REVISED REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN

Former Ozone Industries, Inc. Site

NYSDEC Site # 2-41-033

Order on Consent Index # W2-0922-02-05 (with Endzone, Inc.)

Queens, New York

ENSR Corporation
May 14, 2004
Project No. 08734765

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APPENDICES

1.0 INTRODUCTION

1.1 General

This document presents a detailed Work Plan for conducting a Remedial Investigation (RI) and Feasibility Study (FS) for an area located within a city block in Ozone Park, Queens, New York that is bounded by 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south, and is beneath an abandoned elevated Long Island Railroad (collectively referred to as the Site). To date, no environmental assessment data has been collected at the Site. This RI/FS also pertains to areas in the vicinity of the Site where environmental assessments have occurred (e.g., former Voges Manufacturing Company at 103-22 99th Street and Public School [PS] 65), referred to as the Site vicinity. Environmental assessment data previously collected in the Site vicinity by others is presented herein as background information. The investigation is intended to further evaluate the presence of volatile organic compounds (VOCs) in soil, soil gas and groundwater at the Site and Site vicinity. Figures 1 and 2 depict the Site location.

This revised RI/FS Work Plan has been prepared by ENSR Corporation for the Site in accordance with the Order on Consent between the New York State Department of Environmental Conservation (NYSDEC) and Endzone, Inc. (formerly Ozone Industries, Inc.), with an effective date of February 15, 2003. A copy of the Order on Consent is incorporated into this document as Appendix A. Exhibit A2 of the Consent Order depicts the limits of the Site (Site Location Map), and Exhibit H includes the RI/FS Work Plan requirements.

The original RI/FS Work Plan has been revised following written comments from the NYSDEC in a letter dated December 22, 2003 and subsequent telephone conversations. In addition, ENSR presented to the NYSDEC on January 30, 2004 a letter with response to comments specifically related to the request for an extensive soil gas survey outlined in the NYSDEC December 22, 2003 letter. The original RI/FS Work Plan was submitted to the NYSDEC on April 15, 2003. A copy of the NYSDEC review comment letter is attached in Appendix A. The comments have been addressed and included in this revised RI/FS Work Plan as applicable. Also attached in Appendix A, is a copy of the review comments by the NYSDEC with notes following each indicating how and where the comments are addressed in this revised RI/FS Work Plan if applicable.

The RI/FS will consist of the following activities:

- Surface (if applicable) and Subsurface Soil Investigation;
- Subsurface Soil Vapor Investigation;

- Groundwater Investigation;
- In-Situ Hydraulic Conductivity Testing;
- Site Survey;
- Progress Reports;
- Phase Reports/Additional FFI Work Plan(s) (as appropriate); and
- RI/FS Report.

The organization of this document is outlined below.

1.2 Work Plan Organization

The RI/FS Work Plan is organized into the following sections consistent with the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (DER-10 Guidance).

Section	Purpose
1.0 – INTRODUCTION	Provides a brief overview of the Site and activities to be conducted during the RI/FS.
2.0 – SITE BACKGROUND	Provides a Site description and history, and physical setting. Presents a summary of previous investigations and results in Site vicinity. Provides an overview of the preliminary conceptual site model that presents potential sources of contamination, pathways, receptors and data gaps.
3.0 – SCOPE OF WORK	Describes the proposed RI activities and objectives, including performance of field investigations and site survey, and preparation of RI, FS and progress reports.
4.0 – QUALITY ASSURANCE/QUALITY CONTROL PROTOCALS	References attached Quality Assurance Project Plan.
5.0 – HEALTH AND SAFETY PROTOCOLS	References attached Health and Safety Plan.
6.0 – REPORTING AND PROJECT SCHEDULE	Provides a timetable for completion of RI/FS work tasks.

Section	Purpose
7.0 – CITIZEN PARTICIPATION ACTIVITIES AND REFERENCES	Provides overview of the Citizen Participation Plan and citations to previous investigation reports utilized in preparation of the RI/FS Work Plan.

This Work Plan is supported by a Field Sampling Plan (FSP) (Appendix B), a Quality Assurance Project Plan (QAPP) (Appendix C), a Health and Safety Plan (HASP) (Appendix D), a Community Air Monitoring Plan (CAMP) (Appendix E), and a Citizen Participation Plan (CPP) (Appendix F). These documents have been revised based upon comments received by the NYSDEC on the original RI/FS Work Plan, as discussed above and documented in the documents in Appendix A. The FSP presents procedures for field sampling of various media and the QAPP presents sample collection methods, including analytical methods and quality assurance/quality control (QA/QC) procedures, to be followed during the implementation of the RI. The HASP and CAMP contains procedures and plans to be followed during the RI to protect the health and safety of field personnel and the community. The CPP describes site-specific public participation activities that will take place during the RI/FS process.

