- Sampler signature/date/time
- Air bill number (if shipped by a commercial carrier)

A completed sample tag (attached with adhesive) will be attached to each investigative or QC sample and the sample placed in a shipping container. Sample custody seals will be applied to coolers if samples are shipped by commercial carrier. The following will be recorded with permanent ink on sample labels and on chain-of-custody records by the field sampling team:

- Project name and number
- Sample number identification
- Initials of sampler
- Sampling location (if not already encoded in the sample number)
- Required analysis
- Date and time of sample collection
- Space for laboratory sample number (only on the sample tag)
- Preservative used, if applicable

Immediately after collection, samples will be transferred to properly labeled sample containers and properly preserved. Table 5-3 lists the proper sample containers, volume requirements, and preservations for samples.

The field sampling team will transport or ship by commercial carrier the coolers containing environmental samples to the laboratory. Samples will not be sent to another laboratory without the permission of the O'Brien & Gere Project Manager.

The laboratory will assign a number for each sample upon receipt. That sample number will be placed on the sample label. The sample label will remain attached to the sample container.

A chain-of-custody document providing all information, signatures, dates, and other information, as required on the chain-of-custody form

(Exhibit 1) will be completed by the field sampler and provided for each sample cooler. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody. The field sampler will sign the chain-of-custody record when relinquishing custody and make a copy to keep with the field logbook. If shipped by commercial carrier, the original form is placed in an air-tight plastic bag in the sample cooler with the associated samples.

Sampling containers will be packed with packing materials and put in plastic bags to help prevent breakage and cross-contamination. Samples will be shipped in coolers, each containing a chain-of-custody and ice and ice packs to maintain inside temperature at approximately 4°C. If shipped by commercial carrier, sample coolers will then be sealed between the lid and sides of the cooler with custody seals prior to shipment. The custody seals will consist of adhesive-backed tape that easily rips if it is disturbed. Samples will be shipped to the laboratory by common overnight carrier or will be hand delivered to the laboratory. Samples will be shipped or transported to arrive at the laboratory no later than 48 hours after sample collection. Prior to shipment of sample coolers, the field team leader will contact the laboratory to notify the laboratory of the sample shipments.

Samples will remain in the custody of the sampler until transfer of custody is completed. Transfer consists of:

- Delivery of samples to the laboratory sample custodian
- Signature of the laboratory sample custodian on the chain-of-custody document as receiving the samples and signature of sampler as relinquishing the samples.

If a carrier is used to take samples between the sampler and the laboratory, the air bill number must be written on the chain-of-custody.

If the cooler arrives at the laboratory after hours, an external chain-of-custody will be properly filled out and will accompany the cooler until the laboratory receives the cooler.

10.3. Laboratory custody procedures

Laboratory custody procedures begin when the samples are received by the laboratory. When the samples arrive at the laboratory, the sample custodian will sign the chain-of- custody. The sample custodian's duties and responsibilities upon sample receipt will be to:

- Document receipt of samples.

- Inspect sample shipping containers for the presence or absence of custody seals (only if shipped via overnight courier) and for container integrity.

- Check the cooler temperature and record on the chain-of-custody. If the cooler temperature is greater than 6°C, the Project Manager will be contacted.

- Sign and date the appropriate forms or documents, verify and record the agreement or disagreement of information on sample documents, and, if there are discrepancies, record the problem and notify the Laboratory Project Manager.

- Log sample information into the laboratory sample tracking system.

- Label sample with a unique, sequential laboratory sample number.

- Place samples in the walk-in cooler, or sample storage area that is a secure, limited-access storage. The samples collected for volatile analysis will be stored in a separate refrigerator.

At the laboratory, the analysts will be required to log samples and extracts in and out of storage as the analysis proceeds. Samples and extracts will be returned to secure storage at the close of business. Written records will be kept of each time the sample or extract changes hands. Care must be exercised to properly complete, date, and sign items needed to generate data.

The following procedures must be followed by the laboratory:

- Samples will be handled by the minimum number of people possible.

- The laboratory will set aside a secured sample storage area consisting of a clean, dry, refrigerated, isolated room, which is capable of being locked.

- A specific person will be designated sample custodian. Incoming samples must be received by the custodian who will indicate receipt by signing the chain-of-custody form.

- The custodian will ensure that samples which are heat-sensitive, light-sensitive, radioactive, or which require special handling in other ways, are properly stored and maintained prior to analysis.

- The analytical area will be restricted to authorized personnel only.

- After sample analyses are complete, the analytical data is to be kept secured and released to authorized personnel only.

If quality control samples have not been properly identified during sample collection, the Laboratory Project Manager will contact the

Project Manager to assign quality control samples prior to the start of sample analysis.

10.4. Final evidence file chain-of-custody procedures

The final evidence file will be the central repository for documents that constitute evidence relevant to sampling and analysis activities as described in this QAPP. O'Brien & Gere is the custodian of the evidence file and maintains the contents of evidence files for the Site, including relevant records, reported, logs, field notebooks, pictures, subcontractor reports, and data reviews.

Copies of the laboratory data packages will be stored by the laboratory for incorporation into the sample file; the Laboratory Project Manager will be responsible for final evidence documentation assembly.

Upon completion of the analyses, the Project Manager will begin assimilating the field and laboratory notes. In this way, the file for the samples will be generated. The final file for the sample will be stored at O'Brien & Gere and will consist of the following:

- Laboratory data packages, including summary and raw data from the analysis of environmental and QC samples, chromatograms, mass spectra, calibration data, work sheets, and sample preparation logs
- Chain-of-custody records
- Data validation reports

The following documentation will supplement the chain-of-custody records:

- Field notebooks and data
- Field collection report
- Pictures and drawings
- Progress and QA reports
- Contractor and subcontractor reports
- Correspondence

The evidence file must be maintained in a secured, limited access area until submittals for the project have been reviewed and approved, and for a minimum of ten years past the submittal date of the final report.

11. Analytical Method Requirements

11.1. Laboratory analytical methods

The analytical methods utilized in this project are presented in Table 5-2. Analyses will meet the requirements listed in the analytical methods listed in Table 5-2, the quality control requirements and corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4 and additional requirements listed in this QAPP. The most recent laboratory control limits will be used to evaluate the sample data. In the event of an analytical system failure, the Laboratory QC Coordinator will identify the situation and provide corrective action guidance. The Project Manager will be notified and the situation will be documented in the data package case narrative.

NYSDEC ASP methodology will be used as guidance by the laboratory during sample analysis.

The accuracy of the method will be evaluated by spiking the sample matrix with analytes and surrogates. Standards and reference materials will also be analyzed to determine analyte concentrations for comparison with expected concentrations to provide a measure of accuracy of the methods. Percent recoveries of the spikes will be calculated and compared to established control. A measure of precision will be obtained through the relative percent difference (RPD) between matrix spikes and matrix spike duplicates and laboratory duplicates. Sampling precision will be evaluated based on the RPD of duplicate field samples. RPDs will be compared to established control limits.

The generated data will be input into the laboratory database management system.

Complete descriptions of analytical procedures to be used in the laboratory are described in the methodologies, in the USEPA methods, and the laboratory Standard Operation Procedures (SOPs).

11.2. Method detection limits

The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. The PQL is the lowest concentration that can be reliably quantified within specified limits of precision and accuracy during routine laboratory operations. The lowest calibration standard will establish the PQLs that will be reported by the laboratory in the RI/FS.

The laboratory will report non-detected sample results to the PQLs. Results that are less than the PQLs but greater than MDLs or instrument detection limits (IDLs) will be reported by the laboratory using the “J” flag. The laboratory-generated MDLs, which are applicable at the time of analysis, will be provided by the laboratory along with the sample results. The PQLs listed in Tables 5-4, 5-5, 5-6, 5-7, 5-8 and 5-9 or the most recent detection limits, will be reported by the laboratory. These tables also present the applicable screening criteria including NYSDEC ground water standards and recommended soil cleanup objectives that will be used to evaluate analytical data for the RI/FS.

PQLs may only be achieved in an undiluted sample free of matrix interferences or of high concentrations of target analytes. If matrix interferences are encountered or if high concentrations of target compounds are present, established PQLs may not be achievable without impacting the instrument quality. The laboratory and QAO will discuss these situations before the laboratory proceeds with sample analysis. Samples may be diluted if analytes of concern generate responses in excess of the linear range of the instrument. When matrix interferences are present, samples will be cleaned up during the extraction processes using appropriate methods. The clean-up, extraction and sample preparation methods will be listed in the data package case narrative. If the laboratory has taken appropriate actions and matrix interferences prevent the laboratory from achieving the specified detection limits, the Project Manager will be contacted as soon as the situation is identified and the Laboratory QC Coordinator will document in the data package case narrative how the laboratory demonstrated good analytical practices in order to attempt to achieve the specified reporting detection limits.

12. Quality Control Requirements

The overall effectiveness of a quality control program depends upon operating in the field and laboratory according to a program that systematically ensures the precision and accuracy of analyses by detecting errors and preventing their recurrence or measuring the degree of error inherent in the methods applied. The following sections describe the QA/QC checks that will be utilized in the laboratory and the field during this project.

12.1. Laboratory QA/QC checks

Tables 12-1, 12-2, 12-3, and 12-4 summarize the laboratory quality control checks, frequency of analysis, control limits, and laboratory corrective actions for the analytical method used in this investigation. The following sections present a brief description of laboratory QA/QC analyses.

12.1.1. GC/MS tuning

Tuning and performance criteria are established to verify mass resolution, identification, and to some degree, instrument sensitivity. These criteria are not sample specific; conformance is determined using standard materials. Therefore, these criteria should be met in all circumstances.

12.1.2. Calibration

Compliance requirements for satisfactory instrument calibration are established to verify that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of analysis and continuing calibration and performance checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis. Section 14 of this QAPP describes the laboratory equipment calibration process.

12.1.3. Blanks

Several types of blanks will be analyzed by the laboratory. Corrective action procedures will be implemented for blank analyses if target compounds are detected at concentrations greater than the PQL. The criteria for evaluation of blanks apply to any blank associated with a group of samples. If problems with a blank exist, data associated with the project must be carefully evaluated to determine whether or not there is an inherent variability in the data for the project or if the problem is an isolated occurrence not affecting other data.

A reagent blank consists of laboratory analyte-free water and any reagents added to a sample during analysis only, or straight solvent. This type of sample is analyzed to evaluate whether contamination is occurring during the analysis of the sample. A reagent blank is usually analyzed following highly contaminated samples to assess the potential for cross-contamination during analysis.

A method blank is a water or soil blank that undergoes the preparation procedures applied to a sample. These samples are analyzed to examine whether sample preparation and analysis techniques result in sample contamination. The laboratory will prepare and analyze a method blank with each group of twenty samples of similar matrix that are prepared or analyzed at the same time.

Field/equipment blanks will also be collected and submitted for laboratory analysis, where appropriate. Field/equipment blanks will be handled in the same manner as environmental samples. Field/ equipment blanks are analyzed to assess contamination introduced during field sampling procedures.

Trip blanks will consist of samples of analyte-free water that have undergone shipment from the sampling site to the laboratory in coolers with the aqueous environmental samples to be analyzed for VOCs. Trip blanks will be analyzed for VOCs to determine if contamination has taken place during sample handling and/or shipment. Trip blanks will be utilized for aqueous samples at a frequency of one each per cooler sent to the laboratory for volatile organic analysis.

12.1.4. Internal standards performance

Internal standards, which are compounds not found in environmental samples, will be spiked into samples, blanks, MS/MSDs, and laboratory control samples (LCSs) at the time of sample preparation. Internal standards must meet retention time and performance criteria specified in the analytical method or the sample will be reanalyzed.

12.1.5. Surrogate recovery

Accuracy and matrix biases for individual samples are monitored for organic analyses using surrogate additions. Surrogates are compounds similar in nature to the target analytes that are spiked into environmental samples, blanks, and quality control samples prior to sample preparation for organic analyses. The evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the review and validation of data based on specific sample results is frequently subjective.

12.1.6. Laboratory control sample analyses

LCSs are standard solutions that consist of known concentrations of the complete list of target analytes spiked into laboratory analyte-free water or sand. They are prepared or purchased from a certified manufacturer from a source independent from the calibration standards to provide an independent verification of the calibration procedure. These QC samples are then prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects. The laboratory will prepare and analyze a LCS with each group of a minimum of twenty samples of similar matrix that are extracted, digested, or analyzed at the same time. Percentage recoveries will be evaluated to assess the efficiency of the preparation and analysis method independent of environmental sample matrix effects.

12.1.7. MS/MSD or laboratory duplicate samples

MS/MSD or laboratory duplicate analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix. MS/MSD/laboratory duplicate samples will be prepared and analyzed within the same batch as the environmental samples. MS/MSD samples will be spiked at the laboratory with the complete list of target analytes listed in Tables 5-4, 5-5, 5-6, 5-7, 5-8, and 5-9. MS/MSD/laboratory duplicate data are generated to determine precision and accuracy of the analytical method with respect to sample matrices. Generally, the MS/MSD data alone are not used to evaluate the precision and accuracy for associated organic samples since data may reflect specific matrix effects only present within one sample.

12.1.8. Compound identification and quantitation

The objective of the qualitative criteria is to minimize the number of erroneous identifications of compounds. An erroneous identification can either be a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present). The identification criteria can be applied much more easily in detecting false positives than false negatives. Negatives, or non-detected compounds, on the other hand represent an absence of data and are, therefore, much more difficult to assess. The objective for quantitative requirements is to maximize the accuracy of data and sensitivity of the instrument. Samples should be analyzed undiluted to maximize sensitivity. Unless sample screening indicates the presence of high concentration target analytes, samples should be analyzed undiluted to maximize sensitivity. Samples must be reanalyzed at the appropriate dilution when concentrations exceed the linear calibration range to maximize accuracy.

In the case of matrix interference, the laboratory will perform sample cleanup as provided by the methods. Interferences will be identified and documented. Samples may be diluted only if analytes of concern generate responses in excess of the linear range of the instrument. When matrix interferences are present, samples will be cleaned up during the extraction processes using appropriate methods. The clean-up, extraction and sample preparation methods will be listed in the data package case narrative.

12.2. Corrective action

Generally, the following corrective actions may be taken by the laboratory. When calibration, instrument performance, and blank criteria are not met, the cause of the problem will be located and corrected. The analytical system will then be recalibrated. Sample analysis will not begin until calibration, instrument performance, and blank criteria are met. When matrix spike, reference standard, or duplicate analyses are out of control, samples analysis will cease. The problem will be investigated. Depending on the results of the overall QC program for the sample set, the data may be accepted, accepted with qualification, or determined to be unusable.

If, through the application of the corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4, the data is determined to be unusable, the QC analysis will be re-prepared and reanalyzed. If QC criteria are met upon reanalysis, only the new results are reported. If QC criteria are still not met upon reanalysis, both sets of sample results will be reported and the Project Manager will be notified of the situation at the time of sample analysis.

If matrix interferences are suspected, the Project Manager will be contacted. In the case of matrix interference, the laboratory will perform sample cleanup as provided by the methods. Interferences will be identified and documented. Samples may be diluted only if analytes of concern generate responses in excess of the linear range of the instrument, as determined through sample screening. When matrix interferences are present, samples will be cleaned up during the extraction processes using appropriate methods. The clean-up, extraction and sample preparation methods will be listed in the data package case narrative. If the laboratory has taken appropriate actions and matrix interferences prevent the laboratory from achieving the specified detection limits, the Project Manager will be contacted as soon as the situation is identified and the Laboratory QC Coordinator will document in the data package case narrative how the laboratory demonstrated good analytical practices in order to attempt to achieve the specified reporting detection limits.

In addition, the quality control requirements and corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4, that augment the method requirements, are to be followed by the laboratory during the RI/FS.

12.3. Control limits

Control limits are listed in the appropriate methods or are established separately for respective matrix types for surrogate, LCS, MS/MSD, and duplicate analyses. Control limits can be considered action limits. The laboratory-established limits are defined as ± three standard deviations of the mean and correspond to 99.7% confidence limits of a normal distribution curve. Unless previously established, the laboratory will establish control limits for each analyte of concern using a minimum of twenty data points. The control limits are updated by the laboratory on an annual basis. Therefore, the most recent control limits will be used to evaluate data for this RI/FS. The current control limits used to assess data for this program will be summarized by the laboratory in the analytical report.

12.4. Field sampling

Field sampling crews will always be under direct supervision of a field sampling leader. Bound log books and appropriate data sheets will be used to document the collection of samples and data so that an individual sample or data set can be traced back to its point of origin, sampler, and type of sampling equipment.

Sampling will be performed according to the methods provided in the RI/FS Work Plan.

Field sampling precision will be evaluated through the RPD of the duplicate sample analyses results. Control limits for field duplicate precision have been established at 50% for water samples and 100% for soil samples. Decontamination of sampling equipment will be verified through the analysis of equipment blanks. Proper chain-of-custody protocols, as presented in Section 10 of this QAPP, will be followed.

In order to evaluate data quality, QA/QC samples will be collected during the field investigation. Table 5-3 lists the environmental and corresponding QC samples to be collected by analyses and matrix type.

12.5. Field QA/QC checks

12.5.1. Field duplicate samples

Collection of field duplicate samples provides for the evaluation of the laboratory's performance by comparing analytical results of two samples from the same location. Field duplicate samples are also collected to evaluate field sample collection procedures. Field duplicate samples are duplicate samples collected from one location and sent to the laboratory blind (with two different sample identifications). One field duplicate sample will be collected for every 20 environmental samples (*i.e.*, minimum frequency of 5%) or one per matrix for less than 20 samples.
If less than twenty samples are collected, 1 field duplicate sample will be collected.

12.5.2. Matrix spike and matrix spike duplicates

For chemical analyses (MS/MSD samples are duplicate samples that have spiking solutions added. MS/MSD samples are considered identical to the original sample and require that the sampled material be homogenized in the field and laboratory prior to analysis. Due to the potential loss of volatile compounds during homogenization, samples collected for VOCs analyses will not be homogenized in the field. Since they will not be homogenized, field samplers must make every effort to collect representative samples of the location sampled for VOCs.

The percent recovery of the spiked amount indicates the accuracy of the analysis extraction as well as interferences caused by the matrix. RPDs between spike sample recoveries will indicate the precision of the data. One MS/MSD sample set will be collected for every 20 environmental samples submitted to the laboratory (*i.e.*, minimum frequency of 5%) or one MS/MSD for less than 20 samples.

12.5.3. Field/equipment blanks

Field/equipment blanks will consist of a sample of the analyte-free water that is used to rinse the decontaminated sampling equipment. One field/equipment blank will be collected per set of sampling equipment per sampling event. Field/equipment blanks will not be required if dedicated sampling equipment is used. The field/equipment samples will be subject to the same analyses as the environmental samples. One field blank will be collected for every 20 environmental samples submitted to the laboratory (*i.e.*, minimum frequency of 5%).

12.5.4. Trip blanks

Trip blanks will consist of samples of analyte-free water that have undergone shipment from the sampling site to the laboratory in coolers with the environmental samples to be analyzed for VOCs. Trip blanks will be analyzed for VOCs to determine if contamination has taken place during sample handling and/or shipment. Trip blanks will be utilized for VOC samples at a frequency of one each per cooler of environmental samples sent to the laboratory for VOCs analysis.

12.5.5 Temperature blanks

Temperature blanks will consist of vials of water that have undergone shipment from the sampling site to the laboratory in coolers with the environmental samples to be analyzed for the RI/FS. The temperature of these blanks will be measured at the laboratory upon receipt of the sample cooler to verify compliance with the cooler temperature requirement.

12.6. Data assessment procedures

The procedures employed by the laboratory to assess the quality of data generated in the laboratory include, but are not limited to, the following:

- Determination of analytical precision per method
- Determination of analytical accuracy per method
- Determination of analytical completeness
- Determination of MDLs and PQLs

Data quality reviews by analysts, supervisors, managers, laboratory directors, and QA personnel contribute to the total process.

Precision and accuracy may be assessed utilizing control charts. Control charts will consist of line graphs that provide a continuous graphic representation of the state of each analytical procedure. The standard deviation of the mean of the QC measurement is calculated and the upper and lower warning limits are set at plus or minus two standard deviation units. The upper and lower control limits are set at plus or minus three standard deviation units. Acceptable data are realized when results fall between the lower and upper warning limits. If the QC value falls between the control limit and the warning limit, the analysis should be scrutinized as possibly out of control.

In general, the accuracy of the methods will be determined by spiking the sample matrix with the analyte and by analyzing reference materials with known concentrations. The spiking levels will be selected to reflect the concentration range of interest. Percent recoveries of the spikes and reference materials will be calculated and compared to the established limits.

The precision of the methods will be determined by the analysis of matrix spike, laboratory replicate and field duplicate samples. The precision will be evaluated by calculating the RPD between the duplicates and replicates. RPD calculations will be compared to the established limits.

The definitions and equations used for the assessment of data quality are discussed below.

Accuracy - Is a measure of the nearness of an analytical result, or a set of results, to the true value. It is usually expressed in terms of error, bias, or percent recovery (%R).

Normally, the term accuracy is used synonymously with percent recovery. It describes the recovery of a synthetic standard of known value, or the recovery of known amount of analyte (spike) added to a sample of known value. The %R or accuracy can be calculated by using:

standards: %R = (observed value/true value) x 100

spikes: %R=[((conc. spike + sample conc.)-sample conc).x100)]/conc spike

Precision - Refers to the agreement or reproducibility of a set of replicate results among themselves without assumption of any prior information as to the true result. It is usually expressed in terms of the percent difference (%D) or RPD. The %D is calculated by using:

%D = (larger SR - smaller SR x 100)/ smaller SR

where SR is the sample result.

The RPD is calculated by using:

RPD = ($|$OSR - DSR$|$ x 100)/ ((OSR + DSR)/2)

where OSR is the original sample result and DSR is the duplicate sample result.

Average - The average or arithmetic mean (X) of a set of n values (Xi) is calculated by summing the individual values and dividing by n:

$X = (\sum Xi_{\text{I=1 to n}})/n$

Range - The range (R_i) is the difference between the highest and lowest value in a group. For n sets of duplicate values (X_2, X_1) the range (R_i) of the duplicates and the average range (R) of the n sets are calculated by the following:

$R_i = X_2 - X_1$

$R = \sum Ri_{\text{i=1 to n}}/n$

Standard deviation and variation - The standard deviation (S) of a sample of n results is the most widely used measure to describe the variability of a data set. It is calculated by using the following equation:

$$S = \sqrt{\frac{\Sigma(Xi - \overline{X})^2}{n-1}}\; n_{\text{ to } i-1}$$

where X is the average of the n results and Xi is the value of result. Normally, X ± S will include 68% and X ± 2S includes about 95% of normally distributed data.

The variance is equal to S2. The percent relative standard deviation (%RSD) or coefficient of variation (CV) is the standard deviation divided by the mean and multiplied by 100 as follows:

CV = 100S/X

The Laboratory QC Coordinator, with individual laboratory group leaders, will identify any data that should be rated as "unacceptable,“ based on the assessment of the QA/QC criteria.

Data assessment will be evaluated during data validation and discussed in the data validation report.

13. Instrument/Equipment Testing and Maintenance

Each major piece of analytical laboratory instrumentation that will be used on this project has been documented and is on file with the laboratory. An equipment form will be prepared for each new purchase and old forms will be removed from the instrument area and filed when an instrument is replaced.

The laboratory will be required to maintain an equipment form detailing both preventative maintenance activities and the required QA testing and monitoring. In the event the instrument does not perform within the limits specified on the monitoring form, the Laboratory Manager will be notified and a decision will be made as to what corrective action is necessary. The corrective action procedure shall be documented in the instrument log. If repair is necessary, the instrument will not be used for analyses until repairs are completed and the instrument tested. Repairs made to the instrument will be documented in the instrument logbook. Required QA/QC testing and monitoring will be completed prior to the resumption of sample analysis.

Preventative maintenance procedures will be carried out on field equipment by O'Brien & Gere personnel in accordance with the procedures outlined by the manufacturers' equipment manuals. Maintenance activities involving field equipment will be recorded in the field notebook.

Routine maintenance is performed to keep laboratory instruments running under optimum conditions and to reduce instrument malfunction. Specific preventative maintenance programs outlining required maintenance procedures and their application frequencies are incorporated in laboratory SOPs for each methodology.

Minimally, field and laboratory instruments will undergo maintenance on an annual basis and when calibration, blank, or QC analyses indicate that maintenance is necessary to correct or improve system performance. Maintenance, whether performed by laboratory personnel or manufacturer, is documented as an entry in the appropriate log. Log entries include the reason for maintenance, maintenance performed, date, and initials of person in charge during maintenance.

The operating temperatures for refrigerators, coolers, ovens, and water baths will be monitored by the laboratory daily. The analyst will record the following information in a bound logbook: equipment ID, temperature reading, data and time of reading, and analyst initials.

14. Calibration and Frequency

14.1. Field equipment calibration

Field equipment used during this investigation will be calibrated in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Equipment to be used for the field sampling will be examined to confirm that it is in good operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to confirm that the maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notations on any prior equipment problems are not overlooked, and necessary repairs to equipment have been carried out.

In general, instruments will be calibrated daily prior to use and will be recalibrated as required. All the calibration procedures performed will be documented in the field logbook.

Where applicable, calibration of field instruments will be performed at the intervals specified by the manufacturers. In the event that an internally calibrated field instrument fails to meet calibration procedures, it will be returned to the manufacturer for service, or another field instrument in working order will be obtained.

The RI/FS Work Plan presents specific field equipment calibration information.

14.2. Laboratory equipment calibration

Proper calibration of laboratory analytical instrumentation is essential for the generation of reliable data necessary to meet the project DQOs. Analytical instrument calibration is monitored using control limits that are established for individual analytical methods. Calibration procedures to be followed are specified, in detail, in the analytical methods. These procedures specify the type of calibration, calibration materials to be used, range of calibration and frequency of calibration. In addition, the calibration requirements listed in the quality control requirements and corrective actions in Tables 12-1, 12-2, 12-3, and 12-4, that augment the method requirements, are to be followed by the laboratory during the RI/FS.

The laboratory will be responsible for proper calibration and maintenance of laboratory analytical equipment. Calibration procedures are presented in the analytical methods and the laboratory QA Manual. The following subsections detail some of the calibration procedures outlined in the analytical methods and the laboratory QA Manual.

14.2.1. Gas chromatography/mass spectrometry (GC/MS)

Before the GC/MS is calibrated for organics analysis, the mass calibration and resolutions of the instruments are verified by 4-bromofluorobenzene (BFB) for VOCs, and by decafluorotriphenylphosphine (DFTPP) for SVOCs. The performance check analysis must meet the criteria referenced in the analytical method and the QAPP. The system must be verified every 12 hours of analysis and when the instrument performance check solution fails to meet criteria. Samples are not analyzed until performance check analysis criteria are met.

For organics analysis, an initial five-point calibration is performed for the target compounds prior to start-up and whenever system specifications change or if the continuing calibration acceptance criteria have not been met. One of the calibration standards must be near the reporting limit concentration. The method criteria, including relative response factors (RRFs) and percentage relative standard deviation (% RSD), of specific compounds must meet established criteria as specified in the method and the QAPP. If these parameters fail to meet criteria, corrective actions must be implemented and the initial calibration must be repeated.

14.2.2. Metals and inorganics

Instrument calibration for metal analyses is performed daily. A two-point calibration for ICAP analyses is performed. Five point calibrations are performed for spectrophotometers and cold vapor atomic absorption instruments. Calibration verification is monitored by analyzing a calibration verification standard and a calibration blank following calibration, every ten samples, and at the end of the analytical sequence. The calibration standard recoveries must be within appropriate method and the QAPP criteria or the instrument must be recalibrated. The calibration blank must not contain target compounds at concentrations greater than the detection limit or corrective actions are implemented.

To verify interelement and background corrective factors for ICP analysis, interference check samples (ICSA and ICSAB) must be analyzed at the beginning and end of the analysis sequence or a minimum of twice per eight hours. The percent recoveries for ICS solutions must be within 80%-120% or corrective actions must be implemented. In addition, for ICP analyses, a serial dilution analysis must be performed per sample matrix. If the analyte concentration is greater than fifty times the instrument detection limit (IDL) in the original sample, a serial dilution (five fold dilution) must agree within ten percent of the original determination. Detection limits, interelement corrective factors, and linear ranges must be established at the frequency specified in the method.

14.3. Standards and solutions

The use of standard materials of a known purity and quality is necessary for the generation of reproducible data. The laboratory will monitor the use of laboratory materials including solutions, standards, and reagents. Reagent solutions used for quantitation purposes must be ACS-grade or better. Standards prepared or purchased must be traceable to National Standards of Measurement. Standards should be traceable by lot number to a certificate of analysis, which is on file at the laboratory. Standards and standard solutions are verified prior to use. This verification may be in the form of a certification of analysis from the supplier or by comparison to a standard curve or another standard from a separate source. Standards are routinely checked for signs of deterioration, including unusual volume changes, discoloration, formation of precipitates, or changes in analyte response.

Solvent materials are also verified prior to use. Each new lot of solvent is analyzed to verify the absence of interfering constituents. Reagent and method blanks are routinely analyzed to evaluate possible laboratory-based contamination of samples.

14.4. Records

A records book will be kept for standards and will include the following information:

- Material name
- Control or lot number
- Purity and/or concentration
- Supplier/manufacturer
- Receipt/preparation date
- Recipient's/preparer's name
- Expiration date

These records will be checked periodically as part of the laboratory’s internal laboratory controls review.

14.5. Calibration records

Calibration data will be kept for each instrument that requires calibration. The data will contain a record of activities associated with QA monitoring and instrument repairs. These records will be checked during periodic equipment review and internal and external QA/QC audits.

15. Inspection requirements for supplies

The use of standard materials of a known purity and quality is necessary for the generation of reproducible data. The laboratory will monitor the use of laboratory consumable materials including solutions, standards, and reagents, as described in Section 14.

Solvent materials are also verified prior to use. Each new lot of solvent is analyzed to verify the absence of interfering constituents. Reagent and method blanks are routinely analyzed to evaluate possible laboratory-based contamination of samples.

The sample containers used for this project will be supplied by the laboratory. The containers will be pre-cleaned sample containers that will be purchased from a USEPA-certified manufacturer (I-Chem 200 or equivalent container) or are cleaned using USEPA protocols.

16. Data acquisition requirements

Non-direct measurement data, in the form of historical data from previous site investigations, will be utilized for the RI/FS.

17. Data Management

Definitive data will be generated in the laboratory and screening data will be generated in the field as described in Section 5. The laboratory-generated data will be entered into the laboratory database management system and presented in data packages. The laboratory will perform the data review process, described in Section 20. Validation of the sample data will be performed as described in Section 21.

Data will be managed in a relational database management system (DBMS). Laboratory analytical data will be provided in electronic disk deliverable (EDD) format for direct upload into the DBMS. The DBMS will then be used to provide custom queries and reports to support data validation, data analysis, and report preparation. Data validation qualifiers will be entered into the DBMS by hand and checked independently. Final tables containing the validated sample data will be presented in the RI/FS Report.

Records will be incorporated into the final project files for the samples. The field logs, data packages, and records will be included in the Engineer's project files. The project files will be archived by the Engineer for a period of 10 years.

18. Performance and System Audits

18.1. Performance audits

At the discretion of the Project Manager, field and laboratory performance audits consisting of on-site performance evaluations will be performed once during the field program and during the laboratory analysis program. The audits will be performed by the QAO or her designee. These audits will evaluate the adherence of the field and laboratory programs to the QA program outlined in this QAPP. The protocols used to conduct the audits may be found in the following sections. Acceptance criteria used in determining the need for corrective action will be those criteria defined in this QAPP. Where acceptance criteria are not defined for laboratory procedures and analytical methods, the laboratory's standard operating procedure and QA Manual will be consulted. The results of the field and laboratory audits will be documented and submitted to the Project Manager. These reports, and any corrective actions that were implemented as a result of the audits, will be included in the technical report.

18.1.1. Laboratory audit protocol

The laboratory audit will note factors that may affect the quality of the analytical results. Minimum QA/QC criteria specified in this QAPP and the analytical methods must be adhered to. The areas of concern of the laboratory audit will include:

- Implementation of a scientifically sound QA/QC program addressing precision, accuracy, reproducibility, comparability, completeness, and blank contamination;

- Sufficient documentation and record keeping for technical personnel external to the laboratory to recreate each analytical event; and

- Compliance with the project requirements for laboratory analysis.

The specific parameters to be evaluated include:

- Data comparability
- Calibration and quantitation
- QC execution
- Out-of-control events
- Standard operating procedures
- Sample management
- Record keeping
- Instrument calibration records
- Other analytical records
- QC records
- Corrective action reports
- Maintenance logs
- Data review
- Limits of detection
- QC limits
- Analytical methods

18.1.2. Field audit protocol

The purpose of a field audit is to identify whether the systems and procedures described in the RI/FS Work Plan and QAPP are operational in the field and contributing to the production of accurate and defensible analytical results. An on-site evaluation may be preformed by the QAO or her designee. The areas of concern in a field audit include:

- Sampling procedures
- Decontamination of sampling equipment, if applicable
- Chain-of-custody procedures
- Standard operating procedures
- Proper documentation in field notebooks

18.2. System audits

Routine laboratory and field performance will be monitored through the analysis of field/equipment and laboratory blanks, spiked samples, laboratory control samples, laboratory and field duplicates, and performance evaluation samples. The Laboratory QA Coordinator, in conjunction with the QAO and the Project Manager, will formulate corrective actions in the event that QC limits specified in this document are exceeded. The results of the system audits will be documented in the investigation report.

18.3. Corrective actions

Corrective action procedures will be implemented based on unacceptable audit results, or upon detection of unacceptable data during validation. Two types of audits will be performed during this investigation. The data generation process will be audited by assessing adherence to control limits and by performing an on-site laboratory audit, if requested by the Project Manager. The field program will be audited by assessing adherence to the procedures outlined in this document by the analysis of field QC samples and by performing an on-site field audit, if requested by the Project Manager. If required, corrective action procedures will be developed on a case-by-case basis. The enacted corrective actions will be documented in the appropriate notebook, log, or case file. File and laboratory personnel are encouraged to discuss specific issues and proposed corrective actions with the QAO.

Generally, the following corrective actions will be taken by the laboratory. When calibration, instrument performance, and blank criteria are not met, the cause of the problem will be located and corrected. The analytical system will then be recalibrated. Sample analysis will not begin until calibration, instrument performance, and blank criteria are met. The Project Manager will be notified of situations of repeated calibration, instrument performance, or blank criteria failure at the time of sample analysis. When matrix spike, reference standard, or duplicate analyses are out of control, samples analysis will cease. The problem will be investigated. Depending on the results of the overall QC program for the sample set, the data may be accepted, accepted with qualification, or determined to be unusable. If, through the application of the corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4, the data is determined to be unusable, the QC analysis will be re-prepared and reanalyzed. If QC criteria are met upon reanalysis, only the new results are reported. If QC criteria are still not met upon reanalysis, both sets of sample results will be reported and the Project Manager will be notified of the situation at the time of sample analysis.

If matrix interferences are suspected, the Project Manager will be contacted. In the case of matrix interference, the laboratory will perform sample cleanup as provided by the methods. Interferences will be identified and documented. Samples may be diluted only if analytes of concern generate responses in excess of the linear range of the instrument. When matrix interferences are present, samples will be cleaned up during the extraction processes using appropriate methods. The clean-up, extraction and sample preparation methods will be listed in the data package case narrative. If the laboratory has taken appropriate actions and matrix interferences prevent the laboratory from achieving the specified detection limits, the Project Manager will be contacted as soon as the situation is identified and the Laboratory QC Coordinator will document in the data package case narrative how the laboratory demonstrated good analytical practices in order to attempt to achieve the specified reporting detection limits.

In addition, the quality control requirements and corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4, which augment the method requirements, are to be followed by the laboratory during the RI/FS.

The laboratory will make every reasonable effort to correct QC excursions.

If problems arise with procedures or guidelines set forth herein, the client, the QAO, and the Project Manager, in conjunction with the appropriate agencies, will formulate an appropriate corrective action.

19. QA Reports to Management

Following completion of the RI/FS, O'Brien & Gere will prepare a RI/FS Report. The RI/FS Report will include the results of the investigations. The data validation report will be provided as an appendix to the RI/FS Report.

The data validation reports will contain separate QA sections in which data quality information collected during the investigation is summarized. The validation reports will include the following:

- Guidelines used to evaluate the data.
- Data qualifiers applied to sample results.
- Summary of samples collected and analyses performed.
- Narrative that identifies major and minor analysis excursions detected for each parameter evaluated for each analysis.
- Additional issues and information that may be beneficial to the data user are discussed.
- Data summary forms.

The data validation reports will be prepared under the direction of the O'Brien & Gere Project Manager and will include the report on the usability of the data and the QAO's report on the results of any laboratory and field audits.

20. Data Review, Validation, Verification and Management

20.1. Deliverables

For data to be scientifically valid, legally defensible and comparable, valid procedures must be used to prepare this data. NYSDEC ASP Category B laboratory analytical documentation will be required for each sample analysis.

20.2. Data production, handling and reporting

20.2.1. Underlying documents

Specific laboratory procedures and instrumentation can be found in the QA Manual and/or SOPs from the laboratory.

20.2.2. Data reduction

Data reduction consists of manual and computer data reduction procedures and calculations. Computer data reduction procedures and calculations will be checked manually by the laboratory to verify that compound identification and quantitation adhere to method requirements. The laboratory will be responsible for maintaining a listing of computer-based data reduction programs and SOPs for data reduction. Sample preparation or extraction logs will be used to document sample preparation information (for example, preparation weights, volumes, reagents). Instrument injection logs or bench sheets will also be maintained for each instrument.

Qualitative identification and quantitation of organic analytes will be performed by experienced analysts in accordance with analytical method requirements.

20.2.3. Laboratory data review

Analytical results are generally entered into the laboratory computer system by the analyst, independently reviewed by another analyst or supervisor experienced in the method, and approved by the Laboratory Project Manager. The following are requirements that are generally examined as part of this review:

- Initial calibration criteria were met. Standards in the calibration curve covered the expected concentration ranges of the samples including the PQL.
- Initial and continuing calibrations met the acceptance criteria defined in the method standard procedure.
- Sample results fell within the range of the standard curve.
- For GC/MS methods requiring internal standards, retention times and area responses were evaluated against limits established by the daily calibration.
- Method blanks were processed with each analytical batch and no detectable levels of contamination were identified.
- MS/MSDs were performed at the required frequency and recoveries were within acceptable control limits.
- Duplicate analyses were performed at the required frequency and results were within the control limits.
- LCS analyses were performed with each analytical batch and the results obtained were within control limits.
- For organic compound analyses, surrogate spike recoveries were within control limits.
- Compounds identified by GC/MS have been manually rechecked by comparison with the data system library for both target compounds and tentatively identified compounds. Retention times and ratios of fragmentation were verified.
- Calculations have been accurately performed.
- Reporting units are correct.
- Data for the analysis provide a complete audit trail.

- Reported detection limits comply with data quality indicator requirements.

The analyst's supervisor will check a minimum of 10% of the data back to raw data in the secondary review. When required analyses on the samples in a project are complete, entered, and reviewed, a report will be generated. The report will be forwarded to the assigned Laboratory Project Supervisor or designee for review. The report will then be reviewed for the following items (at a minimum):

- QC data will be reviewed to identify whether or not internal specification and contract requirements have been met.

- Non-conformance reports, if any, will be reviewed for completion of corrective actions and their impact of results. Quality control requirements and corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4 in this QAPP will be referenced in the laboratory review process. Non-compliance and corrective action procedures will be documented in the case narrative in the final report.

The report requires the signature of the Laboratory Project Supervisor or designee. Electronic data are copied onto computer tape, inventoried, and stored off-site in a secure facility, or within locked cabinets on site. This data archive system is maintained for a minimum of ten years.

Following final review, two hard copies of the report will be transmitted to the Engineer.

The laboratories will present the analytical data packages in NYSDEC ASP Category B format. The data packages, which will be fully validatable, will document sample preparation, extraction, and analysis and include raw data and logs associated with the analyses performed for the RI/FS.

The data packages will be provided within 30 days of receipt of the last sample at the laboratory. If during the validation process, additional or supplemental information is requested, the laboratory will provide data reduction, validation, and reporting information to the validator within three working days. Data report forms will be securely bound and the pages will be sequentially numbered. In addition to the hardcopy version of the analytical data packages, the laboratory will provide electronic deliverables.

20.2.4. Data management

Data will be managed in a relational DBMS. Laboratory analytical data will be provided in EDD format for direct upload into the DBMS.

Data validation qualifiers will be entered into the DBMS by hand and checked independently. The DBMS will then be used to provide custom queries and reports to support data validation, data analysis, and report preparation.

21. Data Validation and Usability

Data validation will be performed on the data from the samples collected for the RI/FS. Data validators from O'Brien & Gere will provide data validation services.

Upon request by the data validator, the laboratory will provide additional or supplemental information within 3 working days of the request.

21.1. Validation procedures

Data validation will be performed utilizing the QA/QC criteria established in this QAPP, the quality control requirements and corrective actions listed in Tables 12-1, 12-2, 12-3, and 12-4, the analytical methods, and laboratory established criteria.

Data validators will be responsible for reviewing the QC parameters as listed below. Data validators will recalculate approximately 10% of the laboratory sample calculations using raw data when verifying sample results for full validation. In addition, data validators will review approximately 10% of the raw data to verify that compound identification was performed correctly and transcription errors are not present for full validation.

Sample data will be qualified based on excursions from control limits. Data not within control limits require corrective action by the laboratory. Data validators will check corrective action reports and results of reanalysis if available. Corrective actions implemented by the laboratory will be referenced in the data validation report.