1.3 Consistency With Federal And State Laws

The RI/FS Work Plan is consistent with the elements of an RI/FS as set forth in:

- NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, dated December 25, 2002;
- Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook, dated June 1998;
- Community Air Monitoring Plan guidance, New York State Department of Health, dated June 2000;
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 USC 9601 *et seq.*, as amended;
- National Contingency Plan (NCP), 40 CFR Part 300;
- United States Environmental Protection Agency (USEPA) guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA", dated October 1988; and
- NYSDEC Technical Assistance Guidance Manual (TAGM): *Guidelines for Remedial Investigations/Feasibility Studies* (TAGM 4025) and *Selection of Remedial Actions at Inactive Hazardous Waste Sites* (TAGM 4030).

2.0 SITE BACKGROUND

2.1 Site and Site Vicinity Description and History

The Site is located between a block that is bounded by 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south, and is beneath an abandoned elevated railroad (Long Island Railroad abandoned the line in this area between 1955 and 1962). The Site contains 28 individual bays as noted on Figures 3 and 4. (1996 Sanborn Library, LLC Maps of the Site and Site vicinity are attached in Appendix A.) Ozone Industries, Inc. rented/operated for storage purposes a portion of the Site for a period prior to 1998, possibly starting as early as 1961. Copies of leases have been received from the Environmental Law Division of the City of New York Department of Law, and are currently being reviewed. Additional Site history and use information will be provided in the RI report as applicable.

During the period that Ozone Industries, Inc. rented/operated a portion of the Site, a portion was used to store solvents, hydraulic fluids, and scrap metal chips in roll-off containers that resulted from Ozone Industries, Inc. manufacturing activities. As reported, the previous condition of the portion of the Site utilized by Ozone Industries, Inc. was constructed of cinder block walls, and contained a dirt floor. During that period it is believed that releases of solvents, oil and/or fluids which coated the metal chips may have occurred at the Site. The nature and extent of those releases is not presently known. (Site history, and Site descriptions and uses are not provided in reports previously completed for the Site and Site vicinity as summarized below.) At the property across 100th Street from the Site, Ozone Industries, Inc. manufactured aircraft parts including landing gears, hydraulic assemblies, aircraft steering wheel assemblies, flight controls, etc.

Since the Ozone Park facility was sold by Ozone Industries, Inc. in 1998, Endzone, Inc. is not familiar with the nature of the operations at the Site since that time. The bays are owned by the City of New York and leased to various tenants for different uses. In response to NYSDEC comments concerning the historic and current uses of the bays, and to determine what bays are of most concern (i.e., utilized by former Ozone Industries, Inc.), ENSR completed a Site visit in April 2004 with City of New York officials. Only certain bays were accessible because of access issues with the City of New York and the tenants, which could potentially take weeks to resolve for a return Site visit. The insides of bays 8 – 12 were not accessed or viewed as part of the Site visit, and these are the bays believed to have been rented by former Ozone Industries, Inc., one or more of which would be the bay(s) that stored waste material. The insides of these bays will be viewed (and sampled as discussed below) during the proposed RI investigation field work.

Currently, the bays at the site are constructed of various materials (wood, concrete and sheet metal), and are enclosed rooms or open areas surrounded by chain-link fencing, each approximately 50 feet by 30 feet. The bays viewed in April 2004 by ENSR have asphalt or concrete flooring, extend up to the abandoned elevated railroad tracks above the bays, and the entrances to the bays are either on 99th Street or 100th Street. The foundation of the abandoned elevated railroad above the bays is constructed of concrete, most likely covering a metal beam and secured to the ground with metal casing and steel rivets. Various commercial businesses and private clubs occupy the bays as tenants of the City of New York. The current occupants of the bays, based upon the field reconnaissance by ENSR are listed on Figure 3 (a request to the City of New York for a listing of tenants has been submitted by ENSR). Photographs of the Site are attached in Appendix A.

The streets abutting the Site (99th Street and 100th Street, between 101st Avenue and 103rd Avenue) mostly contain commercial businesses and a few residential properties (e.g., 101-02 99th Street). The names of businesses are noted on Figures 3 and 4. The Site vicinity is characterized as mostly containing residential properties intermixed with commercial businesses and public institutions (fire station and public school). Most or all of the buildings in the Site and Site vicinity appear to have basements. Separate entrances to basements in residential properties on the streets abutting the Site are not evident, thus it is assumed that single basement apartments or dwellings are not present in the immediate Site vicinity. The typical building foundation construction material in the Site vicinity includes concrete and brick. Additional Site and Site vicinity reconnaissance will be performed as applicable during the RI investigation and documented in the RI report as discussed below (especially in relation to potential human receptors/pathways and potential vapor intrusion into existing buildings).

The majority of the underground utilities in the Site vicinity are within 6 feet of the ground surface, although some main sanitary sewer lines appear to be deeper (up to 14 feet below ground surface [bgs]) based upon initial information received. ENSR has requested from and received partial information concerning underground utilities from Consolidated Edison, KeySpan, Verizon and New York City Water and Sewer (Department of Environmental Protection). Some of the utilities are depicted on the attached plans, and the existing information and any additional information collected will be evaluated and utilized as applicable in the RI report.