The following QA/QC information will be included in the review for organic and inorganic analyses where applicable:

- Holding times, sample preservation and percentage solids;
- Calibrations;
- Blank analysis;
- Matrix spike/matrix spike duplicates;
- Laboratory control sample analysis;
- Field duplicate analysis;
- Surrogate recovery (organics);
- Internal standards performance (organics);

- Gas chromatography/mass spectrometry instrument performance check (organics);
- Column performance check standard analysis (organics);
- GC performance (organics);
- Analytical sequence (organics);
- Cleanup efficiency (organics);
- Confirmation analysis (organics);
- Inductively coupled plasma interference check sample analysis (inorganics);
- Inductively coupled plasma serial dilution (inorganics);
- Laboratory replicates (inorganics);
- Verification of instrument parameters (inorganics);
- Target analyte quantitation, identification, and reported detection limits;
- Tentatively identified compounds;
- Documentation completeness; and
- Overall data assessment.

Control limits for the blind field duplicate precision have been established at ±50% for water samples and ±100% for solid samples. For sample results that are less than or equal to five times the PQL, the criterion of plus or minus two times the PQL will be applied to evaluate field precision.

21.2. Assignment of qualifiers

Data affected by excursions from the previously mentioned QA/QC criteria will be qualified using the following USEPA data validation guidance documents or the most current documents and professional judgment:

- USEPA. 1992. *USEPA Region II Evaluation of Metals Data for the CLP Program, SOP HW-2* Revision 11, (modified for SW-846 methods). New York, NY.

- USEPA. 1994. *USEPA Region II Validating Canisters of Volatile Organics in Ambient Air, SOP HW-18,* Revision 0 (modified). New York, NY.

- USEPA. 1999a. *USEPA Region II Validating Volatile Organic Compounds by SW-846 Method 8260B, SOP HW-24* Revision 1, (modified). New York, NY.

- USEPA. 2001b. *USEPA Region II Validating Semivolatile Organic Compounds by SW-846 Method 8270, SOP HW-22* Revision 2, (modified). New York, NY.

In the application of both USEPA validation guidelines and method criteria to data generated in this investigation, data validation will involve utilizing professional judgment to determine the appropriate validation approach. The validation approach to be taken by O'Brien & Gere will be a conservative one; qualifiers will be applied to sample data to indicate both major and minor excursions. In this way, data associated with any type of excursion is identified to the data user. Minor deficiencies in the data generation process noted in the data validation will result in approximation of sample data. Approximation of a data point indicates uncertainty in the reported concentration of the chemical but not its assigned identity. Major deficiencies noted in the data validation will result in the rejection of sample results. Rejected data would be considered unusable for quantitative or qualitative purposes. In accordance with USEPA validation guidance, and using professional judgment, data qualifiers may include the following:

U	Indicates that the analyte was analyzed for, but was not detected. The associated value indicates approximate sample concentration necessary to be detected. The sample quantitation limit is presented and adjusted for dilution and percent moisture.
J	Indicates that the detected analyte is present but the reported value may not be accurate or precise. The result should be considered approximate based on excursions from QA/QC criteria.
UJ	Indicates that the analyte was not detected and the quantitation limit may be inaccurate or imprecise. The result should be considered approximate based on excursions from QA/QC criteria.
N	Indicates that the analyte is tentatively identified. The analyte is considered to be present.
R	Indicates that the detection limit or sample result is unreliable and has been rejected due to a major excursion from QA/QC criteria. The analyte may or may not be present in the sample. The data should not be used for qualitative or quantitative purposes.

The following guidelines are used regarding the assignment of qualifiers and the use of qualified data:

- The data quality evaluation may result in only one type of qualifier ("U", "J", "UJ," or "R") for each analyte; in a case when several qualifiers are applicable to the same analyte, the cumulative effect of the various QA/QC excursions is employed in assigning the final data qualifiers. For example, if a sample result is affected by low surrogate recoveries for which the "J" qualifier is applied, but low MS/MSD recoveries result in the rejection of the sample result (application of the "R" qualifier), the final data qualifier is the "R" qualifier.

- QA/QC excursions which do not result in the qualification of an analyte, or which result in additional qualification of data previously qualified, may not be discussed.

21.3. Data usability evaluation

Based on the QA/QC information review and the qualifiers assigned to the analytical data, an overall evaluation of the data's usability will be performed. Data usability is defined as the percentage of data that remains unqualified or is qualified as approximate or non-detected due to blank contamination, divided by the data reported by the laboratory times 100. The percentage usability excludes the data qualified as rejected due to major QA/QC excursions. The non-usable data is defined as the percentage of the data qualified as rejected divided by the data reported by the laboratory times 100. The data usability will be provided for each type of analysis performed for samples analyzed for this investigation.

The data usability evaluation considers the data parameters of precision, sensitivity, accuracy, representativeness, comparability, and completeness (known as PSARCC parameters), which are described as follows:

- Precision is evaluated through the review of field duplicate samples, laboratory duplicates, and MS/MSD samples.

- Sensitivity is evaluated through the review of reported detection limits.

- Accuracy is evaluated through the review of MS/MSD samples, internal standards, surrogate recoveries, LCS recoveries, calibration, instruction performance check, ICAP interference check analysis, and ICAP serial dilutions.

- Representativeness is evaluated through the review of holding times, sample preservation and preparation, blank analysis and target compound identification and quantification.

- Comparability is evaluated through the review of the analytical methods and reporting procedures for consistency.

- Completeness is defined as the overall percentage of sample results that are determined to be usable.

21.4. Data validation report

The data validation reports will contain separate QA sections in which data quality information collected during the investigation is summarized. NYSDEC Data Usability Summary Report (DUSR) guidance will be utilized in the validation process. The validation reports will include the following:

- Guidelines used to evaluate the data.
- Data qualifiers applied to sample results.
- Summary of samples collected and analyses performed.
- Narrative that identifies major and minor analysis excursions detected for each parameter evaluated for each analysis.
- Additional issues and information that may be beneficial to the data user are discussed.
- Data summary forms.

The data validation reports will be prepared under the direction of the O'Brien & Gere Project Manager and will include the report on the usability of the data and the QAO's report on the results of any laboratory and field audits.

22. Reconciliation With User Requirements

Validated sample results from these investigations will be reviewed by the Project Manager. Data usability with respect to the data quality objectives and data uses will be compared to the project requirements. The parameters that will be used to assess the precision, accuracy, representativeness, comparability, and completeness are presented in Section 5 of this QAPP. In the event that the completeness objective of 90% is not achieved due to major quality control deviations in the sample analysis process, samples will be recollected at the discretion of the Project Manager.

The data validation reports will be prepared under the direction of the Project Manager and will include the report on the usability of the data and the QAO's report on the results of any laboratory and field audits.

References

American Water Works Association (AWWA), American Public Health Association (APHA) and Water Environment Federation (WEF). 1992. *Standard Methods for the Examination of Water and Wastewater*, 18th Edition. Washington, D.C.

New York State Department of Environmental Conversation (NYSDEC). . June 1998. Division of Water Technical and Operational Guidance Series (TOGS) – *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Guidelines* (TOGS 1.1.1).

New York State Department of Environmental Conversation (NYSDEC). 1994. Division Technical and Administrative Guidance Memorandum (TAGM) – *Determination of Soil Cleanup Objectives and Cleanup Levels (TAGM 4046).*

New York State Department of Environmental Conversation (NYSDEC). 2000. *NYSDEC Analytical Services Protocol (ASP) Methods, 2000 Revisions*.

O’Brien & Gere Engineers, Inc. 2003. *Remedial Investigation/ Feasibility Study Work Plan, ITT Automotive Site, Rochester, New York.* O’Brien & Gere Engineers, Inc., Syracuse, New York.

United States Environmental Protection Agency (USEPA). 1992. *USEPA Region II Evaluation of Metals Data for the CLP Program, SOP HW-2* Revision 11. New York, NY.

United States Environmental Protection Agency (USEPA). 1994. *USEPA Region II Validating Canisters of Volatile Organics in Ambient Air, SOP HW-18,* Revision 0 (modified). New York, NY.

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United States Environmental Protection Agency (USEPA). 1999a. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/ Mass Spectrometry (GC/MS).* Cincinnati, OH.

United States Environmental Protection Agency (USEPA). 1999b. *USEPA Region II Validating Volatile Organic Compounds by SW-846 Method 8260B, SOP HW-24* Revision 1 New York, NY.

United States Environmental Protection Agency (USEPA). 2001a. *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, Final, EPA QA/R-5.* Washington, D.C.

United States Environmental Protection Agency (USEPA). 2001b. *USEPA Region II Validating Semivolatile Organic Compounds by SW-846 Method 8270, SOP HW-22* Revision 2. New York, NY.

Quality Assurance Project Plan
ITT Automotive, Inc.
Town of Gates, NY

Table 2-1. ***Project primary concern***

Name and responsibility	Organization and address	Phone Number
Bennett A. Leff	ITT Industries Motion and Flow Control 10 Mountain View Road Upper Saddle River, NJ 07458	201-760-5768
Steve Roland, P.E. Project Officer	O'Brien & Gere Engineers 5000 Brittonfield Pkwy East Syracuse, NY 13221	315-437-6100
Guy Swenson, C.P.G. Project Manager	O'Brien & Gere Engineers 5000 Brittonfield Pkwy East Syracuse, NY 13221	315-437-6100
Yuri Veliz Site Supervisor	O'Brien & Gere Engineers 5000 Brittonfield Pkwy East Syracuse, NY 13221	315-437-6100
Karen Storne QA Officer	O'Brien & Gere Engineers 5000 Brittonfield Pkwy East Syracuse, NY 13221	315-437-6100

Table 5-1. *Sampling, efforts objectives, analyses, data uses, and analytical level*

Sampling Effort	***Objectives***	***Types of analysis***	***Data Uses***	***Analytical Level***
Ground water sampling	Characterize the magnitude and extent of site-related constituents in the ground water.	• VOCs • 1,4-dioxane •	• Support the Feasibility Study and select remedial alternative • Evaluate sources of VOCs	Definitive
Ground water sampling	Characterize the magnitude and extent of site-related constituents in the ground water.	pH Conductivity Temperature	Evaluate purge water stabilization prior to ground water sampling	Screening
Soil sampling	Characterize the nature and extent of contamination in the soil	VOCs, SVOCs (Including 1,4-dioxane), metals, mercury, and cyanide	Support the Feasibility Study and select remedial alternative	Definitive
Soil sampling	Characterize the nature and extent of contamination in the soil	VOCs by PID	Assist selection of samples for laboratory analysis	Screening
Soil gas sampling	Characterize the nature and extent of contamination in soil gas	VOCs	Support the Feasibility Study and select remedial alternative	Definitive

Notes:

VOCs indicates Volatile Organic Compounds.
SVOCs indicates Semivolatile Organic Compounds
Metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc

Quality Assurance Project Plan
ITT Automotive, Inc.
Town of Gates, NY

Table 5-2. *Analytical methods*

Sample type	Parameter	Analytical method*	Reference
Ground water	VOCs	USEPA Method 5030B/8260B	1
Ground water	1,4-Dioxane	USEPA Method 3510C/3520C/8270C	1
Soil	VOCs	USEPA Method 5035/8260B	1
Soil	SVOCs	USEPA Method 3550B/8270C	1
Soil	Metals	USEPA Method 3050B/6010B	1
Soil	Mercury	USEPA Method 7471A	1
Soil	Cyanide	USEPA Method 9010B/9012A/9014	1
Soil gas	VOCs	USEPA Method TO15	2
Soil	Percent Solids	SM 2540G	3
Ground water	pH	Field analysis	**
Ground water	Specific conductance	Field analysis	**
Ground water	Temperature	Field analysis	**
Soil	VOCs by PID	Field analysis	**

Notes:

VOCs indicates volatile organic compounds
SVOCs indicates semivolatile organic compounds including 1,4-dioxane.
Metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc

1. USEPA. 1996. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846,* 3rd Edition. Washington D.C.
2. USEPA. 1999a. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/ Mass Spectrometry (GC/MS).* Cincinnati, OH.
3. APHA, AWWA, WPCF. 1992. *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, Washington, D.C.

* Indicagtes that New York State Department of Environmental Conversation (NYSDEC). 2000. *NYSDEC Analytical Services Protocol (ASP) Methods, 2000 Revisions,* will be used as guidance where applicable.

** Indicates that field analyses are discussed in the Field Sampling Plan.

Source: O'Brien & Gere Engineers, Inc.

Table 5-3. *Field sampling summary*

Parameter (method)*	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Investigative Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD /Spike Duplicate**	Equipment blank***
VOCs (USEPA Method 5030B/8260B)[1]	Ground water	2-40 milliliter glass vials with Teflon® lined septum caps	4°C HCL to pH<2	14 days from collection for preserved samples; 7 days from collection for unpreserved samples.	TBD	One per 20 samples or one per matrix (for less than 20 samples)	1 ea. per cooler with VOC samples	One per 20 samples or one per matrix (for less than 20 samples)	One per sampling event as required.
VOCs (USEPA Method 5035/8260B)[1]	Soil	4 oz. wide mouth glass container sealed with Teflon® lined lid	4°C	Analysis within 14 days from collection.	TBD	One per 20 samples or one per matrix (for less than 20 samples)	1 ea. per cooler with VOC samples	One per 20 samples or one per matrix (for less than 20 samples)	One per sampling event as required.
VOCs (USEPA Method TO-15)[2]	Air	Canisters as prepared in Method TO-15. Canisters Blank test met and sampling system certified as per Method TO-15.	4°C	14 days from collection	TBD	One per 20 samples or one per matrix (for less than 20 samples)	NA	NA	NA
1,4-dioxane (USEPA Method 3510C/3520/8270C)[1]	Ground water	1-one liter amber glass container with Teflon® lined screw caps	4°C	7 days from collection to extraction; 40 days from extraction to analysis	TBD	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per sampling event as required.
SVOCs (USEPA Method 3550B/8270C)[1]	Soil	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis	TBD	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per sampling event as required.

Table 5-3. *Field sampling summary*

Parameter (method)*	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Investigative Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD /Spike Duplicate**	Equipment blank***
Metals, Mercury (USEPA Methods 3050B/6010B, 7471A)[1]	Soil	4 ounce wide mouth polyethylene or fluorocarbon (TFE or PFA) container.	4°C	180 days from collection 28 days from collection for mercury	TBD	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per sampling event as required.
Cyanide (USEPA Methods 9010B/9012A/9014)[1]	Soil	4 ounce wide mouth polyethylene or fluorocarbon (TFE or PFA) container.	4°C	14 days from collection	TBD	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per sampling event as required.

Table 5-3. *Field sampling summary*

Parameter (method)*	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Investigative Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD /Spike Duplicate**	Equipment blank***

NOTES:
* Indicagtes that New York State Department of Environmental Conversation (NYSDEC). 2000. *NYSDEC Analytical Services Protocol (ASP) Methods, 2000 Revisions,* will be used as guidance where applicable.

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**MS/MSD indicates matrix spike/matrix spike duplicate sample.
*** Field/equipment blank is required at a frequency of one per 20 samples or one per day if less than 20 samples are collected for each matrix type. Equipment blank is not required if disposable equipment is used.

1. USEPA. 1996. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846,* 3rd Edition. Washington D.C.
2. USEPA. 1999a. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/ Mass Spectrometry (GC/MS).* Cincinnati, OH.

VOCs indicates volatile organic compounds.
SVOCs indicates semivolatile organic compounds, including 1,4-dioxane..
Metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc

NA indicates not applicable.

TBD indicates numbers of samples will be determined at a later date.

A temperature blank will be submitted with each sample cooler.

Source: O’Brien & Gere Engineers, Inc.

Table 5-4. *Laboratory PQLs and MDLs for volatile organic compounds by USEPA Method 8260B and screening criteria for aqueous samples*

Parameter	Water PQL (µg/L)	Water MDL (µg/L)	Screening Criteria New York State Class GA Ground Water Standard/ Guidance (µg/L)[1]
Chloromethane	1.0	0.04	NE
Vinyl chloride	1.0	0.2	2
Bromomethane	1.0	0.04	5
Chloroethane	1.0	0.04	5
Acetone	10	0.2	50
1,1-Dichloroethene	0.5	0.03	5
Methylene chloride	2.0	0.06	5
Carbon disulfide	0.5	0.03	50
1,2-Dichloroethene (total)	1.0	0.06	5
1,1-Dichloroethane	0.5	0.02	5
2-Butanone	10	0.09	50
Chloroform	0.5	0.02	7
1,1,1-Trichloroethane	0.5	0.02	5
Carbon tetrachloride	0.5	0.02	5
1,2-Dichloroethane	0.5	0.03	0.6
Benzene	0.5	0.03	0.7
Trichloroethene	0.5	0.03	5
1,2-Dichloropropane	0.5	0.04	1
Bromodichloromethane	0.5	0.01	50
4-Methyl-2 pentanone	5.0	0.3	50
cis-1,3-Dichloropropene	0.5	0.02	0.4
Toluene	0.5	0.04	5
trans-1,3-Dichloropropene	0.5	0.02	0.4
1,1,2-Trichloroethane	0.5	0.04	1
Dibromochloromethane	0.5	0.02	50
2-Hexanone	5.0	0.08	50

Table 5-4. *Laboratory PQLs and MDLs for volatile organic compounds by USEPA Method 8260B and screening criteria for aqueous samples*

Parameter	**Water PQL (µg/L)**	**Water MDL (µg/L)**	**Screening Criteria New York State Class GA Ground Water Standard/ Guidance (µg/L)[1]**
Tetrachloroethene	0.5	0.03	5
Chlorobenzene	0.5	0.03	5
Ethylbenzene	0.5	0.02	5
Xylene (total)	1.0	0.07	5
Styrene	0.5	0.02	5
Bromoform	0.5	0.04	50
1,1,2,2-Tetrachloroethane	0.5	0.06	5

Notes:

PQL indicates practical quantitation limit.

MDL indicates method detection limit.

µg/L indicates microgram per liter or parts per billion (ppb).

NE Indicates constituent-specific screening value has not been established.

1- New York State Department of Environmental Conversation (NYSDEC). June 1998. Division of Water Technical and Operational Guidance Series (TOGS) – *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Guidelines* (TOGS 1.1.1).

Table 5-5. *Laboratory PQLs and MDLs for volatile organic compounds by USEPA Method 8260B and screening criteria for soil samples*

Parameter	Low Soil PQL (µg/Kg) wet weight	Medium Soil PQL (µg/kg) wet weight	MDL (µg/kg)	Screening Criteria TAGM 4046 New York State Recommended Soil Cleanup Objectives (µg/Kg)[1]
Chloromethane	5.0	500	0.5	NE
Vinyl chloride	5.0	500	0.5	200
Bromomethane	5.0	500	0.8	NE
Chloroethane	5.0	500	0.7	1900
Acetone	10	1000	1.9	200
1,1-Dichloroethene	2.5	250	0.1	400
Methylene chloride	5.0	250	0.2	100
Carbon disulfide	2.5	250	0.5	2700
1,2-Dichloroethene (total)	5.0	250	0.5	NE (cis) / 300 (trans)
1,1-Dichloroethane	2.5	250	0.1	200
2-Butanone	10	1000	2.2	300
Chloroform	2.5	250	0.4	300
1,1,1-Trichloroethane	2.5	250	0.2	800
Carbon tetrachloride	2.5	250	0.2	600
1,2-Dichloroethane	2.5	250	0.1	100
Benzene	2.5	250	0.2	60
Trichloroethene	2.5	250	0.2	700
1,2-Dichloropropane	2.5	250	0.2	NE
Bromodichloromethane	2.5	250	0.2	NE
4-Methyl-2 pentanone	5.0	500	0.9	1000
cis-1,3-Dichloropropene	2.5	250	0.1	NE
Toluene	2.5	250	0.2	1500
trans-1,3-Dichloropropene	2.5	250	0.2	300
1,1,2-Trichloroethane	2.5	250	0.2	NE
Dibromochloromethane	2.5	250	0.3	NE

2-Hexanone	5.0	500	0.7	NE
Tetrachloroethene	2.5	250	0.2	1400
Chlorobenzene	2.5	250	0.1	1700
Ethylbenzene	2.5	250	0.2	5500
Xylene (total)	5.0	250	0.4	1200
Styrene	2.5	250	0.1	NE
Bromoform	2.5	250	0.2	NE
1,1,2,2-Tetrachloroethane	2.5	250	0.3	600

Notes:

PQL indicates practical quantitation limit.

MDL indicates method detection limit.

µg/kg indicates microgram per kilogram or parts per billion (ppb).

NE Indicates constituent-specific screening value has not been established.

1- New York State Department of Environmental Conversation (NYSDEC). 1994. Division Technical and Administrative Guidance Memorandum (TAGM) – *Determination of Soil Cleanup Objectives and Cleanup Levels (TAGM 4046).*

Table 5-6. *Laboratory PQLs and MDLs for volatile organic compounds using USEPA Method TO-15 and screening criteria for air samples.*

Parameter	**PQL (ppbv)**	**MDL (ppbv)**	**Screening Criteria** [1]
Chloromethane	0.2	0.06	-
Vinyl chloride	0.2	0.09	-
Bromomethane	0.3	0.06	-
Chloroethane	0.3	0.1	-
Acetone	0.8	0.2	-
1,1-Dichloroethene	0.3	0.06	-
Methylene chloride	0.3	0.03	-
Carbon disulfide	0.5	0.09	-
1,2-Dichloroethene (total)	0.4	0.1	-
1,1-Dichloroethane	0.2	0.03	-
2-Butanone	3.0	0.1	-
Chloroform	0.2	0.06	-
1,1,1-Trichloroethane	0.3	0.03	-
Carbon tetrachloride	0.3	0.03	-
1,2-Dichloroethane	0.2	0.04	-
Benzene	0.2	0.05	-
Trichloroethene	0.3	0.04	-
1,2-Dichloropropane	0.4	0.07	-
Bromodichloromethane	0.2	0.02	-
4-Methyl-2 pentanone	3.2	0.1	-
cis-1,3-Dichloropropene	0.2	0.07	-
Toluene	0.2	0.09	-
trans-1,3-Dichloropropene	0.2	0.09	-
1,1,2-Trichloroethane	0.2	0.1	-
Dibromochloromethane	0.2	0.04	-
2-Hexanone	2.0	0.06	-

Tetrachloroethene	0.2	0.03	-
Chlorobenzene	0.2	0.2	-
Ethylbenzene	0.2	0.16	-
Xylene (total)	0.6	0.3	-
Styrene	0.2	0.19	-
Bromoform	0.2	0.05	-
1,1,2,2-Tetrachloroethane	0.2	0.02	-
1,4-Dioxane	2.0	0.13	

Notes:

1- Indicates that air screening criteria are not available at this time.

PQL indicates practical quantitation limit.

MDL indicates method detection limit.

ppbv indicates parts per billion by volume.

-- Indicates constituent-specific screening value is not available.

Table 5-7. ***Laboratory PQLs and MDLs for semivolatile organic compounds using USEPA Method 8270C and screening criteria for soil samples..***

Parameter*	**Low Soil PQL (µg/kg), wet weight**	**Medium Level Soil PQL (µg/kg), wet weight**	**MDL(µg/kg)**	**Screening Criteria TAGM 4046 New York State Recommended Soil Cleanup Objectives (µg/Kg)**
Phenol	330	10,000	3.1	30
Bis(2-chloroethyl)ether	330	10,000	3.4	--
2-Chlorophenol	330	10,000	2.6	800
1,3-Dichlorobenzene	330	10,000	3.3	1,600
1,4-Dichlorobenzene	330	10,000	2.7	8,500
1,2-Dichlorobenzene	330	10,000	3.3	7,900
2-Methylphenol	330	10,000	2.8	100
Bis(2-chloroisopropyl)ether	330	10,000	2.6	--
4-Methylphenol	330	10,000	2.7	900
N-Nitroso-di-n-propylamine	330	10,000	3.4	--
Hexachloroethane	330	10,000	3.2	--
Nitrobenzene	330	10,000	1.8	200
Isophorone	330	10,000	2.9	4,400
2-Nitrophenol	330	10,000	4.0	330
2,4-Dimethyl phenol	330	10,000	2.5	--
Bis(2-chloroethoxy) methane	330	10,000	1.9	--
2,4-Dichlorophenol	330	10,000	2.9	400
1,2,4-Trichlorobenzene	330	10,000	2.5	3,400
Naphthalene	330	10,000	2.3	13,000
4-Chloroaniline	330	10,000	6.4	220
Hexachlorobutadiene	330	10,000	4.0	--
4-Chloro-3-methylphenol	330	10,000	2.3	240

Table 5-7. ***Laboratory PQLs and MDLs for semivolatile organic compounds using USEPA Method 8270C and screening criteria for soil samples..***

Parameter*	**Low Soil PQL (µg/kg), wet weight**	**Medium Level Soil PQL (µg/kg), wet weight**	**MDL(µg/kg)**	**Screening Criteria TAGM 4046 New York State Recommended Soil Cleanup Objectives (µg/Kg)**
2-Methylnaphthalene	330	10,000	2.5	36,400
Hexachlorocyclopentadiene	330	10,000	35	--
2,4,6-Trichlorophenol	330	10,000	5.0	--
2,4,5-Trichlorophenol	1600	48,000	35	100
2-Chloronaphthalene	330	10,000	2.8	--
2-Nitroaniline	1600	48,000	5.9	430
Dimethyl phthalate	330	10,000	1.8	2,000
Acenaphthylene	330	10,000	1.5	41,000
2,6-Dinitrotoluene	330	10,000	2.6	1,000
3-Nitroaniline	1600	48,000	10	500
Acenaphthene	330	10,000	4.1	50,000
2,4-Dinitrophenol	1600	48,000	66	200
4-Nitrophenol	1600	48,000	8.0	100
Dibenzofuran	330	10,000	3.1	6,200
2,4-Dinitrotoluene	330	10,000	2.5	--
Diethylphthalate	330	10,000	3.3	7,100
4-Chlorophenyl-phenyl ether	330	10,000	1.9	--
Fluorene	330	10,000	3.4	50,000
4-Nitroaniline	1600	48,000	6.1	--
4,6-Dinitro-2-methylphenol	1600	48,000	49	--
N-Nitrosodiphenylamine	330	10,000	2.4	--
4-Bromophenyl-phenyl ether	330	10,000	2.9	--

Table 5-7. ***Laboratory PQLs and MDLs for semivolatile organic compounds using USEPA Method 8270C and screening criteria for soil samples..***

Parameter*	**Low Soil PQL (µg/kg), wet weight**	**Medium Level Soil PQL (µg/kg), wet weight**	**MDL(µg/kg)**	**Screening Criteria TAGM 4046 New York State Recommended Soil Cleanup Objectives (µg/Kg)**
Hexachlorobenzene	330	10,000	3.4	410
Pentachlorophenol	1600	48,000	119	1,000
Phenanthrene	330	10,000	1.5	50,000
Anthracene	330	10,000	1.9	50,000
Carbazole	330	10,000	2.0	--
Di-n-butyl phthalate	330	10,000	41	8,100
Fluoranthene	330	10,000	2.0	50,000
Pyrene	330	10,000	1.3	50,000
Butylbenzylphthalate	330	10,000	2.8	50,000
3,3-Dichlorobenzidine	660	20,000	2.6	--
Benzo(a)anthracene	330	10,000	1.8	224
Chrysene	330	10,000	2.1	400
Bis(2-ethylhexyl)phthalate	330	10,000	10	50,000
Di-n-octylphthalate	330	10,000	3.2	50,000
Benzo(b)fluoranthene	330	10,000	1.8	1,100
Benzo(k)fluoranthene	330	10,000	2.4	1,100
Benzo(a)pyrene	330	10,000	1.4	61
Indeno(1,2,3-cd)pyrene	330	10,000	2.3	3,200
Dibenz(a,h)anthracene	330	10,000	1.8	14
Benzo(g,h,i)perylene	330	10,000	1.7	50,000
1,4-dioxane	330	10, 000	12.02	---

Notes:
PQL indicates practical quantitation limit
MDL indicates method detection limit

Table 5-7. ***Laboratory PQLs and MDLs for semivolatile organic compounds using USEPA Method 8270C and screening criteria for soil samples..***

Parameter*	**Low Soil PQL (µg/kg), wet weight**	**Medium Level Soil PQL (µg/kg), wet weight**	**MDL(µg/kg)**	**Screening Criteria TAGM 4046 New York State Recommended Soil Cleanup Objectives (µg/Kg)**

--- indicates not available

Reference for PQLs and MDLs: O'Brien & Gere Laboratories, Inc.

Reference for NYS soil standards: NYSDEC. Division Technical and Administrative Guidance Memorandum (TAGM 4046) Determination of Soil Cleanup Objectives and Cleanup Levels

Table 5-8. ***Laboratory PQLs and MDLs for 1,4-dioxane using USEPA Method 8270C and screening criteria for aqueous samples..***

Parameter*	**Water PQL (µg/L)**	**MDL(µg/L)**	**Screening Criteria New York State Class GA Ground Water Standard/ Guidance (µg/L)[1]**
1,4-dioxane	10	0.82	---

Notes:
PQL indicates practical quantitation limit
MDL indicates method detection limit

--- indicates not available

Reference for PQLs and MDLs: O'Brien & Gere Laboratories, Inc.

1- New York State Department of Environmental Conversation (NYSDEC). June 1998. Division of Water Technical and Operational Guidance Series (TOGS) – *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Guidelines* (TOGS 1.1.1).

Table 5-9. *Laboratory PQLs and MDLs for metals by USEPA Method 6010B, mercury by USEPA Method 7471A and cyanide by USEPA Method 9012A/9014 and screening criteria for soil samples*

Parameter	**Soil PQL (µg/kg), wet weight**	**MDL (µg/kg)**	**Screening Criteria TAGM 4046 New York State Recommended Soil Cleanup Objectives (µg/Kg)**
Aluminum	10,000	18	SB
Antimony	6,000	6.1	SB
Arsenic	500	5.0	7,500
Barium	10,000	0.8	300,000
Beryllium	1,000	00.2	160
Cadmium	1,000	0.9	1,000
Calcium	100,000	25	SB
Chromium	1,000	3.9	10,000
Cobalt	5,000	4.0	30,000
Copper	1,000	21	25,000
Iron	5,000	22	2,000,000
Lead	500	3.3	400,000
Magnesium	100,000	86	SB
Manganese	5,000	0.6	SB
Mercury	100	2.3	100
Nickel	5,000	3.3	13,000
Potassium	500,000	134	SB
Selenium	500	8.3	2,000
Silver	1,000	4.4	SB
Sodium	100,000	33	SB
Thallium	1,000	6.7	SB

Table 5-9. *Laboratory PQLs and MDLs for metals by USEPA Method 6010B, mercury by USEPA Method 7471A and cyanide by USEPA Method 9012A/9014 and screening criteria for soil samples*

Parameter	**Soil PQL (µg/kg), wet weight**	**MDL (µg/kg)**	**Screening Criteria TAGM 4046 New York State Recommended Soil Cleanup Objectives (µg/Kg)**
Vanadium	5,000	2.8	150,000
Zinc	1,000	2.7	20,000
Cyanide	500	160	--

Notes:
PQL indicates practical quantitation limit
MDL indicates method detection limit.

--- indicates not available

References for PQLs and MDLs: O’Brien & Gere Laboratories, Inc.

Reference for NYS soil standards: NYSDEC. Division Technical and Administrative Guidance Memorandum (TAGM 4046) Determination of Soil Cleanup Objectives and Cleanup Levels

Table 12-1. *Volatile organic compounds using USEPA Method 8260B Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Holding times	Samples must be extracted and analyzed within holding time.	VOCs: Analyze within 7 days of collection for unpreserved aqueous; 14 days from collection for preserved aqueous and solids.	1. If holding times are exceeded for initial or any reanalyses required due to QC excursions, **notify QAO* immediately since resampling may be required**. 2. Document corrective action in the case narrative.
MS Tuning	Once every 12 hours prior to initial calibration and calibration verifications.	1. BFB key ions and abundance criteria listed in the method must be met for all 9 ions and analyses must be performed within 12 hours of injection of the BFB. 2. Part of the BFB peak will not be background subtracted to meet tune criteria. 3. Documentation of all BFB analyses and evaluation must be included in the data packages.	1. Tune the mass spectrometer. 2. Document corrective action in the case narrative - **samples cannot be analyzed until control limit criteria have been met.**
Initial Calibration	Prior to sample analysis and when calibration verifications criteria are not met. Initial calibration will contain all target analytes in each standard.	1. Five concentrations bracketing expected concentration range for all compounds of interest; one std must be near the PQL. 2. CCC compounds ≤30% RSD. 3. SPCC RF as listed in method, non-SPCC ≥ 0.050 RF except for ketones and 2-chloroethyl vinyl ether with RF ≥ 0.010. 4. For compound with %RSD >15, quantitation must be performed using a separate calibration curve and the COD must be > 0.990.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action in the case narrative - **samples cannot be analyzed until calibration control limit criteria are met. Contact QAO* to discuss problem target analytes before proceeding with analysis.** 4. **If the laboratory chooses to apply the mean exception (average % drift or % difference is less than 15%), the QAO* will be contacted prior to proceeding with analysis.**

Table 12-1. *Volatile organic compounds using USEPA Method 8260B Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Calibration Verification	Every 12 hours, following BFB. The calibration verification will contain all target analytes in each standard at a concentration that is representative of the midpoint of the initial calibration.	1. Within method specified criteria, and percent drift or percent difference (%D) ≤ 20 for CCC compounds, ≤ 50% D for remaining compounds, SPCC RF same as listed in initial calibration. 2. The internal standards areas and retention times must meet the method criteria.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative - **samples cannot be analyzed until calibration control limit criteria are met**.
Preparation Blank Analysis	Every 12 hours, following calibration verification	Common laboratory contaminants (methylene chloride, acetone) less than 3 X PQL; anything else less than PQL. PQLs will be provided along with the preparation blank results.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument, recalibrate analytical system, and reanalyze all samples if detected for same compounds as in blank. 3. Document corrective action in the case narrative - **samples cannot be analyzed until blank criteria have been met.**
Field/ Equipment Blank Analysis	Collected one per sampling equipment and after every 20 samples.	Common laboratory contaminants less than 3 X PQL; anything else less than PQL.	1. Investigate problem. 2. Document in the case narrative.
Trip Blank	1 per cooler containing VOC samples.	Common laboratory contaminants less than 3 X PQL; anything else less than PQL.	1. Investigate problem. 2. Document in the case narrative.
Laboratory Control Sample Analysis	Each analytical batch (every 12 hours). Prepared independently from calibration standards. Spike must contain all target analyte and should be at a concentration, which is in the lower 1/2 of the calibration curve.	Recovery within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used.	1. If recovery failures are above control limits and these compounds are not detected in the associated samples, corrective action is not required. 2. If recovery failures are below control limits, reanalyze LCS and examine results of other QC analyses. 3. If other QC criteria have not been met, stop analysis, **locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS**. 4. Document corrective action in the case narrative.

Table 12-1. *Volatile organic compounds using USEPA Method 8260B Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Internal Standards	All samples and blanks (including MS/MSD)	1. Response -50% - +100% of internal standards from continuing calibration of the day. 2. RT must be ± 30 sec. from associated calibration verification standard of that sequence.	1. Reanalyze. 2. If still outside of the limits, report both analyses. 3. Document corrective action in the case narrative. Special Circumstances: If matrix interferences is present (as demonstrated by the lab and documented in the case narrative): 1. Reanalyze (may be at a higher dilution) 2. If internal standard is >10%, report both runs. 3. If internal standard is <10%, report both runs.
Surrogate Spike	All samples and blanks (including MS/MSD)	Recovery within laboratory control limits.	1. Reanalyze any environmental or QC sample with surrogates that exceed control limits. 2. If still outside of the limits, report both analyses. 3. Document corrective action in the case narrative. Special Circumstances: If matrix interference is present (as demonstrated by the lab and documented in the case narrative): 1. Reanalyze (may be at a higher dilution) 2. If surrogate recovery is >10%, report both runs. 3. If surrogate recovery is <10%, report both runs.
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Recovery and RPD within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. Spike must contain target analytes.	1. Reanalyze if <10%. 2. If reanalysis is still <10%, report both analyses and document in the case narrative. 3. If >10% and LCS criteria are met, document in case narrative; no additional corrective action required. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; *i.e.,* surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. 5. Re-extract or reanalyze samples and associated MS/MSD and LCSs as required. 6. Document corrective action in the case narrative

Table 12-1. *Volatile organic compounds using USEPA Method 8260B Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Field Dup. Analysis	Collected 1 per matrix; every 20 samples of similar matrix	50% RPD for waters and 100% RPD for soil. For sample results that are less than or equal to five times the PQL, the criterion of plus or minus two times the PQL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Tentatively Identified Compound	If required, perform for each sample and blank analysis. Non-target compounds will be reported using a Mass Spectral Library search.	Not applicable	Not applicable
Dilutions	1. When target analyte concentration exceeds upper limit of calibration curve. 2. When matrix interference is demonstrated by the lab and documented in the case narrative (highly viscous samples or a large number of nontarget peaks on the chromatogram). 3. A reagent blank will be analyzed if an analyte saturates the detector or if highly concentrated analytes are detected. 4. Laboratory will note in the data deliverables which analytical runs were reported.	1. The reagent blank will meet the method blank criteria.	1. Reanalyze reagent blank until method blank criteria are met. 2. Document corrective action in the case narrative.

Table 12-1. *Volatile organic compounds using USEPA Method 8260B Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
pH Determination	Once sample aliquot is taken from the VOC vial, the pH of water samples must be determined.	Record pH and report in the case narrative.	Not applicable
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable
Laboratory Control Limits	1. Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
Percent Solids	For soil samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable

Table 12-1. *Volatile organic compounds using USEPA Method 8260B Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Deliverables	1. NYSDEC ASP Category B deliverables must be provided to document each audit item for easy reference and inspection. 2. An example calculation will be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided. 6. Cooler temperatures and any observations of bubbles in sample containers will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.

Table 12-1. *Volatile organic compounds using USEPA Method 8260B Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Method and QAPP Requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable

Notes:
*Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP.
QAO* indicates that communications with the QAO will be documented and included in the data packages.
Source: O'Brien & Gere Engineers, Inc.

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Sampling Procedure	As per USEPA Method TO-15	As per USEPA Method TO-15.	As per USEPA Method TO-15.
Canister Blank Test	Prior to sample collection.	Any canister that has not tested clean (compared to direct analysis of humidified zero air of less than 0.2 ppbv of targeted VOCs) will not be used.	As a "blank" check of the canister(s) and cleanup procedure, the final humid zero air fill of 100% of the canisters is analyzed until the cleanup system and canisters are proven reliable (less than 0.2 ppbv of any target VOCs). The check can then be reduced to a lower percentage of canisters.
Sampling System certification	Prior to sample collection	1. Verify that the calibration system is clean (less than 0.2 ppbv of any target compounds) by sampling a humidified gas stream, *without* gas calibration standards, with a previously certified clean canister. 2. The assembled dynamic calibration system is certified clean if less than 0.2 ppbv of any targeted compounds is found. 3. Sample the dynamic calibration gas stream with the sampling system with nominal concentrations of 10 ppmv in nitrogen of selected VOCs. 4. A recovery of between 90% and 110% is expected for all targeted VOCs.	Certification is not achieved until recovery criterion is met.
Holding Times	Samples must be extracted and analyzed within holding time.	VOCs: Although method indicates that most VOCs can be recovered from canisters near their original concentrations after storage times of up to thirty days, analyze within 14 days from collection for air.	1. If holding times are exceeded for initial or any reanalyses required due to QC excursions, **notify QAO* immediately since resampling may be required**. 2. Document corrective action in the case narrative.

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
MS Tuning	Once every 12 hours prior to initial calibration and calibration verifications.	1. BFB key ions and abundance criteria listed in the method must be met for all 9 ions and analyses must be performed within 12 hours of injection of the BFB. 2. Three scans (the peak apex scan and the scans immediately preceding and following the apex) are acquired and averaged. Background subtraction is conducted using a single scan prior to the elution of BFB. 3. Part of the BFB peak will not be background subtracted to meet tune criteria. 4. Documentation of all BFB analyses and evaluation must be included in the data packages.	1. Tune the mass spectrometer. 2. Document corrective action in the case narrative - **samples cannot be analyzed until control limit criteria have been met.**

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Initial Calibration	Prior to sample analysis and when calibration verifications criteria are not met. Initial calibration will contain all target analytes in each standard.	1. Five concentrations bracketing expected concentration range for all compounds of interest; one std must be near the PQL. 2. The calculated %RSD for the RRF for each compound in the calibration table must be less than 30%. 3. The RRT for each target compound at each calibration level must be withiin 0.06 RRT units of the mean RRT for the compound. 4. The area response of internal standards at each calibration level must be within 40% of the mean area response over the initial calibration range for each internal standard. 5. The retention time shift for each of the internal standards at each calibration level must be within 20 s of the mean retention time over the initial calibration range for each internal standard.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action in the case narrative - **samples cannot be analyzed until calibration control limit criteria are met. Contact QAO* to discuss problem target analytes before proceeding with analysis.**
Calibration Verification	Every 12 hours, following BFB. The calibration verification will contain all target analytes in each standard at a concentration that is representative of the midpoint of the initial calibration.	1. The %D for each target compound in a daily calibration sequence must be within ±30 percent in order to proceed with the analysis of samples and blanks.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative - **samples cannot be analyzed until calibration control limit criteria are met**.

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Analysis Sequence	1. Perform instrument performance check using BFB. 2. Initiate multi-point calibration or daily calibration checks. 3. Perform a laboratory method blank. 4. Complete this sequence for analysis of less than or equal to 20 field samples.	Not Applicable.	Not Applicable.