2.2 Previous Investigations – Site Vicinity

The following sections summarize the environmental investigations completed for the Site vicinity on behalf of the NYSDEC, Division of Environmental Remediation. The information is taken from five reports completed between January 2000 and May 2003 as listed in Section 7.2 below. The other reports listed in Section 7.2 contain information regarding environmental conditions at properties formerly owned or operated by Ozone Industries, Inc. and do not pertain to the Site. Summaries of the Ozone Industries, Inc. reports are included in the Records Search Report completed by ENSR pursuant to the Order on Consent (dated March 13, 2003). In addition, ENSR has requested from NYSDEC through the Freedom of Information Law a copy of the report completed by Innovative Engineering Solutions, Inc. entitled *Vapor Extraction System Design for PS 65* (dated September 6, 2002). ENSR has not received a copy yet.

2.2.1 Preliminary Site Assessment (PSA) Report – Public School 65 (former Voges Manufacturing Company) and Ozone Industries, Inc. (January 2000)

This PSA was performed in response to a Phase I and II conducted in 1996 for the New York City School Construction Authority of the former Voges Manufacturing Company at 103-22 99th Street (south of the Site) that was proposed for a school construction. (The School, PS 65 opened in September 1996.) The former Voges Manufacturing Company used the Public School 65 property from 1920 to 1995 for the manufacturing of buttons, molding of plastic parts and machining of aircraft parts.

The Phase I and II work included the installation of groundwater monitoring wells in the vicinity of the former Voges Manufacturing Company property and sampling groundwater for VOCs. Trichloroethene (TCE) was detected in groundwater samples collected upgradient and downgradient (in relation to assumed groundwater flow direction at the time) of the former Voges Manufacturing Company property.

This PSA was conducted by Lawler, Matusky & Skelly Engineers LLP between June and August 1999 and consisted of:

- Installation of 21 probe points and four groundwater piezometers;
- Groundwater sampling for VOC analysis; and
- Measuring groundwater elevations and determining groundwater flow direction.

The 21 probe points included:

- Five on 101st Avenue and 101st Street (upgradient of the Site) (GP-1 through GP-5);
- Ten along 100th Street (east and southeast of the Site) (GP-6 through GP-11, and GP-14 through GP-17);
- Four on 99th Street (GP-18 through GP-21); and
- Two along 98th Street (GP-22 and GP-23).

The piezometers were installed at probe points GP-3, -11, -20 and –23. The probe points are depicted on attached Figures 3 and 4.

The groundwater sampling for laboratory VOC analysis included samples from the 21 probe points collected at approximately 38 feet bgs and at 50 and 60 feet bgs in six of the locations (GP-2, -8, -11, -17, -20 and –23), and samples from the four piezometers.

The results of the assessment are detailed in the PSA, depicted on site plans and summarized in tables. The total VOC levels in groundwater are depicted on attached Figure 4. In general, the following results were reported:

- Samples collected from investigation points upgradient or north of the Site (GP-1 through GP-6, and PZ-1) did not contain VOCs above Class GA groundwater standards and TCE was not detected;
- Samples from investigation points along 100th Street east of the Site contained levels of various VOCs, and TCE levels ranging from 23 micrograms per liter (ug/l) to 2,200 ug/l (GP-17, 40 foot sample);
- The highest TCE levels were detected in water table samples from PZ-2 (6,800 ug/l) and from GP-11 (22,000 ug/l) located adjacent to the Site, with decreasing levels at depth in GP-11 (50 and 60 feet bgs); and
- Samples from the four points on 99th Street (GP-18 through GP-21) and the two along 98th Street (GP-22 and GP-23) contained TCE levels ranging from 70 ug/l to 1,400 ug/l (GP-21) (water table samples). In general, the TCE concentrations (and VOC levels) decreased with depth (GP-20 and –23).

Based upon measurements in the four piezometers at the time of the investigation, it was concluded in the report that the groundwater flow direction was southerly across the Site vicinity.

The report also states that during the Phase II in 1996, seven air samples were collected from within PS 65, and that TCE concentrations ranged from 0.17 to 0.30 parts per billion per volume (ppbv), below the calculated site-specific USEPA risk based criterion of 0.53 ppbv.

2.2.2 Immediate Investigation Work Assignment Field Investigation Letter Report (September 2001)

This report by URS Corporation includes the findings of further investigations performed in the Site vicinity in June 2001, which included:

- Installation of six temporary well points (GP-31 through GP-36);

- Completion of seven soil borings completed as piezometers (PZ-05 through PZ-11);
- Completion of two soil borings (GP-37 and –38);
- Soil sampling for field screening and VOC laboratory analyses;
- Groundwater sampling for VOC laboratory analyses;
- Site survey; and
- Collection of groundwater depth measurements and groundwater flow direction determination.

Investigation points GP-34 through GP-36, and PZ-08 through PZ-10 were completed along 99th Street west of the Site; piezometer PZ-11 was installed along 103rd Avenue between 100th and 101st Streets downgradient or cross-gradient of the Site; investigation points GP-31 through GP-33 and PZ-05 through PZ-07 were completed along 101st Street east of the Site; and borings GP-37 and GP-38 were located within the basement of 101-32 100th Street. All investigation points are depicted on attached Figures 3 and 4.

The groundwater sample depth for the temporary wells was approximately 43 feet bgs. The soil borings (PZ-05 through PZ-11) were completed to depths of 42 feet bgs, and the well installations (one-inch diameter) were completed with 15 feet of screen at depths of 35 to 46 feet bgs. Soil borings GP-37 and GP-38 were completed to depths of six feet bgs. A total of sixteen groundwater samples were collected and laboratory analyzed for VOC, along with two soil samples from GP-37 and GP-38.

The results of the assessment are detailed in the report, depicted on site plans and summarized in tables. The total VOC levels in groundwater are depicted on attached Figure 4. In general the following groundwater results were reported:

- The analyses indicated TCE concentrations ranging from 3 ug/l (GP-31) to 510 ug/l (PZ-08);
- Higher levels were detected in samples from GP-35 (1,600 ug/l), PZ-09 (2,100 ug/l) and GP-36 (2,200 ug/l); all of which were located along 99th Street adjacent to or just south of the Site; and
- The sample from PZ-01 (upgradient along 101st Avenue) contained non-detectable VOC levels.

The results of soil analyses indicated very low levels of TCE (11 and 45 micrograms per kilogram).

Based upon measurements at the time of the work, it was concluded in the report that the groundwater flow direction was southerly across the Site vicinity.

2.2.3 Field Investigation Letter Report for Phase II and Phase II Field Activities (September 2002)

This report by URS Corporation includes the findings of further investigations performed in the Site vicinity in July and August 2002, which included:

- Installation of 19 permanent soil gas wells (SG-01 through SG-19);
- Soil gas sampling and laboratory analyses for VOCs (2 rounds);
- Installation of 19 temporary groundwater monitoring wells at the soil gas locations (GP-01 through GP-19);
- Installation of 11 temporary groundwater monitoring wells along 103rd Avenue (GP-101 through GP-111);
- Completion of nine shallow (MW-01, -06S, -9, -13S, -19, -101, -105, -120S and -121) and three deep (MW-06D, -13D and –120D) permanent groundwater monitoring wells;
- Soil sampling for VOC laboratory analyses;
- Groundwater sampling for VOC laboratory analyses (2 rounds);
- Site survey; and
- Collection of groundwater depth measurements and groundwater flow direction determination.

The well locations are depicted on Figures 3 and 4,and the soil gas sampling points (which correspond with the temporary wells GP-01 through GP-19) are depicted on Figure 3 attached to the URS report (September 2002).

The permanent soil gas wells were installed at depths of approximately 12 feet bgs. During completion of the temporary groundwater wells, groundwater samples were collected for VOC laboratory analyses at three depths, at approximately 38 to 40 feet, 53 to 55 feet and 73 to 75 feet bgs. The nine shallow wells were completed to depths of 35 to 40 feet bgs with 15 feet of screen, and the three deep wells were completed to depths of 75 feet with 10 feet of screen (all 2-inch diameter wells).

The first round of soil gas sampling in July 2002 included all 19 locations, and the sampling conducted in August 2002 included 12 locations. Ninety-one (91) groundwater samples were collected during the July 2002 sampling round, and 20 samples were collected in August 2002. Twenty-seven soil samples were submitted for VOC laboratory analyses.

The results of the assessment are detailed in the report, depicted on site plans and summarized in tables. The analyses of soil samples for VOCs did not indicate detectable levels in the majority of the samples. A low level of TCE was detected in the sample from GP-108 located south of the Site near the intersection of 103rd Avenue and 99th Street. In addition, tetrachloroethene (or PCE) was detected in a shallow soil sample (ground surface to 2-feet) in MW-09 located on 99th Street. The analyses of soil gas samples for VOCs in July and August 2002 indicated various VOCs, with TCE levels ranging from 0.86 ppbv to 58 ppbv (July) and 76 ppbv (August) in SG-06 (located at the intersection of 103rd Avenue and 99th Street).

The total VOC levels in groundwater are depicted on attached Figure 4. The July – August 2002 results indicated the following:

- The groundwater sampling in July 2002 generally indicated decreasing VOC and TCE concentrations with depth, and the highest levels were detected at the groundwater interface;

- The samples collected at the groundwater interface contained various VOCs, with the highest TCE levels detected in samples from investigation points along 98th Street (1,200 ug/l in GP-16 to 2,400 ug/l in GP-13), on 99th Street (1,400 ug/l in GP-09), and along 103rd Avenue near 99th Street in GP-111 (2,700 ug/l) and GP-108 (2,800 ug/l). The highest level was detected in the 53 to 55 foot sample from GP-13 (2,900 ug/l); and

- The August 2002 sampling round also indicated various VOCs in the samples and TCE levels ranging from non-detectable (PZ-01) to 929 ug/l (MW-19, located along 98th Street). The highest TCE concentration was detected in the sample from well PZ-09 (1,180 ug/l) located along 99th Street adjacent to the Site.