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Laboratory Method Blank Analysis	1. A laboratory method blank (LMB) is an unused, certified canister that has not left the laboratory. The blank canister is pressurized with humidified, ultra-pure zero air and carried through the same analytical procedure as a field sample. The injected aliquot of the blank must contain the same amount of internal standards that are added to each sample. 2. Method blanks are analyzed at least once in a 24-hour analytical sequence. All steps in the analytical procedure are performed on the blank using all reagents, standards, equipment, apparatus, glassware, and solvents that would be used for a sample analysis. 3. The laboratory method blank must be analyzed after the calibration standard(s) and before any samples are analyzed. 4. Whenever a high concentration sample is encountered (i.e., outside the calibration range), a blank analysis should be performed immediately after the sample is completed to check for carryover effects.	1. The area response for each internal standard in the blank must be within ±40 percent of the mean area response of the IS in the most recent valid calibration. 2. The retention time for each of the internal standards must be within ±0.33 minutes between the blank and the most recent valid calibration. 3. The blank should not contain any target analyte at a concentration greater than its quantitation level (three times the MDL as defined) and should not contain additional compounds with elution characteristics and mass spectral features that would interfere with identification and measurement of a method analyte.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument, recalibrate analytical system, and reanalyze all samples if detected for same compounds as in blank. 3. Document corrective action in the case narrative - **samples cannot be analyzed until blank criteria have been met.**

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Laboratory Control Sample Analysis	Each analytical batch. Prepared from independent calibration standards. Spike must contain all target analytes and should be at a concentration, which is in the lower 1/2 of the calibration curve.	Recovery within 70-130% recovery.	1. If recovery failures are above control limits and these compounds are not detected in the associated samples, report results. 2. If recovery failures are below control limits, reanalyze LCS and examine results of other QC analyses. 3. If other QC criteria have not been met, stop analysis, **locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS**. 4. Document corrective action in the case narrative.
Laboratory Control Sample Duplicate Analysis	Each analytical batch. Prepared from independent calibration standards. Spike must contain all target analytes and should be at a concentration, which is in the lower 1/2 of the calibration curve.	Precision within 25 RPD.	1. If recovery failures are outside of control limits, reanalyze LCS and examine results of other QC analyses. 2. If other QC criteria have not been met, stop analysis, **locate and correct problem**. 3. Document corrective action in the case narrative.
Internal Standards	All samples and blanks (including MS/MSD)	1. Retention times for any internal standard must be within 20 sec from the latest daily (24-hour) calibration standard (or mean retention time over the initial calibration range). 2. The area response for any internal standard must not change by more than ±40 percent between the sample and the most recent valid calibration.	1. Reanalyze. 2. If still outside of the limits, report both analyses. 3. Document corrective action in the case narrative. .

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Field Dup. Analysis	Collected 1 per matrix; every 20 samples of similar matrix	50% RPD for waters and 100% RPD for soil. For sample results that are less than or equal to five times the PQL, the criterion of plus or minus two times the PQL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Dilutions	1. When target analyte concentration exceeds upper limit of calibration curve. 2. When matrix interference is demonstrated by the lab and documented in the case narrative (highly viscous samples or a large number of nontarget peaks on the chromatogram). 3. A reagent blank will be analyzed if an analyte saturates the detector or if highly concentrated analytes are detected. 4. Laboratory will note in the data deliverables which analytical runs were reported.	Not applicable.	Not applicable.
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable.	Not applicable.

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Laboratory Control Limits	Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable.	Not applicable.

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	**Frequency**	**Control Limits**	**Corrective Action**
Deliverables	1. NYSDEC ASP Category B deliverables must be provided to document each audit item for easy reference and inspection. 2. An example calculation will be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable.	Provide missing or additional deliverables for validation purposes.

Table 12-2. *Volatile organic compounds using USEPA Method TO-15 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Method and QAPP Requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable.	Not applicable.

Notes:
*Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP.
QAO* indicates that communications with the QAO will be documented and included in the data packages.
Source: O'Brien & Gere Engineers, Inc.

Table 12-3. *Semivolatile organic compounds using USEPA Method 8270C Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	SVOCs: Extract within 14 days for soil samples from collection. Analyze extracts within 40 days of extraction.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, **notify the QAO* immediately since resampling may be required.**
MS Tuning	Once every 12 hours prior to initial calibration and calibration verification.	1. DFTPP key ions and abundance criteria listed in the method must be met for all 13 ions and analyses must be performed within 12 hours of injection of the DFTPP. 2. Part of the DFTPP peak will not be background subtracted to meet tune criteria. 3. Documentation of all DFTPP analyses and evaluations must be included in the data packages.	1. Tune the mass spectrometer. 2. Document corrective action in the case narrative - **samples cannot be analyzed until control limit criteria have been met.**
Initial Calibration	Prior to sample analysis and when calibration verification criteria are not met. Initial calibration will contain all target analytes in each standard.	1. Five concentrations bracketing expected concentration range for all compounds of interest; one standard must be near the PQL. 2. CCC compounds meet method RSD. 3. SPCC RF as listed in method, non-SPCC > 0.050 RF. 4. For compounds with %RSD >15, quantification must be performed using a separate calibration curve and the COD must be > 0.990.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action in the case narrative - **samples cannot be analyzed until calibration control limit criteria are met**. **4. Contact QAO* to discuss problem target analytes before proceeding with analysis.** **5. If the laboratory chooses to apply the mean exception (average % drift or % difference is less than 15%), the QAO* will be contacted prior to proceeding with analysis.**

Table 12-3. *Semivolatile organic compounds using USEPA Method 8270C Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Calibration Verification	Every 12 hours, following DFTPP. Calibration verification will contain all target analytes in each standard at a concentration that is representative of the midpoint of the initial calibration.	1. Within method specified criteria, percent drift or percent difference (%D) < 20 for CCC compounds and 2. < 50 %D for remaining compounds, SPCC RF as listed in method, non-SPCC > 0.050. 3. The internal standards areas and retention times must meet the method criteria.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative - **samples cannot be analyzed until calibration control limit criteria are met**.
Preparation Blank Analysis	Prepared with each extraction batch of no more than 20 analytical samples.	1. Common laboratory contaminants (phthalate) less than 3 X PQL, anything else less than PQL. 2. PQLs will be provided along with the preparation blank results.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument, recalibrate analytical system and re-extract and reanalyze all samples if detected for same compounds as in the blank. 3. Document corrective action in the case narrative - **samples cannot be analyzed until blank criteria have been met.**
Field/ Equipment Blank Analysis	Collected one per sampling equipment and after every 20 samples.	Common laboratory contaminants less than 3 X PQL; anything else less than PQL.	1. Investigate problem. 2. Document in the case narrative.
Laboratory Control Sample Analysis	Prepared with each extraction batch, of no more than 20 analytical samples. Prepared independently from calibration standards. Spike must contain all target compounds and should be at a concentration that is approximately in the lower 1/2 of the calibration curve.	Recovery within laboratory control limits. For compounds without established laboratory control limits, 70 to 130% recovery will be used.	1. If recovery failures are above control limits and these compounds are not detected in the associated samples, corrective action is not required. 2. If recovery failures are below control limits, reanalyze LCS and examine results of other QC analyses. 3. If other QC criteria have not been met, stop analysis, **locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS**. 4. Document corrective action in the case narrative.

Table 12-3. *Semivolatile organic compounds using USEPA Method 8270C Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Internal Standards	All samples and blanks (including MS/MSD).	1. Response -50% - +100% of the internal standards from the continuing cal of the day. 2. RT must be ± 30 sec. from calibration verification of that sequence.	1. Reanalyze. 2. If recovery is still outside criteria, report both analyses. 3. Document corrective action in the case narrative. Special Circumstances: If matrix interferences is present (as demonstrated by the lab and documented in the case narrative): 1. Reanalyze (may be at a higher dilution) 2. If internal standard is >10%, report both runs 3. If internal standard is <10%, report both runs.
Surrogate Spike	All samples and blanks (including MS/MSD).	Recovery within laboratory control limits.	1. Reanalyze if more than 1 AE or 1 BN fails, or if any one surrogate %R is < 10%. 2. If recovery is still outside control limits and if the recovery is < 10%, re-extract if still in holding time. 3. If recovery is still outside control limits, and if recovery is >10%, report both analyses. 4. Document corrective action in the case narrative. Special Circumstances: If matrix interference is present (as demonstrated by the lab and documented in the case narrative): 1. Reanalyze (may be at a higher dilution) 2. If surrogate recovery is >10%, report both runs. 3. If surrogate recovery is <10%, report both runs.
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater. Spike must contain all target analytes.	Recovery and RPD within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used.	1. Reanalyze if <10%. 2. If reanalysis is still < 10%, report both analyses and document in the case narrative. 3. If >10%, and LCS criteria are met, document in the case narrative. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e. surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. 5. Re-extract or reanalyze samples and associated MS/MSD and LCSs as required. 6. Document corrective action in the case narrative.

Table 12-3. *Semivolatile organic compounds using USEPA Method 8270C Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Field Dup. Analysis	Collected 1 per matrix; every 20 samples of similar matrix.	50% RPD for waters and 100% RPD for soil. For sample results that are less than or equal to five times the PQL, the criterion of plus or minus two times the PQL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Cleanup	GPC must be performed for all soils or water extracts with high molecular weight contaminants.	Calibrate according to method. Criteria must be met as listed in method for calibration and blank analysis.	Clean GPC column or replace.
Tentatively Identified Compounds	If required, for each sample and blank analysis. Non-target compounds will be reported using a Mass Spectral Library search.	Not applicable	Not applicable
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable

Table 12-3. *Semivolatile organic compounds using USEPA Method 8270C Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. When matrix interference demonstrated by lab and documented in the case narrative (highly viscous samples or a large number of nontarget peaks on the chromatogram). 3. Samples should be cleaned up during sample preparation/extraction procedure using appropriate methods when matrix interference is present. 4. Laboratory will note in the data deliverables which analytical runs were reported.	1. The reagent blank will meet the method blank criteria.	1. Reanalyze reagent blank until method blank criteria are met.

Table 12-3. *Semivolatile organic compounds using USEPA Method 8270C Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Laboratory control limits	1. Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
Percent solids	For soil samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable

Table 12-3. *Semivolatile organic compounds using USEPA Method 8270C Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Deliverables	1. NYSDEC ASP Category B deliverables must be provided to document each audit item for easy reference and inspection. 2. An example calculation will be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.

Table 12-3. *Semivolatile organic compounds using USEPA Method 8270C Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Method and QAPP requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable

Notes:
*****Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP.
QAO* indicates that communications with the QAO will be documented and included in the data packages.
Source: O'Brien & Gere Engineers, Inc.

Table 12-4. *Metals using USEPA Method 6010B, Mercury using USEPA Method 7470A/7471A, and Cyanide using USEPA Method 9012A9014 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be digested and analyzed within holding time.	Metals: Analyze 180 days from collection. Mercury: Analyze 28 days from collection. Cyanide: Analyze 14 days from collection.	1. If holding times are exceeded for initial or any reanalyses required due to QC excursions, **notify the QAO* immediately since resampling may be required**. 2. Document corrective action in the case narrative.
Calibration Verification (ICV, CCV)	Two point calibration for ICP. Five point calibration for remaining methods. Calibrate according to method and each time instrument is set up; verify at 10% and at the end of each run. For ICP - Std. at or below the PQL should be analyzed after initial cal. Mercury standard should be less than or equal to 5 times the PQL.	ICV, CCVs - 90% to 110% of expected value for ICP, AA, colorimeter, and spectrophotometer. ICV, CCV for Mercury - 80% to 120% of expected true value. ICV, CCV for Cyanide - 85% to 115% of expected true value. Correlation coefficient for first or second order curve must be ≥ 0.995. For cyanide, distill and analyze low standard and high standard which must agree within ±10% of the true value.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative – **samples cannot be analyzed until calibration control limit criteria have been met.**
Calibration Blank	At beginning and end of run and at a rate of 10% during run.	Less than PQL.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action in the case narrative - **samples cannot be analyzed until blank control limit criteria have been met.**
Preparation Blank Analysis	1 per batch of samples digested, or 1 in 20, whichever is greater.	Less than PQL.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument and recalibrate analytical system and re-preparation and reanalyze affected samples if detected. 3. Document corrective action in the case narrative – **samples cannot be analyzed until blank criteria are met.**

Table 12-4. *Metals using USEPA Method 6010B, Mercury using USEPA Method 7470A/7471A, and Cyanide using USEPA Method 9012A9014 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Field/ Equipment Blank Analysis	Collected one per sampling equipment and after every 20 samples.	Less than PQL	1. Investigate problem. 2. Document in the case narrative.
Laboratory Control Sample Analysis	Every 20 samples or each digestion batch. Prepared independently from calibration standards.	Recovery within laboratory control limits.	1. Reanalyze LCS and examine results of other QC analyses. 2. If recovery is still outside limits, and other QC criteria are met, report results. 3. If other QC criteria have not been met, **stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS.** 4. Document corrective action in the case narrative.
Serial Dilution Analysis for ICP	Required when analyte concentration is >50 times the IDL.	An analysis of a 1:5 dilution of the sample should provide a result with 90% to 110% of the original determination (for concentrations 50x the IDL).	1. Qualify data. 2. Document corrective action in the case narrative.
Interference Check Sample Analysis	Beginning and end of each analytical run or twice during every 8 hours, whichever is more frequent for ICP.	Percent recovery of all elements should be between 80% and 120%. Elements not present in ICSA solution must not be detected above the PQL concentration.	1. Reanalyze. 2. If limits are still exceeded, adjust instrument. 3. **Restart analytical run and reanalyze samples analyzed since last satisfactory ICS**. 4. Document corrective action in the case narrative.
Matrix Spike Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Recovery within in-house control limits (does not apply if sample concentration > 4 X spike concentration). Spike must contain all analytes.	1. If LCS criteria are met, document in the case narrative. 2. If LCS criteria are not met, examine other QC data to identify the source of the problem. 3. Re-prepare/ reanalyze samples associated with the matrix spike and LCS. 4. Document corrective action in the case narrative.
Laboratory Duplicate or Matrix Spike Duplicate Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	RPD less than in-house limits for concentration > 5X PQL. Abs. difference less than 2X PQL otherwise.	1. Investigate problem and reanalyze. 2. Document corrective action in the case narrative.

Table 12-4. *Metals using USEPA Method 6010B, Mercury using USEPA Method 7470A/7471A, and Cyanide using USEPA Method 9012A9014 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Field Dup. Analysis	Collected 1 per matrix; every 20 samples of similar matrix	100% RPD for soil. For sample results that are less than or equal to five times the PQL, the criterion of plus or minus two times the PQL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Furnace Analysis	Dilution test: One sample for each analytical batch. Recovery test: When dilution test fails or all samples in batch are below 10 times the MDL.	Dilution test – within 10 %RPD. Recovery test - 85% to 115%,	1. If dilution test fails, run the recovery test. 2. If recovery test fails, run method of standard addition, (MSA). 3. Document corrective action in the case narrative.
Laboratory control limits	1. Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
IDL Determination	Within 30 days of the start of analysis and semiannually.	Not applicable	Not applicable
Linear Range Analysis	Every 6 months.	Not applicable	Not applicable

Table 12-4. *Metals using USEPA Method 6010B, Mercury using USEPA Method 7470A/7471A, and Cyanide using USEPA Method 9012A9014 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Interelement Correction For ICP	Within 6 months of the start of analysis and annually. Correction factors for Al, Ca, Fe, and Mg must be reported and for others if they are applied.	Not applicable	Not applicable
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. When matrix interference demonstrated by lab and documented in the case narrative. 3. Laboratory will note in the data deliverables which analytical runs were reported.	Not applicable	Not applicable
Percent solids	For soil samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable

Table 12-4. *Metals using USEPA Method 6010B, Mercury using USEPA Method 7470A/7471A, and Cyanide using USEPA Method 9012A9014 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Deliverables	1. NYSDEC ASP Category B deliverables must be provided to document each audit item for easy reference and inspection. 2. An example calculation will be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.

Table 12-4. *Metals using USEPA Method 6010B, Mercury using USEPA Method 7470A/7471A, and Cyanide using USEPA Method 9012A9014 Quality Control Requirements and Corrective Actions.**

Audit	Frequency	Control Limits	Corrective Action
Method and QAPP requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable

Note
*Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP.
QAO* indicates that communications with the QAO will be documented and included in the data packages.

Source: O'Brien & Gere Engineers, Inc.

Figure 1. ***Example chain-of-custody***

Project Name:_______________________________________
Project No. ______________________Sheet ____ of ____

Office: __________________________
Address:__________________________
Phone: __________________________

CHAIN OF CUSTODY

Cooler Temperature ________________________

CLIENT: LOCATION:	COLLECTED BY: (Signature)

SAMPLE DESCRIPTION/LOCATION	Date	Time	Sample Matrix[1]	Sample Type[2]	No. of Containers	ANALYSIS REQUESTED/COMMENTS[3]

[1] Matrix = Soil [2]Type = grab, composite [3] SVOC - 8270C

	Date	Time		Date	Time
Relinquished by:______________________________ of:____			Received by:________________________________ of:____		
Relinquished by:____________________________ of:_______________________________________	Date	Time	Received by:___________________________________ of:____	Date	Time
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by:____________________________ of:____	Date	Time	Courier Name and Airbill Number:_____________________________________ ____ ***Attach delivery/courier receipt to Chain of Custody**	Date	Time
Relinquished by:______________________________ of:____	Date	Time	Received by:__________________________ of:____________________________________	Date	Time

Soil Vapor Sample Collection Procedures

Sampling objectives

This method involves the collection of a sample of vapor from the unsaturated soil for analysis for use in evaluating the potential exposure through migration to indoor air. The samples will be analyzed using method TO-15. This method involves the use of a pre-evacuated canister for collection and transport of the sample.

Sampling considerations

The following factors should be considered when designing the sampling program:

- *Depth to ground water* – Soil vapor samples should be collected from just below the slab.
- *Type of soil* – It may be difficult to draw air into the sampler in low-permeability soils. In these instances, there is a likely chance that surface air will be drawn in via the sampling hole. Low flow rates, smaller air volumes, and/or thicker, more substantial surface seals may be needed to minimize this potential.
- *Constituents of concern* –The constituents of concern should be identified prior to selecting the analytical method to be used for the program.
- *Detection limit* – Different constituents have different action levels. Therefore, it is important to consider the action levels to assess whether the detection limit is sufficient.
- *Sample depth* – The depth of the sample should be just below the slab. However, the sample should not be collected within 1 ft of the ground water table to avoid entrainment of water.
- *Sample location* – At least one sub-slab/indoor air sample location should be collected for each section of the building separated by footers.
- *Material inventory* – An inventory of materials and activities in the sampling location should be completed to identify potential impacts to the sample results.

Sample collection point installation

The sample collection device is typically tubing constructed of Teflon. Caution should be used when using Tygon® or other flexible tubing as it volatile organics are adsorbed to this type of material.

1. If surface is covered by asphalt of concrete a nominal hole shall be drilled through the surface.
2. A nominal hole shall be completed to a depth just below the slab using a slide hammer, drill or soil gas sampling device.
3. An appropriate length of 3/16-inch (outside diameter) Teflon tubing shall be placed to the base of the hole
4. A low-permeable, VOC-free, non-shrinking material shall be placed into the hole at the surface to act as a seal to minimize short circuiting of the vapor extraction process.
5. After sealing around the tubing, cap the tubing and leave the system undisturbed for one to two days.
6. Attach a 6- to 8-in length of Tygon® tubing to the end of the Teflon tubing

Attach the Tygon® tubing to the flow controler and 6-liter Summa canister equipped with vacuum gauges.

Sample collection

Consistent with the TO-15 method requirements, a Summa canister will be used to collect the sample. The pre-evacuated canister results in a vacuum that is used to draw the sample into the canister.

1. Purging of the tubing prior to sample collection is not required.
2. Open the valve on the summa canister. Collect samples over a period of two to eight hours.
3. Check the canister vacuum at the start and end of the sample period. Periodic monitoring of the vacuum during the sampling period is also suggested.
4. Once the meter shows that the canister is full, close the valve and detach the sampling valve from the tubing.
5. A tag or similar device should be attached to the canister with the following information: site name, sample location identification, sample date, sampling time, and total draw time. This information should also be provided on the chain-of-custody form.

Vapor Intrusion Potential Evaluation (VIPE)

Objective

The objective of the vapor Intrusion Potential Evalaution (VIPE) is to assess if constituents detected in sub-surface environments have the potential to migrate via vapor infiltration to the indoor air of buildings at concentrations that represent unacceptable indoor concentrations relative to building uses and exposed receptors.

Guidance

The VIPE will conducted be in accordance with the Environmental Protection Agency (EPA), 2002, *Draft Guidance For Evaluating The Vapor Intrusion to Indoor Air Pathway From Groundwater And Soils*, USEPA-OSWER. Docket ID No. RCRA-2002-0033. (OSWER Guidance).

The draft OSWER Guidance is indicated for use at RCRA Corrective Action, CERCLA (National Priorities List and Superfund Alternative Sites), and Brownfield sites. The OSWER Guidance allows for a flexible approach, allowing for the application of data screening steps, as appropriate, and site-specific considerations regarding the buildings in the vicinity of the site. The building on the site is a commercial building. As such, the VIPE Work Plan has been prepared in the context of an commercial building setting.

General Methodology

The OSWER guidance recommends a tiered approach to VIPEs. The evaluation will be guided by the Site conditions and available Site data and the “starting tier” may be selected based on the these conditions and data. As part of the data evaluation, the draft OSWER guidance identifies three tiers of assessment that involve increasing levels of complexity and specificity.