Based upon measurements at the time of the work, it was concluded in the report that the groundwater flow direction was southerly across the Site vicinity, with a low or anomaly in the area of PZ-11 (103rd Avenue, between 100th and 101st Streets), as depicted on Figure 4.

2.2.4 Field Investigation Letter Report for The 2003 Groundwater and Soil Gas Sampling Event (May 2003)

This report by URS Corporation includes the findings of further investigations performed in the Site vicinity in July and August 2002 (originally presented in September 2002 report discussed above) and March and April 2003, which included (March and April 2003 work only):

- Soil gas sampling for VOC laboratory analyses from permanent soil gas sampling points;

- Groundwater sampling of existing monitoring wells and piezometers for VOC laboratory analyses; and

- Collection of groundwater depth measurements and groundwater flow direction determination.

The well locations are depicted on Figures 3 and 4, and the soil gas sampling points (which correspond with the wells GP-01 through GP-19 noted on Figures 3 and 4) are depicted on Figure 3 attached to the URS report. The results of the assessment are detailed in the report, depicted on site plans and summarized in tables. The total VOC levels in groundwater are depicted on attached Figure 4. Along with all historical data collected as described above, the data will be further evaluated in the RI report (or interim letter reports as discussed below in Section 3.4) subsequent to collection of the assessment data proposed in this Work Plan.

2.3 Physical Setting

The Site and Site vicinity are located within an urban area, with mixed commercial and residential uses. The following information, contained in the PSA (January 2000) summarizes the hydrogeological, surface hydrology and meteorological setting of the Site and Site vicinity. The information will be supplemented and/or updated as necessary during the RI/FS process.

- The aquifers at the Site and Site vicinity include the Upper Glacial Aquifer (ground surface to 150 feet bgs) and the Jameco/Magothy (150 to 300 feet bgs) formations. Both consist of highly permeable sand and gravel, with clay layers of varying thicknesses at different depths (therefore, not acting as an aquaclude). Drilling logs from the Phase II assessment in 1996 indicated brown loose fine to medium sand with some fine gravel and traces to little silt. Bedrock is estimated to be 575 feet bgs, and groundwater is approximately 35 to 40 feet bgs.

- The closest well used for drinking water purposes is located approximately one mile northeast (upgradient) of the Site, and no wells used for drinking water are located downgradient of the Site.

- The nearest down slope surface water body is the Shelbank Basin (approximately 1.5 miles south) (see Figure 1).

- The annual precipitation for Queens County is 42.12 inches. The evaporation during July through October is 21.28 inches.

2.4 Preliminary Conceptual Site Model

As discussed in the prior sections of this Work Plan, the Site is characterized by the presence of certain VOCs (primarily TCE) above potentially relevant regulatory criteria in groundwater.

Based on the site characterization information obtained to date, a preliminary conceptual site model (CSM) has been developed that presents potential sources of contamination, pathways and receptors.

The primary potential source of constituents to environmental media and potential receptors at the Site includes historical handling and storage at the Site of solvents, hydraulic fluids, and scrap metal chips in roll-off containers that resulted from former Ozone Industries, Inc. manufacturing activities.

Based upon the groundwater flow direction (south across the Site vicinity) and distribution of TCE in groundwater, the most TCE-impacted area is located in the vicinity of the Site, potentially a result of the storage and handling practices at the Site. The highest TCE level in groundwater was detected at GP-11 near the Site (22,000 ug/l). Many of the higher levels detected in the Site vicinity were between 1,000 ug/l and 3,000 ug/l, detected in samples from near the Site and south of the Site. It is not clear if other sources of TCE and/or chlorinated VOCs are present south of the Site.

Data are being collected as part of this RI in part to further assess what pathways are complete, and if so, what potential there is for impacts to receptors. The CSM will be further refined in the RI with a focus towards these potentially complete pathways and receptors, as follows.

Human receptors/pathways to be evaluated during the RI/FS include:

- Potential migration of vapors from impacted groundwater to indoor air; and

- Exposure to potentially contaminated soil at the Site.

Currently, no ecological receptors/pathways will require evaluation during the RI/FS.

2.4.1 Data Gaps

Data gaps to be further investigated as part of the RI/FS include:

- Soil conditions (i.e. contaminant concentrations) at the Site;

- Subsurface soil gas conditions to evaluate the potential migration of vapors from impacted groundwater and soil to indoor air;

- Groundwater and soil conditions, shallow and deep near the Site and location GP-11;

- Refinement of the groundwater monitoring well network to supplement previously estimated groundwater flow directions and to provide additional information on groundwater contaminant levels; and

- Identify other potential source areas that may be contributing to groundwater contamination (with installation of cross-gradient and upgradient monitoring wells, as discussed below, and possible collection of additional history and use information for other properties in the Site vicinity and/or bays at the Site).

3.0 SCOPE OF WORK

This section presents the planned RI field activities and objectives. Proposed soil, soil gas and groundwater sampling is presented below and also discussed in Appendix B – FSP (which includes sampling methods). The rationale for the number of samples to be collected is presented below, and the names and locations of proposed sampling points are presented on Figures 3 and 4. Location identification numbers (IDs), sample IDs and analytical parameters and methods are presented in the QAPP (Appendix C).

The proposed investigation is based on the results of the background assessment work previously conducted in the Site vicinity (no assessment data has been collected at the Site), potential data gaps identified for the Site, comments presented in the December 22, 2003 NYSDEC letter concerning the original RI/FS Work Plan, discussions with NYSDEC officials and a Site visit in April 2004 by ENSR. Data collected during the prior investigations will be used in conjunction with data collected as part of the RI as applicable.

Endzone, Inc. does not own the bays at the Site. The bays are owned by the City of New York and leased to various tenants for different uses. In response to NYSDEC comments concerning the historic and current uses of the bays, and to determine what bays are of most concern (i.e., utilized by former Ozone Industries, Inc.), ENSR completed a Site visit in April 2004 with City of New York officials. Only certain bays were accessible because of access issues with the City of New York and the tenants, which could potentially take weeks to resolve for a return Site visit. The insides of bays 8 – 12 were not accessed or viewed as part of the Site visit, and these are the bays believed to have been rented by former Ozone Industries, Inc., one or more of which would be the bay(s) that stored waste material. Instead of arranging another Site visit to view the insides of these bays of concern to finalize the plan for the RI investigation included herein, the plans for conducting field work will contain contingencies for responding to various conditions. (Ultimately, a more encompassing access agreement between the City of New York and its tenants, and Endzone, Inc. will be completed prior to beginning the proposed RI investigation field work.) In addition, the actual locations of proposed sampling points presented herein and the accompanying plans will be adjusted in the field at the time of the actual field program based upon Site information collected just prior to the field work. Therefore, the sampling locations within the bays are generally discussed and depicted on the accompanying plans. However, the intent is to assess the subsurface conditions (and surface soil conditions, if exposed) in the area where waste material was presumably stored.

3.1 Focused Soil Gas Investigation (and Ambient Air Sampling)

The purpose of this soil gas investigation is to assess potential impacts to indoor air quality by sampling subsurface soil vapors for the presence of VOCs by EPA Method TO-15. The sampling will be conducted at 10 locations (SG-1 through SG-10) depicted on Figures 3 and 4. Eight locations (SG-

1 through SG-8) are located within the bays at the Site and SG-9 and SG-10 are located outside the bays along 99th and 100th Streets. The grab samples will be collected from approximately 8 feet bgs.

Pursuant to the NYSDEC December 22, 2003 comment letter, soil gas samples will be collected from existing soil gas wells SG-03, SG-09, SG-13 and SG-16 (located in the southern part of the Site vicinity) for VOCs by EPA Method TO-15. In addition, a representative ambient air sample will be collected for VOC analyses by EPA Method TO-15 from a bay of concern at the Site during the soil gas sampling, if it can be determined that other potential sources of VOCs are not present in the bay (it is highly unlikely that ambient air sampling will be completed until soil gas samples are collected and evaluated, because Endzone, Inc. does not own the Site and access and control of other sources of VOCs will be very difficult). If conducted, the sample will be collected over a two to four hour time frame, depending upon access issues and the amount of field investigation time allowed in the bay. Alternatively, an air sample could be collected utilizing an emission isolation flux chamber located on the floor of one of the bays. This would eliminate interference from VOC sources in the bays unrelated to Site contaminants and directly measure potential VOCs migrating through the floor from the subsurface. The air sample collected in the sealed flux chamber would be collected into a SUMMA canister for off-site laboratory analysis.

The soil gas and ambient air sampling methodologies are presented in the FSP (Appendix B).

3.2 Focused Soil Investigation

The purpose of this soil sampling program is to further assess the distribution of VOCs in subsurface soils (beneath an impervious surface) at the Site and Site vicinity. In addition, if present, surface soils in area of no impervious cover, will be sampled for laboratory analyses. Soil sample collection and field screening procedures are presented in Section 3.3 of the FSP.

The soil sampling program will consist of:

- One initial deep exploratory soil boring (with groundwater sampling);
- Soil borings within the Site area (beneath bays);
- Surface soil sampling (if applicable); and
- Soil borings in the Site vicinity.