Tier 1 - Primary Screening: The primary screening is designed to be used with general knowledge of a site and the chemicals known or reasonably suspected to be present in the subsurface. The primary screening process evaluates if chemicals of sufficient volatility and toxicity are present; if inhabited buildings are located above or in close proximity to subsurface contamination; and if current conditions warrant immediate action. If these conditions do not occur, the pathway is classified as incomplete and not evaluated further.

Tier 2 - Secondary Screening: The secondary screening analysis compares measured or modeled concentrations of target chemicals in various media (groundwater, soil gas, and/or indoor air) to conservative health based numerical criteria. These numerical criteria reflect reasonable worst-case estimates of site-specific conditions such as depth of contamination, soil type, building specific properties, and receptor populations.

Tier 3 – Detailed Site-Specific Pathway Assessment: If the results of the Tier 1 and Tier 2 evaluation suggests that further assessment is warranted, a Tier 3 evaluation may be considered. The Tier 3 assessment may involve the collection of more detailed site-specific information such as confirmatory soil vapor, sub-slab, and/or indoor air sampling.

The tiered evaluation process presented in the OSWER Guidance represents a logical and linear progression designed to screen out sites not needing further consideration and focuses attention on those sites that need further consideration of the vapor intrusion pathway. However, the OSWER Guidance also states that the evaluation may proceed directly to Tier 2 or 3, or may use other technically sound approaches in evaluating the vapor intrusion pathway.

Bedrock Coring Guidance

Introduction

This guidance document describes the methodology and procedures for obtaining and handling core samples and the recording and description of cored drilling operations. The Bedrock Coring Guidance document was developed for use by geologists and geotechnical engineers in the office and field. Its purpose is to provide a standard format for use during planning, implementation, and documentation of core drilling operations. Additionally, the guidance document was developed to aid and guide the geologist or geotechnical engineer and improve continuity during core drilling operations observed by O'Brien & Gere Engineers, Inc. The guidance document was prepared according to available guidance documents, published standards, and standard practices. References for the documents used are included in the Bibliography section of this document.

Objectives: The primary objective of this guidance document is to provide a standard format for company-wide use during the planning, observation and documentation of core drilling. The process of core drilling can involve a variety of technologies and subsurface conditions. Accurate, comprehensive, and consistent planning, observation, and documentation of core drilling activities is an important component of a project.

Limitations: There are a variety of core drilling techniques, drilling tools, drilling conditions, and project objectives which can affect the implementation and documentation of core drilling. This guidance document does not cover all core drilling efforts. The guidance documents should be reviewed in light of the project objectives and expected site conditions, and modified if necessary.

Bedrock coring procedures

1. The drill hole (if necessary) from which the core run will be attempted will be completed using an approved drilling method to a depth specified by the supervising geologist or geotechnical engineer.

2. The appropriate casing (Appendix Table 1) will be installed into the drill hole (if required) and seated on a tooled/leveled bedrock surface or into a competent formation to a specified depth to prevent drill hole side wall damage, minimize drill fluid loss, and minimize formation damage while coring and tripping.

3. The annular space between the casing and the drilled formation will be grouted, if required, by packer(s), tremie or surface pour with cement mixture to depth(s) specified by the supervising geologist or geotechnical engineer.

4. Core drilling will begin with a core barrel device approved by the supervising geologist or geotechnical engineer, and will continue until core blockage occurs or until the net length of the core barrel has been drilled.

5. The volume of drilling water lost to the formation will be monitored and recorded.

6. The core barrel will be removed from the drill hole, disassembled, and the core removed. The core barrel will be reassembled, returned to the drill hole, and coring resumed as necessary.

7. At the conclusion of coreing, 110% of the volume of water lost to the formation will be purged from the core hole. 8.The recovered core will be placed into a core box with the top of the core run end at

the upper left corner of the box. The recovered core will be boxed and labeled with appropriate marking, spacers and blocks. Soft or friable cores or those which change materially upon drying will be wrapped in plastic film or sealed in wax, or both, if such treatment is required by the project. Properly marked space blocks (Figure 1) will be used to indicate noticeable gap in the recovered core which might indicate a change or void in the formation. Attempt to fit fractured, bedded or jointed pieces of core together as they naturally occurred.

9. Core boxes should be constructed of wood or other durable material for the protection and storage of cores while on route from the drill site to the office, laboratory or other storage point. The core boxes will be permanently marked to indicate the top, bottom, upper left hand corner (top of core run), drill hole identification numbers and project name.

10. Core samples to be preserved in sleeves will be cut, returned to pre-cut sleeves and labeled with the run number, top of run, depth (below reference point) or elevation of top of run, drill hole identification numbers, and project name. One end of the sleeve will be capped and sealed to prevent fluid loss. Representative drilling fluid used during coring will be poured into the open end of the sleeve to fill void spaces. Then the open end will be capped and sealed to prevent drill fluid loss. Appropriately sleeved core sample intervals will be ejected/extruded (under pressure) if examination is required by the supervising geologist or geotechnical engineer (CAUTION! - Clear path of exiting jammed core.)

Bedrock coring logging guidance

The following applicable site and drilling/coring information should be included and recorded on the Boring Log/Field Book for future reference. Information to assist in the documentation of the core drilling is presented in the Appendix. References listed in the bibliography can provide additional information.

1) Date, O'Brien & Gere geologist or geotechnical engineer.

2) Client and project name.

3) Client, project number.

4) Project objectives.

5) Weather.

6) Drilling contractor: subcontractors, driller, helpers, other personnel on site, license numbers (if applicable).

7) Rig type: manufacturer, model number, year of manufacture.

8) Drill hole identification number, location measured and described so that the location could be found by another person (address, city, county, state, country, township, range, section, offset, block, location with respect to site features).

9) Project drilling start date.

10) Location of reference point (casing top, Kelly bushing, or other) with respect to ground surface for definition of coring interval(s).

11) Drilling methods or drill hole advancement/types.

12) Size, type, design, model and manufacturer of core barrel used (Appendix, Table 1).

13) Size, type, design and manufacturer of core bit, reaming shell and guide shoe used.

14) Record core drilling activity (See Appendix).
Core drill rate in minutes per foot, rotation rates, and bit pressure when applicable.
Character of drilling (soft, slow, hard, easy, smooth, etc).
Downhole problems.
Down time and reasons .

15) Log core.
Rock description per PPI 302.
Rock Quality Designator (RQD - %) (see Appendix).
Drill breaks (see Appendix).
Core photos (if required for project).

16) Drill hole completion method.

17) Drill hole abandonment method (if applicable).

18) Project drilling completion date.

Appendix

1) Record core drilling activity

- Pump pressure when applicable and gains/losses (elevations).
- Elevation of or depth to ground water and raising or lowering of level, including dates and times measured during/after coring.
- Drill string behavior during coring.
- Drill fluid type and additives (mud weight when applicable).
- Elevations or depths and times at which lost circulation occurred.
- Length of each core run and the length or percentage, or both, of the core recovered.
- Bit gauging and appearance (post-coring).
- Core barrel appearance (post-coring).
- Jamming/blockage.
- Hole alignment.
- Fishing (and tools used)/duration.
- Apparent caving (during tripping in, out or coring).
- Decontamination effort (when applicable).

2) Rock Quality Designator (RQD - %)

$$- \%RQD = 100 \times \frac{\text{Length of core in pieces 4 inches and larger}}{\text{Hole length actually drilled/attempted (cored)}}$$

Guidelines:

1. Measure from the center of natural breaks.
2. Exclude joints that dip within 5E of core axis.
3. Exclude drill breaks (see criteria for identification of drill breaks).
4. <u>DO NOT</u> calculate RQD for soft semi-indurated "rock" or severely weathered rock.

Scale:

90 - 100		Excellent ....Massive
75 - 90	Good	Lightly Fractured
50 - 75	Fair	Moderately Fractured
25 - 50	Poor	Highly Fractured
0 - 25		Very Poor .... Sheared

(Appropriate to think of RQD in conditions of equal effect, i.e., group the RQD ranges as equivalent to rock type, structural domain, shear zones, etc.)

3) Criteria for Identification of Drilling Breaks:

- A rough, brittle surface with fresh cleavage planes in individual rock minerals indicates an artificial fracture.

- A generally smooth or somewhat weathered surface with soft coating or infilling materials such as talc, gypsum, chlorite, mica or calcite obviously indicates a natural discontinuity.

- In rocks showing foliation, cleavage or bedding, it may be difficult to distinguish between natural discontinuities and artificial fractures when the breaks are parallel with the incipient planes of weakness. If drilling has been carried out carefully, then the questionable breaks should be counted as natural features, to be on the conservative side.

- Depending on the drilling equipment, part of the length of core being drilled may occasionally rotate with the inner barrels in such a way that grinding of the surfaces of discontinuities and fractures occurs. In weak rock types, it may be very difficult to decide if the resulting rounded surfaces present ARE natural or artificial features. When in doubt, the conservative assumption should be made, i.e., assume that they are natural.

- It may be useful to keep a separate record of the frequency of artificial fractures for assessing the possible influence of blasting on the weaker sedimentary and foliated or schistose metamorphic rocks.

TABLE 1 (DCDMA)

Core Bit Sizes				
Size Designation	**Outside Diameter**		**Inside Diameter**	
	in.	**mm**	**in.**	**mm**
RWT	1.16	29.5	0.375	18.7
EWT	1.47	37.3	0.905	22.9
EWG, EWM	1.47	37.3	0.845	21.4
AWT	1.88	47.6	1.281	32.5
AWG, AWM	1.88	47.6	1.185	30.0
BWT	2.35	59.5	1.750	44.5
BWG, BWM	2.35	59.5	1.655	42.0
NWT	2.97	75.3	2.313	58.7
NWG, NWM	2.97	75.3	2.155	54.7
HQ	3.78	96	2.5	63.5
2-3/4 x 3-7/8	3.84	97.5	2.69	68.3
HWT	3.89	98.8	3.187	80.9
HWG, ...	3.89	98.8	3.000	76.2
4 x 5-1/2	5.44	138.0	3.97	100.8
6 x 7-3/4	7.66	194.4	5.97	151.6

Casing Sizes						
Size Designation	**Outside Diameter**		**Inside Diameter**		**Threads per inch**	**Will Fit Hole Drilled with Core Bit Size**
	in.	**mm**	**in.**	**mm**		
RW	1.144	36.5	1.19	30.1	5	EWT, EWG, EWM
EW	1.81	46.0	1.50	38.1	4	AWT, AWG, AWM
AW	2.25	57.1	1.91	48.4	4	BWT, BWG, BWM
BW	2.88	73.0	2.38	60.3	4	NWT, NWG, NWM
NW	3.50	88.9	3.00	76.2	4	HWT, HWG
HW	4.50	114.3	4.00	101.6	4	4 X 5-1/2
PW	5.50	139.7	5.00	127.0	3	6 X 7-3/4
SW	6.63	168.2	6.00	152.4	3	6 X 7-3/4
UW	7.63	193.6	7.00	177.8	2	---
ZW	8.63	219.0	8.00	203.2	2	---

Drill Rods							
Size Designation	**Rod and Coupling Outside Diameter**		**Rod Inside Diameter**		**Coupling Bore, Threads**		
	in.	**mm**	**in.**	**mm**	**in.**	**mm**	**per in.**
RW	1.09	27.7	0.72	18.2	0.41	10.3	4
EW	1.38	34.9	1.00	25.4	0.44	11.1	3
AW	1.72	43.6	1.34	34.1	0.63	15.8	3
BW	2.13	53.9	1.75	44.4	0.75	19.0	3
NW	2.63	66.6	2.25	57.1	1.38	34.9	3
HW	3.50	88.9	3.06	77.7	2.38	60.3	3

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Overburden and Bedrock Screened Monitoring Well Installation

This protocol documents the procedure for installation of monitoring wells in overburden and bedrock. This protocol was prepared according to conventional practices and ASTM Method D 5092-90.

Guidelines for using this protocol

This protocol provides guidance on the way to install monitoring wells. Individuals who implement this protocol must be trained in the installation of monitoring wells.

Objective

This protocol has the following objectives:

- Provide a means to collect representative ground water quality samples
- Provide a method to evaluate the hydrogeological conditions of a site
- Provide a standard for durable and reliable construction of monitoring wells

Method

The typical steps to install monitoring wells are the following:

1. Identify project objectives.

2. Identify well location (clear of all subsurface utilities).

3. Identify well drilling method and drill borehole. See the appropriate protocol.

4. If the well is to be used to monitor ground water quality, the well screen, plug, and riser should be certified clean from the manufacturer. If they are not, clean them with a high pressure steam cleaner.

5. Inspect the well construction materials for proper specifications and integrity.

6. Measure and record depth of borehole and the lengths and quantities of all materials placed in the hole. This includes, but is not limited to, screen interval, blank casing or riser length, and pack, bentonite seal, grout, and protective casing.

7. Install the screen and riser assembly to the predetermined depth. See that the well is straight. Use centralizers if necessary.

8. Compute and measure the volume of filter pack required to fill the annular space; record these data on the well completion diagram during installation. Emplace the filter pack in increments; this procedure enables you to monitor progress carefully and to prevent bridging. If bridging occurs, break the bridge before proceeding with installation. The filter pack should extend a minimum of 2 ft above the top of the screen.

9. Withdraw the augers or temporary casing in the stipulated increments. To limit borehold collapse the lowest point of casing or auger should not be more than 2 ft higher than the top of filter material.

10. Tremie a bentonite pellet or slurry seal above the filter pack. If bridging in the tremie pipe occurs, the pellets may be allowed to free fall. Tamp the pellets into place with a weighted tape. If the seal is installed above the water table take care to see that the sealant is hydrated. The minimum thickness of the bentonite seal should be 2 ft.

11. Once the grout is prepared, tremie it to the top of the bentonite seal. It should be installed from the bottom of the hole upward. This reduces the opportunity for void spaces to develop in the grout.

12. Install a protective casing, which extends below the frost line, to slightly above the top of the well casing. Drill a weep hole into the protective casing so that accumulated water can drain. See that the well identification is clearly visible on the inside and outside of the lid of the protective casing.

Technical basis

The following items are important considerations when the hydrogeologists install screened monitoring wells:

- Select inert well construction materials such as PVC or stainless steel to produce representative ground water samples.
- The well screen should be new, machine slotted or continuous wrapped-wire wound. The screen should be plugged at the bottom. The screen slot size should be selected based on the grain size of the stratum to be monitored. In addition, the screen lot size should retain at least 90% of the filter.
- The use of a stabilizer or centralizer to maintain plumbness, particularly for deep wells (greater than 50 ft).
- Filter pack should be compatible with screen slot size.
- Bentonite pellets provide a relatively low permeable plug to prevent vertical migration or cross contamination.
- If the well is to be used to monitor ground water quality, the grout mixture must be pH neutral so as not to modify the pH of the ground water.
- A stable borehole must be constructed before installing the well. Boreholes that are not straight or are partially obstructed should be corrected before installation.
- The primary well screen filter pack should consist of material of known chemistry, usually siliceous. The thirtieth percentile grain size value of the filter (the size greater than 30% of the filter pack particles) must be four to ten times the equivalent thirtieth percentile grain size value of the stratum being monitored. The filter material should have a uniformity coefficient less than or equal to 2.5.
- Cement should be one of the five Portland types specified in ASTM C 150. Quick setting cement containing additives should not be used because the additives may leach from the cement and affect the chemistry of the ground water.
- Threaded joints are recommended. If the stainless steel casing is not threaded, the joints should be beveled for welding. If the well installation technique requires hammering, the casing should be both threaded and welded to maintain integrity.

Limitations

When a monitoring well is installed, the following factors should be watched:

- The grain size in the aquifer may be such that the ground water quality sample cannot be free of turbidity.
- Instability of the aquifer may cause voids to develop in the filter pack, bent, seal, and grout installation.

Considerations

The following are important factors that the individual responsible to install screened monitoring wells, observation wells, and piezometers should consider:

- If the well is to be used to monitor ground water quality, water used in the installation of the well should be obtained from a source with known chemistry and should not contain constituents that could compromise the integrity of the well.
- The riser should be new and constructed with a material that is compatible with the screen construction material.
- The mixing of a grout backfill should be performed in accordance with the manufacturer's specification. The grout should be mixed with a paddle-type mixer or be recirculated through a pump until lumps have disintegrated.

Overburden and Bedrock Screened Monitoring Well Installation

This protocol documents the procedure for installation of monitoring wells in overburden and bedrock. This protocol was prepared according to conventional practices and ASTM Method D 5092-90.

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Method

The typical steps to install monitoring wells are the following:

1. Identify project objectives.

2. Identify well location (clear of all subsurface utilities).

3. Identify well drilling method and drill borehole. See the appropriate protocol.

4. If the well is to be used to monitor ground water quality, the well screen, plug, and riser should be certified clean from the manufacturer. If they are not, clean them with a high pressure steam cleaner.

5. Inspect the well construction materials for proper specifications and integrity.

6. Measure and record depth of borehole and the lengths and quantities of all materials placed in the hole. This includes, but is not limited to, screen interval, blank casing or riser length, and pack, bentonite seal, grout, and protective casing.

7. Install the screen and riser assembly to the predetermined depth. See that the well is straight. Use centralizers if necessary.

8. Compute and measure the volume of filter pack required to fill the annular space; record these data on the well completion diagram during installation. Emplace the filter pack in increments; this procedure enables you to monitor progress carefully and to prevent bridging. If bridging occurs, break the bridge before proceeding with installation. The filter pack should extend a minimum of 2 ft above the top of the screen.

9. Withdraw the augers or temporary casing in the stipulated increments. To limit borehold collapse the lowest point of casing or auger should not be more than 2 ft higher than the top of filter material.

10. Tremie a bentonite pellet or slurry seal above the filter pack. If bridging in the tremie pipe occurs, the pellets may be allowed to free fall. Tamp the pellets into place with a weighted tape. If the seal is installed above the water table take care to see that the sealant is hydrated. The minimum thickness of the bentonite seal should be 2 ft.

11. Once the grout is prepared, tremie it to the top of the bentonite seal. It should be installed from the bottom of the hole upward. This reduces the opportunity for void spaces to develop in the grout.

12. Install a protective casing, which extends below the frost line, to slightly above the top of the well casing. Drill a weep hole into the protective casing so that accumulated water can drain. See that the well identification is clearly visible on the inside and outside of the lid of the protective casing.

Technical basis

The following items are important considerations when the hydrogeologists install screened monitoring wells:

- Select inert well construction materials such as PVC or stainless steel to produce representative ground water samples.
- The well screen should be new, machine slotted or continuous wrapped-wire wound. The screen should be plugged at the bottom. The screen slot size should be selected based on the grain size of the stratum to be monitored. In addition, the screen lot size should retain at least 90% of the filter.
- The use of a stabilizer or centralizer to maintain plumbness, particularly for deep wells (greater than 50 ft).
- Filter pack should be compatible with screen slot size.
- Bentonite pellets provide a relatively low permeable plug to prevent vertical migration or cross contamination.
- If the well is to be used to monitor ground water quality, the grout mixture must be pH neutral so as not to modify the pH of the ground water.
- A stable borehole must be constructed before installing the well. Boreholes that are not straight or are partially obstructed should be corrected before installation.
- The primary well screen filter pack should consist of material of known chemistry, usually siliceous. The thirtieth percentile grain size value of the filter (the size greater than 30% of the filter pack particles) must be four to ten times the equivalent thirtieth percentile grain size value of the stratum being monitored. The filter material should have a uniformity coefficient less than or equal to 2.5.
- Cement should be one of the five Portland types specified in ASTM C 150. Quick setting cement containing additives should not be used because the additives may leach from the cement and affect the chemistry of the ground water.
- Threaded joints are recommended. If the stainless steel casing is not threaded, the joints should be beveled for welding. If the well installation technique requires hammering, the casing should be both threaded and welded to maintain integrity.

Limitations

When a monitoring well is installed, the following factors should be watched:

- The grain size in the aquifer may be such that the ground water quality sample cannot be free of turbidity.
- Instability of the aquifer may cause voids to develop in the filter pack, bent, seal, and grout installation.

Considerations

The following are important factors that the individual responsible to install screened monitoring wells, observation wells, and piezometers should consider:

- If the well is to be used to monitor ground water quality, water used in the installation of the well should be obtained from a source with known chemistry and should not contain constituents that could compromise the integrity of the well.
- The riser should be new and constructed with a material that is compatible with the screen construction material.
- The mixing of a grout backfill should be performed in accordance with the manufacturer's specification. The grout should be mixed with a paddle-type mixer or be recirculated through a pump until lumps have disintegrated.

Hydraulic Testing with Packer Installation

The following provides details regarding the methodology to be used to complete hydraulic testing with the installation of a packer assembly.

Packer Installation and Testing

The packer assembly will consist of a packer string that includes two inflatable rubber packers mounted to a 1-inch diameter steel pipe that extends to the ground surface. The spacing between the packers will be 10 ft unless individual borehole conditions dictate otherwise. A 2-ft section of the pipe between the packers will be perforated to allow the introduction or withdrawal of water from the packed-off section.