The initial deep exploratory soil boring will be completed in the proposed MW-201 location (along 100th Street next to the Site) to characterize the soil stratigraphy and VOC levels, and groundwater VOC levels through field screening of soil and groundwater samples. This will assist with subsequent subsurface investigations and ensure that subsequent drilling does not breach a subsurface confining layer, allowing for potential cross contamination of different geologic zones if present. The initial deep exploratory soil boring will be completed to an estimated depth of 100 feet bgs, unless conditions are present that require deeper or shallower drilling.

The soil borings within the bays at the Site will consist of approximately eight soil borings (SS-1 through SS-8, same locations as the soil gas investigation), and will be completed to depths extending to potentially the groundwater table (approximately 35 feet bgs at the Site) based upon the capability of the drilling method which will be determined by access to the bays. At least four of the soil borings will be located within the storage bays formerly leased by the former Ozone Industries, Inc., and two in each of the storage bays north and south of the subject storage bays. At least two of the four borings located within the storage bays formerly leased by the former Ozone Industries, Inc. will be located in the bay that is potentially most likely to be impacted from past solvent storage and/or use (as discussed above, the final determination of what bay subsurface areas are assessed will be based upon access to the bays prior to initiating field work).

As discussed above, one deep soil boring (MW-201) will be completed in the area of GP-11 adjacent to the Site (to a depth of approximately 100 feet bgs) and two soil borings (MW-202 and MW-203) will be completed in the Site vicinity to depths of approximately 75 bgs. As part of utility clearance work, each subsurface investigation location will be initially cleared with vacuum extraction to a depth of approximately 6 feet, except for the borings completed within the bays, which will be initially cleared by use of a hand auger.

Soil samples will be collected continuously during performance of the borings and each sample will be field screened for total VOCs with a photoionization instrument. Soil samples will be collected with a hand auger within the utility clearance zone from ground surface to 6 feet bgs. Up to 36 soil samples will be collected for laboratory VOC analysis from the borings. Vertically, the samples submitted for VOC laboratory analysis will in general include one shallow sample (from the first foot of soil beneath the floor), one groundwater interface sample (if encountered in the borings completed beneath the bays) and the sample with the highest field screening result (if different from the first two locations). Soil sample collection and field screening procedures are presented in Section 3.0 of the FSP. The planned soil boring locations are presented in Figures 3 and 4.

As discussed in the December 22, 2003 comment letter by the NYSDEC, surface soil (present in areas without an impervious surface) samples will be collected at the Site wherever surface soils are exposed (i.e., no pavement or floor covering the ground surface). The samples will be collected from ground surface to approximately 2-inches bgs (per NYSDEC comments) for laboratory analytical parameters to include metals and semi-VOCs. Based upon the April 2004 Site visit, no bays accessed and viewed contained exposed soil. Therefore, this sampling will only be conducted if the bays of concern do not contain flooring or some impervious barrier over the soil, prohibiting access to the soil by people. If sampling occurs, one representative sample from at least one exposed soil area per bay that contains no flooring will be collected. At the time of sampling, it will also be ascertained if existing operations could or have impacted the surface soils, thus differentiating potential impacts from former operations by Ozone Industries, Inc.

3.3 Groundwater Investigation

The specific objectives of groundwater sampling are to provide groundwater quality data in the vicinity of the Site, to assess deep groundwater conditions, and to expand the groundwater monitoring well network horizontally to evaluate groundwater conditions and flow direction. Four new groundwater monitoring wells will be installed during completion of the soil borings outside of the bays, and one groundwater well will be installed in an upgradient location pursuant to the NYSDEC December 22, 2003 comment letter. The planned monitoring well locations are shown on Figures 3 and 4. The groundwater investigation procedures are presented in the FSP (Section 3.0).

As requested by the NYSDEC, groundwater samples will be collected at certain depth intervals during advancement of the soil borings discussed above and prior to monitoring well placement in order to identify potential zones of elevated groundwater contamination. The existing groundwater data indicates that the TCE plume is mainly present in the zone of 35 to 55 feet bgs. Therefore, it is important to identify in the field where the highest zone of groundwater contamination is present. In order to accomplish this, groundwater samples will be collected at five different intervals of approximately 35-38', 44-47', 52-55', 62-65' and 72-75' during the completion of soil borings. These are the similar depth intervals previously targeted by URS during work in the Site vicinity; however, the intervals will be determined by actual field conditions encountered (e.g., soil headspace readings and groundwater elevations). The groundwater samples will be screened on-site using a portable gas chromatograph. Additional details are provided in Section 3.0 of the FSP.

The depths and well screen intervals of proposed monitoring wells MW-201S, MW-202 and MW-203 will be based upon the soil and groundwater sampling and field screening results, with the intent to capture or intercept the zone of greatest impact. Monitoring well MW-201D will complete a cluster at the MW-201 location, and will be installed based upon field screening results and at least 10 feet beneath the bottom of the shallower well. The deep upgradient well (PZ-01D) will be installed and screened also based upon field screening results and deeper than the existing PZ-01 well.