The packer string will be lowered into the borehole. Upon reaching the test interval, the packers will be inflated to isolate the test interval. The packer will be inflated to the operating inflation pressure specified by the packer manufacturer. The packer seal will be evaluated subsequent to inflation by allowing the packer assembly to free hang in the recovery well and observing whether the inflated packer can support the weight of the packer assembly.

Once the packer assembly has been inflated a transducer will be installed in the 1-inch diameter pipe and the hydraulic head in the packed-off interval will be monitored until the head has stabilized. At that point a conventional in-situ hydraulic conductivity test will be performed.

Following the completion of the in-situ hydraulic conductivity test, the packers will be deflated and moved to the next test interval.

In Situ Hydraulic Conductivity Tests

Introduction

The hydraulic conductivity of a hydraulic unit (aquifer) may be investigated by a field procedure known as *in situ* hydraulic conductivity testing (also known as slug or bail tests). The field procedure requires the creation of an instantaneous hydraulic head differential between the water level within the well as compared to the water level in the target formation. The *in situ* hydraulic conductivity test method presented below involves the instantaneous insertion or removal of an inert solid object, a slug, into or out of the well and the monitoring of the time required for the water level to return to equillibrium. Other methods available to create the instantaneous change in head are through the use of a true water slug or the release of a vacuum or pressure on a tightly capped well. The water level response in the well is a function of the differential head created and the hydraulic conductivity and coefficient of storage of the aquifer.

Objectives

Objectives:

- Evaluate hydraulic conductivity of a ground water zone.

- Evaluate transmissivity of a ground water zone.

Scope:

- This protocol provides guidance on the field procedure for performing an *in situ* hydraulic conductivity test.

- A physical slug of a known volume, composed of inert material such as solid PVC or teflon, is the preferred tool to create the instantaneous change in head.

- This protocol presents recommended procedures to be used to evaluate the *in situ* hydraulic conductivity test results.

Technical Considerations

- Subsurface materials have different saturated hydraulic conductivities due to texture, the degree of lithification, and the development of secondary permeability by fracturing.

- Ground water flows into or out of a well in response to a change in the hydraulic head in the well relative to the surrounding aquifer. The rate of ground water flow is directly related to the magnitude of the head change, the well intake cross sectional area, and the hydraulic conductivity of the aquifer.

- *In situ* hydraulic conductivity testing frequently is the most effective field testing procedure available to evaluate low hydraulic conductivity formations.

- The fundamental basis for determining hydraulic conductivity from *in situ* hydraulic conductivity testing is the monitoring of the rate of return of the water level in the well to equilibrium conditions after a change in head is created.

- Analytical solutions for evaluating the *in situ* hydraulic conductivity test data must be chosen depending upon assumptions about the materials surrounding the well and the storage conditions of the ground water zone.

Limitations

- Interpretations typically assume a simple horizontal layered earth with no lateral heterogeneities.

- Subsurface heterogeneities can affect the accuracy of the test results.

- Near-well conditions such as sand/gravel pack, poor well development, skin effects (such as borehole smearing) and well bore storage can affect the accurracy of the test results.

- *In situ* hydraulic conductivity tests require that the initial change in head be "instantaneous". In formations which have high hydraulic conductivities the use of automated data recording equipment is necessary to document the rapid changes in water levels in the well. The accuracy of the *in situ* hydraulic conductivity test interpretation is compromised if the initial change in head in the well is not "instantaneous" relative to the recovery time of the water level in the well. A rule of thumb for deciding whether a slug is "instantaneous" is that the time required for the water level to return to equilibrium is 30 times longer than the time involved in the insertion of the slug.

- Formations with high hydraulic conductivities can be subject to "noise" due to pulsing water in the well. This can lead to erroneous interpretations of the data set.

- Interpretations are not unique. Incorrect assumptions of the conditions which affect the test will provide results which do not accurately reflect site conditions. Therefore, care must be taken in identifing the conditions of the test, selecting the interpretation method, and selecting the input parameters to be used in the interpretation.

- The calculated value of hydraulic conductivity from an *in situ* hydraulic conductivity test is an estimate and only reflects the hydraulic properties in the immediate vicinity of the test well.

- Storage coefficient cannot be satisfactorily determined using *in situ* hydraulic conductivity tests.

- The existing methods of interpretation for *in situ* hydraulic conductivity tests are based upon ideal assumptions which are typically not found in the real world.

- The method of well installation, the frequency and type of use of a well, the screen interval, and the nature of the well development can affect the results of an *in situ* hydraulic conductivity test.

- The presense of light non-aqueous phase liquid (LNAPL) or dense non-aqueous phase liquid (DNAPL) can affect the accuracy of the data collected from the *in situ* hydraulic conductivity test.

Equipment Requirements

- A water level indicator with hundreds of a foot measurement increments or a pressure transducer connected to a data logger system.
- A inert solid slug of sufficient diameter and length to artificially raise or lower the water level one foot or more in the well (commonly either a PVC or teflon slug).
- A timing device.

IN SITU HYDRAULIC CONDUCTIVITY TEST PROTOCOL

This section presents the field protocols for the completion of *in situ* hydraulic conductivity tests.

Test Design

A. Identify the test objectives and document them.

B. Identify potential limitations of test and interpretation methods as they relate to the project and site.

C. Identify the available database for correlation purposes (other hydraulic conductivity test data, maps or logs of subsurface soils).

D. Evaluate access to wells and obstructions or siltation in wells.

E. Review boring and well completion logs for wells to be tested for lithology, natural discontinuities, possible well yield, screen length, location of ground water table with respect to the screen interval, and type of sand/gravel pack.

F. Determine the type of *in* situ hydraulic conductivity test to be used.

1. Only use a rising head test if the screened interval of the well straddles the water table. The introduction of water into the unsaturated portion of the formation during a falling head test will result in an inaccurate estimation of hydraulic conductivity.

2. If the screened interval of the well is fully submerged below the water, use both the rising or falling head test and average the results.

G. Evaluate the amount of head change to be induced in the well.

H. Evaluate the water level measurement frequency needed.

1. During the early portions of the test, measure water levels at closely spaced intervals. The frequency of measurements will be governed by the rate of recovery of the water level in the well. The faster the recovery the more frequent the measurements need to be made. Measurement frequency can decline logarithmically during the test (the length of time between measurements increasing during the test). Water levels should be recorded until the water level has recovered to 95% of static pre-test conditions.

I. Determine the type of slug and water level recording device to be used.

1. Choose manual or electronic method based upon previously determined hydraulic conductivity (K) values or expected K based upon grain size encountered within the well:
   a. If $K > 10^{-3}$ cm/sec use pressure transducer
   b. If $K < 10^{-3}$ cm/sec use pressure transducer or manual method.

Field Protocols

A. Record the following information in the project field book:

Name
Date

Client name and job description
Client and job number
Weather conditions
Well number and well location in sufficient detail to relocate

B. Measure and document static head. If a presure transducer is to be used lower transducer into well and secure the pressure transducer cable to the well to prevent movement. Connect pressure transducer to electronic data logger. Measure the static head with both the transducer and manually. Then start the automatic recording by the data logger.

C. Insert the slug into or withdraw the slug from the ground water in the well.

1. Given the variability of test conditions, there is no absolute requirement for the magnitude of the change in water level. It is suggested that a minimum of 1 foot instantaneous hydraulic head change be created to allow for effective measurement of aquifer response. About 75% of the estimated displacement by the slug should be documented in the water level recordings.

D. Measure the recovery of the water level in the well until 95% recovery to static conditions has been achieved.

1. For manual measurements record the time (real or elapse time) and the depth to ground water in the well in the project field book. All of the meausements should be from the same point on the well casing using the same well probe.
2. For pressure transducer the time and water level will be automaticaly recorded.

E. Data Review

1. Make sure the necessary information is documented for each test.
2. Make preliminary analysis of data before leaving the field to determine if test was successful:
   - a. Did the slug create an instantaneous head change in the well of sufficient magnitude to observe a meaningful water level response?
   - b. Did you collect a sufficient number of data points to define the water level recovery for the test?
   - c. Is the test data generally consistent with your pre-test expectations.
   - d. If the test was not successful, reevaluate the test design and complete a new test.

3. For electronic tests copy the data file onto a disk and label the disk with project number, date, test well and file name.

IN SITU HYDRAULIC CONDUCTIVITY TEST DATA INTERPRETATION

This section presents guidance for analyzing *in situ* hydraulic conductivity test data.

- The incremental change in head with time is utilized to calculate the hydraulic conductivity of the target aquifer.

- The following information is required to initialize the data set prior to analysis:
  - date, time and well identification;

- identification of rising versus falling head test;
- inside diameter of well screen and riser casing;
- screen length;
- borehole diameter;
- sand pack length;
- aquifer thickness;
- depth of well;
- pre-test static water level;
- location of static water level relative to screen interval;
- record of the reference point for water level measurements; and,
- recorded water levels which include date, clock time, and cumulative time since test inception. If the water levels are recorded with a pressure transducer, then the data file name must be recorded.

- Hydraulic conductivity can be calculated via one of the following methods:

A. Bouwer and Rice (1976)
B. Hvorslev (1951)

It is recommended that the Bouwer and Rice method be used for unconfined aquifers. For confined aquifers the Hvorslev method is recommended.

Important Points

- Double check calculations

- Each of the above methods assumes certain test and aquifer conditions. Select the interpretation method which is capable of most accurately approximating test conditions. Document the method selected and why.

- For formations which are finer grained than the sand pack: if the water level is above the top of the sand pack, the screen length should reflect the saturated length of the sand pack. If the water level is below the top of the screen then the length of the well screen should reflect the length of saturated sand pack.

- If the water level is below the top of the screen in formations which are finer grained than the sand pack, the well radius used must consider the borehole diameter and the porosity of the sand pack. The effective radius “r_e “ can be calculated using the following equation:

$$r_e = ((r_c)^2(1-n) + (n(r_w)^2)^{1/2}$$

where: r_e = effective well radius (L)
r_c = radius of well casing (L)
r_w = radius of borehole (L)
n = porosity of sand pack (dim)

- If the screened interval contains significant layering of fine and coarse grained soils, then the hydraulic conductivity of the coarse grained soils will be higher than the bulk hydraulic conductivity calculated via the testing procedure. The following formula should be employed to estimate the hydraulic conductivity of the coarse grained layers:

$$K_s = K_b/s\%$$

where s% is the percent thickness of the coarse grained layers (or more permeable material) in the screened interval, K_b is the bulk hydraulic conductivity and K_s is the hydraulic conductivity of the more permeable layers.

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Ground Water Sampling

Guidelines for using this protocol

This protocol provides methods and procedures for the collection of representative ground water samples using a bailer or pump. The type of analysis for which a sample is collected determines the type of container, preservative, holding time, and filtering requirement. Individuals who implement this protocol must have been trained in ground water sampling.

Objective

This protocol is designed to reduce variability and to encourage continuity in sample collection among samplers who collect ground water samples. The objectives of this protocol are the following:

- To enable personnel to collect representative samples of ground water for laboratory analysis
- To assess the horizontal and vertical distribution of pollutants in a water-bearing unit.

Technical basis

The sampler must follow correct procedures in order to collect samples that are representative of the ground water. It is the responsibility of the sampler to see that the sample is neither altered nor contaminated by the sampling and handling procedures.

The existing ground water in the casing of the well and near the well may not be representative because of the influence of the well installation. Therefore, well is purged to remove the water within the well casing and to draw ground water that is representative of the formation.

The hydrogeological environment in the subsurface is different from that at the surface. The water's temperature, gas content, reduction-oxidation potential, and other physical, biological, and chemical conditions usually vary between the subsurface and the surface. When the sampler follows appropriate procedures, the sample will typify subsurface ground water conditions.

Before collecting the sample, the common practice is to purge the well (with pump or bailer) until three or more well-volumes have been removed. The pump should not be lowered to the bottom of the well before the well is purged because it will inhibit the complete purging of the well.

The following methods may be used to evaluate the purging of a well:

- Monitor the water level in the well while pumping it. When the level has stabilized, most of the water being pumped will be coming from the aquifer.
- Monitor the temperature, specific conductivity, and pH of the water while pumping it. When they are stable, little or no water should be coming from the casing's storage.

Effective purging is also possible by initially pumping or removing water from the top of the water column and then slowly moving the pump through the water column.

Sampling systems can alter the physical, chemical, and biological conditions of the ground water. Equipment that constricts the flow of the water can change the pH of the sample simply because it changes the partial pressure of the sample's dissolved gases. Equipment that introduces dissolved oxygen in the sample can alter organic and inorganic constituents. Turbulence and reduction of pressure can change the levels of dissolved oxygen, carbon dioxide, and volatile organic compounds.

The sampling equipment should not be allowed to affect the sample. The sampling system used depends on several factors, including the type and size of the well, pumping level, type of contaminant, analytical procedures, and the presence or absence of permanent pumping fixtures. Appendix A discusses various sampling systems.

Method

At the outset of ground water sampling, follow these instructions. Record field notes with waterproof ink in a bound and sequentially numbered field notebook. Dedicate a single field notebook to each project. Include the following in the daily field notes at a minimum:

- project name and number
- client name
- date and time
- weather conditions
- sampler's name
- project objective(s)

Throughout the sampling round, record the following items as appropriate:

- sample location(s)
- well designations
- limiting field conditions
- problems encountered

For activities that take place in the field, O'Brien & Gere personnel must follow the appropriate procedures for health and safety.

The procedure a sampler should use to sample ground water observation wells depends on the size and depth of the well to be sampled and the volume of ground water in the well. Samplers document their procedures on a Ground Water Field Sampling Log. Appendix B presents an example of that form.

To obtain representative samples from wells containing only a few gallons of ground water, the bailing procedure is preferred. To obtain representative samples from wells containing more than a few gallons of ground water, evacuation by pumping is generally more efficient. The procedures below are divided into four subsections:

1. Collection of descriptive data
2. Bailing
3. Pumping
4. Procedure after collecting sample.

When sampling, determine the objectives of the project, the extent of the sampling effort, the sampling methods to be used, and the equipment and supplies that are needed. Obtain the appropriate sampling, filtering, and monitoring equipment. Decontaminate or pre-clean the equipment. Check to see that it is in working order. Prepare the sampling schedule and check the schedule with staff, clients, and regulatory agencies as required.

Collection of descriptive data

Before collecting a sample with either a bailer or pump, data are compiled about the well and the ground water in the well. Before collecting the sample, measure the water level to ascertain the volume of ground water to be removed from the well. This datum also is used for other hydrogeological evaluations. Where appropriate, measure the thickness of NAPL. Follow these steps to measure the water level:

1. Survey the site to locate wells.
2. Check that the water level measuring equipment is operating correctly.
3. As feasible, begin measuring at wells with the least amount of contamination and proceed to those that are more contaminated.
4. Record in field book changes in the well such as erosion or cracks in protective concrete pad or the integrity of the well.
5. Don a new pair of disposable gloves.
6. Slit the center of a plastic sheet, and slip sheet over the well. This creates a clean surface on which the sampling equipment can be positioned.
7. Clean meters, tools, and sampling equipment before placing them on the plastic sheet.
8. Using a pre-cleaned electric water level probe, measure the depth to the ground water and the depth to the bottom of the well twice. Note the measuring points on the well's casing. If Non-aqueous Phase Liquid (NAPL) is present, use an oil-water interface probe to estimate its thickness. Record this information in the Ground Water Sampling Field Log.
9. Decontaminate the well probe. Rinse it with distilled water after use.
10. Compute the volume of water in the well. Use the following equation for the calculation:

well volume = $\pi r^2 h$ (7.48)

r = radius of well
h = height of water column

The measures for *r* and *h* are in feet; the well volume is in gallons. Table 304-1 shows the volume of water found in wells of typical sizes.

Table 304-1. ***Examples: volume of wells per length***

diameter (inch)	volume (gal/ft)
2	0.1632
3	0.3672
4	0.6528
6	1.4688

To find the total volume of water, multiply the values in the second column of Table 304-1 by the total length of the water column in the well. Record this volume on the Ground Water Field Sampling Log. For low permeable formations, the water in the sand pack must also be purged. Calculate the purge volume based on the borehole's radius.

Having completed those steps, you proceed to collect the sample. Follow these steps to collect the sample:

a. Attach a bailer to a length of clean polypropylene rope to reach the bottom of the well. Lower the bailer slowly into the well. Submerge it only far enough to fill it one-half full. The purpose of this initial bail is to ascertain the presence of Light Non-aqueous Phase Liquid (LNAPL).

b. Collect a sample to assess appearance:

  i. Remove the bailer from the well. Keep the polypropylene rope on the plastic sheet.
  ii. Transfer the recovered ground water from the bailer to a clean glass container.

iii. On the Ground Water Sampling Field Log, record the appearance of the sample, including the presence of a sheen, odor, and turbidity.

Note: This sample will not undergo laboratory analysis. It is collected to observe the appearance of the ground water only.

c. Collect a sample to assess the presence of a Dense Non-aqueous Phase Liquid (DNAPL):

i. Lower the bailer slowly to the bottom of the well.
ii. Retrieve a sample of water at the base of the well.
iii. Transfer the recovered ground water from the bailer into a clean glass container.
iv. On the Ground Water Sampling Field Log, record the appearance, including the presence of a separate-phase liquid, odor, and turbidity.

Note: This sample will not undergo laboratory analysis and is collected to ascertain the presence of NAPL.

The subsequent steps of the sampling depend on whether you are using a bailer or pump to collect the sample. Follow the instructions in the appropriate subsection below.

Bailing

Use the following steps to withdraw ground water from a well with a bailer:

a. To bail the well, follow these steps:

i. Lower the bailer to the bottom of the well. Move the bailer up and down to resuspend any material that may have settled to the bottom of the well.
ii. Initiate bailing of the well from the bottom. Keep the polypropylene rope on the plastic sheet. Pour the ground water from the bailer into a container of known volume to measure the volume withdrawn from the well.
iii. Continue bailing the well through the water column and from the bottom until a sufficient volume (at least three well volumes) has been removed or until the well is dry. If the well is dry, allow sufficient time for the well to recover before proceeding.

During the removal of successive well volumes, measure the water temperature, pH, and conductivity with calibrated meters. Record the data on the Ground Water Sampling Field Log.

b. Keep sample bottles cool and with their caps on until they are ready to receive samples. The type of analysis for which a sample is collected determines the type of container, preservative, holding time, and filtering requirement. Samples are transferred directly from the sampler to the container. The container should hold any necessary preservative and should be correctly labeled before the sample is transferred to it.

When you are ready to fill the bottles, remove them from their transport containers. Prepare them to receive the samples:

i. Inspect labels to see that the samples are properly identified.
ii. Arrange the sampling containers to allow for convenient filling:

- Fill the containers that will undergo analysis for volatile organic compounds (VOC) first.

- If necessary, collect both a filtered and unfiltered sample for ground water that will be analyzed for metals.

c. Examine the sample containers and verify they are labeled. Collect the samples in the following way:

   i. Minimize agitation of the water in the well; begin sampling by lowering the bailer slowly into the well. Lower it only far enough to fill it completely.
   ii. Fill each sample container in accordance with the QAPP or other sampling outline.
   iii. Return each sample bottle to its proper transport container.
   iv. Record the appearance of the ground water on the Ground Water Sampling Field Log.

Keep these considerations in mind:

- If the sample bottle cannot be filled quickly, keep them cool with the caps on until they are filled.
- The VOC containers should be filled first, from one bailer, then securely capped.
- **Samples must not be allowed to freeze**.

d. Take these actions after the last sample has been collected:

   i. Record the date and time.
   ii. Place a sample of well water in a beaker. Measure and record the pH, specific conductivity, turbidity, and temperature on the Ground Water Sampling Field Log.
   iii. Rinse the beaker with distilled water before reuse.

Continue with the procedures described below in subsection 304.4.5., "Procedure after collecting sample."

Pumping
Use the following steps to withdraw ground water from a well with a pump:

a. Prepare the pump for operation. Follow the manufacturer's directions.
b. To withdraw water from the well, follow these steps:

   i. Lower the pump to just below the top of the water column.
   ii. Pump the ground water into a graduated pail. Continue pumping until sufficient well volumes (at least three) have been removed or the well is pumped dry. Lower the pump's intake as necessary.
   iii. If the well is pumped dry, allow sufficient time for the well to recover before proceeding. Record this information on the Ground Water Field Sampling Log.

c. Arrange the sampling containers to allow for convenient filling:

The type of analysis for which a sample is collected determines the type of container, preservative, holding time, and filtering requirement. Samples are transferred directly from the sampler to the container. The container should hold any necessary preservative and should be correctly labeled before the sample is transferred to it.

- Fill the containers that will undergo analysis for volatile organic compounds (VOC) first.
- If necessary, collect both a filtered and unfiltered sample for ground water that will be analyzed for metals.

d. Collect the samples that will be analyzed in the following way:

    i. With the pump raised to a level just below the surface of the water in the well, fill each sample container in accordance with requirements of the QAPP or other sampling outline.
    ii. Return each sample bottle to its proper transport container.
    iii. Record the appearance of the ground water on the Ground Water Sampling Field Log.

e. Perform the following tasks after the last sample has been collected:

    i. Record the date and time.
    ii. Place a sample of well water in a beaker. Measure and record the pH, specific conductivity, turbidity, and temperature on the Ground Water Sampling Field Log.
    iii. Rinse the beaker with distilled water before reuse.

Keep these considerations in mind:

- If the sample bottle cannot be filled quickly, keep them cool with the caps on until they are filled.
- The containers labeled VOCs should be filled first from one bailer then securely capped.
- **Samples must not be allowed to freeze.**

f. Remove the pump from the well.

Procedure after collecting sample
After you have collected the sample, follow these practices to complete the documentation and leave the well intact and secure:

a. Pack and log the sample. Put the samples in a cooler containing ice or coolant pack. Ship samples within 24 hrs or as specified in the work plan or QAPP, whichever is shorter. Include adequate packing and coolant with the samples so that the samples arrive unimpaired.

b. Begin the chain of custody. If necessary, refer to TPPI 101.

c. Replace the well cap, and lock the well protection assembly before leaving the well location.

d. Put the polypropylene rope, gloves, and plastic sheet in a plastic bag for disposal.

e. Decontaminate the equipment:

Bailer. Follow decontamination procedures discussed in the QAPP, another sampling outline, or TPPI 105. Wrap the decontaminated bailer in aluminum foil.

Pump. Clean the pump and associated tubing both internally and externally:

    i. Rinse with wash water (and acetone or methanol mixture as necessary) and distilled water using disposable towels and separate wash basins.
    ii. Return the pump to its covered storage box.

f. Place the polypropylene rope, gloves, and plastic sheet into a plastic bag for disposal.

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Informative appendix A: Sampling systems

Bailer. A bailer is a simple device for sampling well water. A bailer may be a weighted bottle or a capped pipe or an alternative. The bailer is lowered and raised on a length of rope by hand. When a bailer enters the water, a check valve opens and permits the water to enter. When the bailer is retrieved, the weight of the water in the bailer closes the check valve. The water that enters the bailer is that from the lowest level it reached when lowered.

The sample is decanted to a container. The best bailers have a discharge port on the bottom from which the water is decanted to the sample container. If the water is poured from the top of the bailer, the sample may be agitated and aerated and its chemistry changed.

Advantages

- May be constructed from a variety of material. The material should not be incompatible with the parameters to be sampled.
- Economical and convenient such that a separate bailer may be dedicated to each well. This practice can obviate cross-contamination.
- No power required.
- Low ratio of surface to volume reduces off-gassing of VOCs.
- Usually easy to clean.

Disadvantages

- It is sometimes impractical to evacuate stagnant water in a well depending on the size and depth of the well.
- Transfer of samples from the bailer to sample containers can result in agitation or aeration.
- Wells can be cross-contaminated if the equipment is not adequately cleaned after each use or if dedicated equipment is not used.
- The bailer moving through the water column can increase turbidity and mixing in the well.

Suction lift pumps. Centrifugal and peristaltic pumps are common suction-lift pumps. They use externally powered impellers or rotors to draw water from a well to the surface through an intake line.

Centrifugal pumps are the most common. They are portable and have pumping rates of 5 to 40 gal/min. Most centrifugal pumps require a foot-valve on the end of the suction line to help to maintain the pump's pressure differential for suction. Centrifugal pumps may introduce gas into the sample through cavitation if the sample contacts the pump itself. They, therefore, are unsuitable for samples to be analyzed for VOCs or trace metals.

Peristaltic pumps are generally low volume suction pumps. They are suitable to sample shallow wells of small diameter. Pumping rates are generally low; they can be accurately controlled, however.

These pumps can mix air from small leaks in the suction circuit into the sample. This modifies the sample.

Constituents in the well water can sorb to the pumps, tubes, flexible PVC, or silicone rubber, or materials from the tubes can desorb to the water. The samples are thus modified.

A procedure has been developed to obviate some of the effects the pumping can have to modify the samples. Samples may be collected by inserting one end of a tube into the well and connecting the opposite end of the tube to an intermediate container. The pump applies suction to the intermediate container and causes the sample to be deposited into it without contacting the pump.

Submersible pumps. When samples must be collected from depths greater than the capacity of suction lift pumps, submersible pumps can be used. Submersible pumps are lowered and raised in a well by an attached hose or support line. The hose transports the water from the well and houses the electrical cable that controls the pump.

Submersible pumps can modify the physical and chemical character of a sample. The high speed of the pump can cause off-gassing and the loss of VOCs and trace metals. The pump itself also puts the sample under more pressure than is present in the ground. It can, then, cause gases to dissolve into the sample and thus modify the sample. The sample also absorbs heat from the pump motor and is thus further modified from its conditions in the original location.

Submersible pumps provide high flow rates and are efficient for purging a well. To reduce the flow, a restricting device such as a gate valve or reducing orifice in the discharge line is necessary. Such devices can affect the sample and also reduce the motor's life. A more efficient way to reduce the discharge rate of the pump is to control the motor's speed by reducing power.

Water containing silt or sand can damage submersible pumps. They are prone to overheating. The interior and exterior of the portable submersible pumps and discharge lines are cleaned according to TPPI 105.

Bladder pumps. Bladder pumps, gas-operated squeeze pumps, and diaphragm pumps have a flexible membrane tube in a rigid housing, a supply of compressed gas, and appropriate control valves. When the pump is submerged, water enters the membrane tube through the bottom check valve. Gas under pressure is applied to the space between the housing and the membrane to force the water through the sampling tube. When the pressure is released, a check valve stops the sample from flowing down the discharge line, and water from the well again enters the pump through the bottom check valve. The lift capacity of the pump is directly related to the pressure of the compressed gas.

Bladder pumps provide representative samples under a wide range of field conditions. The sample does not contact the compressed gas, thus reducing the potential for stripping of dissolved gases or VOCs. The pressure that drives the pump can be controlled by modifying the force of the compressed gas. The bladder material, however, may affect the chemistry of the sample.

Bladder pumps are not the most efficient for purging wells. They are susceptible to damage from sediment. Inlet screens can reduce the potential for such damage. They can also run dry without damage. They may be difficult to disassemble and clean in the field.

Piston pumps. The two common piston pump designs are the single-acting and dual-acting pumps. The single-action pump is more common. It is a mechanical piston pump referred to as a stationary barrel-type pump. It has a plunger or set of plungers (pistons) that move inside a cylinder (stationary submerged barrel). As the piston moves back and forth in the cylinder under suction, it displaces water from the cylinder.

Piston pumps can provide representative samples for most parameters. Samples may be altered by degassing or stripping volatile constituents by the suction produced during refill of the pump. This effect can be reduced if the pump's cycling rate is reduced. A flow restriction or valve, however, can induce pressure changes that can alter the sample's chemistry. The pump's rate of flow can be controlled if the stroke rate can be controlled.

Sediment can damage piston pumps. Screens on the inlet can reduce the damage. The pumps are also damaged if they run dry. Piston pumps are not easily portable. Pneumatically actuated piston pumps are difficult to disassemble for cleaning.

Low Flow Ground Water Sampling Protocol

Pre-sampling

Prior to sampling, a complete round of ground water elevations will be recorded from the entire site monitoring well network. An electronic water level probe will be used to measure the depth to water in each well. The depth to water will be measured to the nearest 0.01 foot from the surveyed points on the well casings. The depth to water measurements will be recorded in the field log book. In addition to the depth to water measurements, the condition of the well pad, the protective casings and locks, and the well head will also be recorded in the field log book.

Prior to commencing sampling activities, the ground water quality monitoring probes/meters including pH, conductivity, ORP, dissolved oxygen, and turbidity will be calibrated daily in accordance with the manufacturer's instructions. At a minimum, two-point calibrations will be conducted for pH, conductivity, and turbidity. The dissolved oxygen probe will be checked against a zero-dissolved oxygen solution. In addition, the dissolved oxygen calibration will be corrected for local barometric pressure and elevation. Calibration results will be recorded in the field log notebook.

Low-flow purging and sampling procedures

The following describes the low-flow purging and sampling procedures:

1. Don a new pair of gloves, and lay out plastic sheeting on the ground in the vicinity of the well head.

2. Prepare the bladder pumping system for operation. Connect the tubing to the in-line, water quality, indicator parameter meter.

3. Commence well purging by low flow pumping from the well. The flow rate shall not exceed 0.5 liters/min. Initially, a flow rate between 200 ml/min and 500 ml/min will be used. The drawdown will be monitored and the flow rate will be reduced if the drawdown exceeds 0.3 ft. Efforts should be made to minimize the generation of air bubbles in the sample tubing by either increasing the flow rate as appropriate, or restricting the flow by clamping the tubing. Record purge rate on the Low-Flow Ground Water Sampling Log. An example of the Low-Flow Ground Water Sampling Log to be utilized during this project is provided in Exhibit C.

4. During purging, monitor and record pH, specific conductivity, temperature, oxidation-reduction potential (redox), dissolved oxygen, and turbidity at time intervals sufficient to evacuate the volume of the flow-through cell. This time interval can be calculated by dividing the volume of the flow through the cell by the pumping rate.

5. Well sampling can commence after equilibration of water quality parameters. Equilibrated trends are generally obvious and usually follow either an exponential decay or asymptotic trend during purging. The equilibration guidelines are as follows:

Temperature	± 3% of measurement
pH	± 0.1 pH units
Specific conductance	± 3% of measurement
Redox	±10 mV
DO	±10% of measurement
Turbidity	± 10% of measurement

If the indicator field parameters have not equilibrated within the above specified limits after 4 hours of purging, then one of the following options may be taken: 1) continue purging until stabilization is achieved; or 2) discontinue purging and collect samples (document attempts to achieve stabilization). Record total volume of water purged and purging time on the Low-Flow Ground Water Sampling Log for future reference.

6. Ideally, drawdown in the well should not exceed 0.3 ft. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and/or allow stabilization of indicator parameters. If the recharge rate of the well is very low and it appears that the well will be purged dry, the pump should be shut down prior to purging the well dry. Sampling should commence as soon as the well has recharged to a sufficient level to collect the appropriate volume of samples. Sample collection using bailing techniques may be used in this situation. However, turbidity levels shall be maintained as low as possible.

7. Remove the sampling bottles from their transport containers, and prepare the bottles for receiving samples. Inspect all labels to insure proper sample identification. Sample bottles should be kept cool with their caps on until they are ready to receive samples. Arrange the sampling containers to allow for convenient filling.

8. Sample bottles for VOC analyses, containing hydrochloric acid for preservation, will be filled completely so that there is no headspace or bubbles. The VOC sample vials will be examined for proper filling by inverting the vials immediately after filling.

9. Check the pH of field preserved samples. The VOC vials are pre-preserved with 0.5 ml of 1:1 HCl. Prior to collecting the VOC samples, fill one of the pre-preserved vials and use as a test vial to check that the sample pH is less than 2. If the pH is less than 2, fill and cap the appropriate number of VOC sample vials. If the pH is greater than 2, add additional HCl to another pre-preserved vial, fill the vial with sample and check the pH. Repeat this process using new pre-preserved vials until the pH is brought to less than 2.

10. Check the pH of the remaining pre-preserved samples by pouring a small quantity of sample onto the pH paper. Samples preserved with nitric acid (HNO3) and sulfuric acid (H2SO4) should have a pH of less than 2. Samples preserved with sodium hydroxide (NaOH) should have a pH greater than 11. If it is necessary to adjust the pH, add approximately 0.5 ml of the appropriate preservative directly to the sample until the pH within the appropriate range.

11. After the last sample has been collected, record the date and time.

12. Begin preparing the Chain of Custody documentation.

Procedure after taking sample

After taking a ground water sample, follow these practices to complete the documentation and leave the well intact and secure:

1. Pack the ground water sample. The type of analysis for which a ground water sample is collected determines the type of container, preservative, holding time, and filtering requirement. Ground water samples are transferred directly from the sampler to the container. The container should hold any necessary preservative and should be correctly labeled before the sample is transferred to it.

Next, log the ground water sample. Put the ground water samples in a cooler containing ice. Ship the ground water samples within twenty-four hours via overnight delivery. Include adequate packing and ice with the ground water samples so that the samples arrive unimpaired.

2. Complete the chain-of-custody.

3. Replace the well cap and lock the well protection assembly before leaving the well location.

4. Put the gloves and plastic sheet in a plastic bag for disposal.

Passive Bag Ground Water Sampling Procedure

Introduction

Ground water samples will be collected from monitoring wells to evaluate ground water quality. The protocol presented in this appendix describes the procedures to be used to collect ground water samples from monitoring wells using passive-diffusion bag samplers. Passive-diffusion sampling of ground water using a semipermeable membrane is a patented technology [U.S. Patent Number 5,804,743 held by Don A. Vroblesky (U.S. Geological Survey) and William T. Hyde (General Electric Company)].

Passive-diffusion sampling of ground water using a semipermeable membrane was initially studied and described by Vroblesky and Hyde (1997). The method is based on the principal that volatile organic compounds (VOCs) in ground water migrate via molecular diffusion through a semipermeable membrane such as polyethylene until the concentrations on either side of the membrane reach equilibrium. Deionized water sealed within a semipermeable passive-diffusion bag serves as the sample medium, which is placed in the open interval of the monitoring well and removed after an equilibration period. Certain types of VOCs (e.g., some ketones) do not equilibrate rapidly enough for practical sampling using passive bags. Passive-diffusion bags have been successfully benchmarked, however, for many common VOCs including aromatics and chlorinated ethenes and ethanes. Comparative passive-diffusion sampling for other groups of analytes (e.g., semivolatile organic compounds, pesticides, polychlorinated biphenols, and inorganics) has not been demonstrated.

With the passive-diffusion sampling method, it is assumed that the water inside the open interval of a monitoring well represents ambient ground water quality without any purging. This assumption is based on the fact that the wellbore hydraulic conductivity is higher than that of the surrounding formation in almost all geologic settings. Thus, the open interval of the well is assumed to be constantly flushed with ambient ground water. Vroblesky and Hyde (1997) presented results comparing passive-diffusion ground-water sampling results for VOCs to those obtained using other methods, including submersible pump, bladder pump, and bailer. They concluded that the passive-diffusion sampling results were similar to those obtained using the other purging and sampling methods.

Materials

Specific to this activity, the following materials shall be available:

- Site plan, well construction records, prior ground water sampling records (if available);
- Passive-diffusion bag sampler, constructed as described below;
- Water level probe;
- Temperature, pH, specific conductivity, ORP, and/or turbidity meters (optional);
- Appropriate water sample containers; and
- Appropriate blanks (trip blanks supplied by the laboratory).

Procedures

Passive-Diffusion Bag Sampler Construction

Passive-diffusion bag samplers will be purchased from a licensed commercial supplier, or, subject to licensing requirements, may be constructed in a clean, laboratory or office environment according to the following procedures:

Step 1 - Cut a roll of 4-mil polyethylene, flat (2-inch wide) tubing into 18-inch-long sections. Close one end of each cut section using a 24-inch impulse heat sealer to create an elongated bag. In addition, heat seal the two sides of the bag to create a double side seal. Fill the bag with approximately 150 milliliters (ml) of laboratory-grade deionized water. Heat-seal the other end of the bag, taking care to minimize or eliminate headspace.

Step 2 - Place the passive-diffusion bag samplers in a clean plastic bag or wrap in clear polyethylene sheeting, and transport to the site in a cooler containing wet ice to minimize the formation of headspace inside the passive-diffusion bags.

Step 3 - Prior to mobilization to the site, review well construction details and water levels in each well to be sampled. Fabricate well-specific passive bag holders by measuring the line (i.e., nylon, stainless steel, nylon - coated stainless steel or Teflon®– coated stainless-steel line) and attaching the snap hooks on the line such that the deionized water-filled polyethylene bag can be secured by the hooks within the screened or open rock interval of the well and the stainless-steel weight will barely rest on the bottom of the well. Generally, the deionized water-filled polyethylene bag will be placed at the midpoint of the saturated portion of the open interval of the well. For wells with partially saturated screens or open intervals, the deionized water-filled polyethylene bag will be placed at a location corresponding to the approximate midpoint of the water column, or deeper within the water column if necessary, to ensure the placement of the passive bag is 2 to 3 feet below the measured water level. Leave several feet of extra line at the top to facilitate the proper placement of the passive bag sampler within the well. To minimize the potential for contamination, place each well-specific passive bag holder in a labeled zip-sealing bag upon completion for transport to the site. After the first sampling event, the holders may be dedicated to certain wells if stainless-steel or Teflon®-coated stainless-steel line is utilized. The dedicated bag holder may be attached to the top of the well casing or to the well cap to prevent the line from falling into the well during placement of the deionized water-filled polyethylene bag or between sampling events..

Passive-Diffusion Bag Sampler Installation

Step 1 - Don appropriate personal protective equipment (as required by the Health and Safety Plan).

Step 2 - Place plastic sheeting around the well (optional, based on field conditions at the time of sampling and the method used to contain the wire sample holder).

Step 3 - Clean the non-disposable, down-hole monitoring equipment (e.g., water-level probe, field parameter meters).

Step 4 - Open the well cover while standing upwind of the well. Remove well cap and place it in a location that will minimize the potential for contamination. If the historical concentrations of VOCs in the well indicates the potential for exposure to VOCs in the breathing zone, or if no ground water quality information exists for the well, then complete the remainder of this step. If exposure to VOCs is unlikely, then, at the discretion of the sampler, proceed to step 5.

Insert photoionization detector (PID) probe approximately 4 to 6 inches into the casing or the well headspace and cover with gloved hand. Record the PID reading in the field log. If the well headspace reading is less than 5 PID units, proceed; if the headspace reading is greater than 5 PID units, screen the air within the breathing zone. If the breathing zone reading is less than 5 PID units, proceed. If the PID reading in the breathing zone is above 5 PID units, move upwind from well for five minutes to allow the volatiles to dissipate. Repeat the breathing zone test. If the reading is still above 5 PID units, don appropriate respiratory protection in accordance with the requirements of the Health and Safety Plan. Record all PID readings.

Step 5 - Measure the depth to water and the total well depth [if a complete round of water level measurements were obtained prior to conducting the ground water sampling event, redundant water-level measurements do not need to be collected at the actual tine of sampling. Further, total depth measurements will be obtained on an annual basis (typically in October of each year) in conjunction with monitoring network inspection activities.

Step 6 - Remove the appropriate passive-diffusion bag sampler from the shipping container.

Step 7 - Attach the deionized water-filled polyethylene bag to the line of the well-specific passive bag holder or the dedicated holder using the stainless-steel snap hooks.

Step 8 - Slowly lower the passive bag sampler down the well until the stainless-steel weight reaches the bottom of the well indicating that the sampler is properly positioned in the screened or open rock interval. The passive bag sampler will generally be placed at the midpoint of the saturated portion of the open interval of the well.

Step 9 - Secure the line extending above the top of the well riser pipe either to the steel casing or the locking cap.

Step 10 - Close and lock the well.

Step 11 - Record the date and time of placement of the passive bag sampler in the well on the passive bag installation inventory form provided at the end of this attachment.

Step 12 - Allow an equilibration period of 14 days or more before retrieving the passive-diffusion bag. If necessary, the well may be accessed briefly during the equilibration period (e.g., to obtain fluid water level measurements), provided that the line remains at the top of the well casing throughout the equilibration period, which should be a minimum of 14 days.

Passive-Diffusion Bag Sampler Retrieval and Sample Collection

Step 1 - After the equilibration period, unlock and open the well by following Steps 1 through 4 from the installation procedure. Slowly remove the passive-diffusion bag sampler from the monitoring well.

Step 2 - Remove the sample-filled polyethylene bag from the stainless-steel snap hooks and dry with a clean paper towel. Cut a small hole in the sample-filled polyethylene bag using a decontaminated knife or decontaminated stainless-steel scissors. Pour water from the bag directly into appropriate laboratory sample container.

Step 3 - Complete the sample label and place sample container in a cooler containing wet ice.

Step 4 - Record on the passive bag installation inventory form the date and time of sample collection. In addition record in the field log, any pertinent observations of the sample (e.g., physical appearance, the presence of, or lack of, odors, sheens, etc.), and the values of the field indicator parameters, if measured.

Step 5 - Return dedicated holders, if used, to the monitoring well after sampling activities are complete. Close and lock the monitoring well.

Field Quality Control

The following quality control procedures should be observed in the field:

- Samples should be collected from monitoring wells in order of increasing concentration, to the extent known;
- All monitoring instrumentation shall be operated in accordance with manufacturer instructions. Instruments should be calibrated at the beginning of each day, and the calibration should be verified at the end of each day.
- If passive diffusion is being benchmarked versus another sampling method (e.g., low-flow or traditional purge using a pump or bailer), the other sampling method should be performed on the same day that the passive-

diffusion bag is retrieved and sampled at a given well. This protocol will provide the best practicable comparison between the results of the different sampling methods.

- Each passive sampler should be dedicated to a single monitoring well. If a passive-diffusion bag holder is being re-used following a period of storage, the length of the line and position of the snap hooks relative to the sample interval should be verified prior to placement in the monitoring well.

Material Disposal

Materials generated during ground water sampling activities, including disposable equipment, will be placed in appropriate containers. Containerized waste will be characterized and disposed of in accordance with applicable rules and regulations.