3.3.1 Monitoring Well Development and Groundwater Sampling

A surge and purge method will be used to perform well development on all newly installed monitoring wells and existing wells proposed for sampling. Refer to Section 3.3 of the FSP for well development procedures. The specific objectives of well development are to:

- Improve the hydraulic connection between the well and the aquifer;
- Reduce the amount of suspended solids in the groundwater samples; and
- Remove silt and other solids that may accumulate during well construction.

After development, the monitoring wells will be allowed to equilibrate for a minimum of seven days prior to water level measurements or groundwater sampling activities. Water levels will be measured in each of the monitoring wells in accordance with Section 3.3 of the FSP. Groundwater elevations will be used to confirm the groundwater flow direction.

Following well development and water level gauging, all new wells and approximately 16 existing wells will be sampled, including PZ-01, -05, -07, -08, -09, and –10, and MW-01, -6S, -6D, -9, -13S, -13D, -101, –105, -120S and –120D. There is the potential that some of these existing wells may no longer be available for sampling, and/or their integrity may have been compromised. In this case, nearby wells (if applicable) will be substituted for those wells that are no longer available. Groundwater samples will be collected for analysis of VOCs. A second groundwater sampling round will take place approximately three months after the first. Refer to Section 3.0 of the FSP for low-flow groundwater sampling procedures.

The soil (auger cuttings) generated as part of the program discussed in Section 3.2, bailed groundwater generated during development and sampling, and any other investigative-derived waste will be properly drummed and delivered off Site on a daily basis. Alternatively, for the liquid investigative-derived waste, consistent with URS during their sampling for NYSDEC in the Site vicinity, ENSR will investigate and arrange for the discharge of development and purge water to the New York City sewer system. Refer to Section 3.8 of the FSP for these procedures.

3.4 Additional Rounds of Field Investigation Activities

Per discussions with NYSDEC representatives in October 2002, if evaluation of the data gathered in the sampling described in this Work Plan indicates that further data gaps exist, the approach will not be to complete the RI report with the data obtained at that time. Instead, Endzone, Inc. will propose the scope of additional investigations to the NYSDEC in a short letter submittal (rather than a formal work plan). Following NYSDEC approval, this additional round of work will be completed, and the RI/FS report will be prepared after all data gaps have been filled. This approach will greatly streamline the process, and expedite the completion of this project.

3.5 Community Air Monitoring

Consistent with New York State Department of Health guidance for Generic CAMPs, attached in Appendix E is a CAMP specific for the intended drilling and groundwater sampling programs proposed in Sections 3.1, 3.2 and 3.3 that include (ground) intrusive and non-intrusive activities. The CAMP specifies real-time air monitoring requirements for VOCs to be performed during intrusive activities (drilling), and periodic monitoring for VOCs during non-intrusive activities (i.e. groundwater sampling).

3.6 In-Situ Hydraulic Conductivity Testing

Rising head permeability tests (slug tests) will be performed at each of the newly installed monitoring wells and at a selection of existing wells (MW-01, -06S, -06D, -09, -13S, -13D and –101) to assess the permeability of the soils. The slug tests will be performed in accordance with Section 3.4 of the FSP.

3.7 Site Survey

The coordinates of all RI soil borings and monitoring wells will be surveyed by a New York registered surveyor to establish the horizontal and vertical coordinates. All vertical measurements will be surveyed in 1929 USGS National Geodetic Vertical Datum (NGVD 1929) coordinates, and all horizontal measurements will be in New York State Plane coordinates, using 1983 North American Datum (NAD83). The information will be utilized to establish well elevations for the determination of groundwater depths and flow directions. The survey will be performed in accordance with Section 3.6 of the FSP.

4.0 QUALITY ASSURANCE/QUALITY CONTROL PROTOCOLS

A QAPP is attached in Appendix C, which describes the quality assurance and quality control protocols necessary to achieve the initial data quality objectives. Pursuant to the Order on Consent, the plan designates a data validation expert assigned to this project and describes the individual's qualifications and experience.

5.0 HEALTH AND SAFETY PROTOCOLS

A site-specific HASP has been completed for the proposed work and is attached in Appendix D. The HASP was completed in accordance with the Order on Consent, 29 CFR 1910 standards of the Federal Occupational Safety and Health Administration, and the DER-10 Guidance.

6.0 REPORTING AND PROJECT SCHEDULE

6.1 Remedial Investigation Report

The RI report serves as documentation of data collection and analysis in support of the FS. The RI report will include the information required by the DER-10 Guidance in Section 3.14, including an updated Site description and history (as applicable), description of the completed site assessment activities, findings (i.e., hydrogeology, contaminant levels and distribution, etc.), any completed risk evaluation (e.g., qualitative exposure assessment), and conclusions and recommendations. The report will include sample/field logs, boring and well logs, data summary tables, laboratory reports and figures or plans as appropriate.

In accordance with the Consent Order, the RI Report will include the data generated and other information obtained during the RI, a listing of any additional data that must be collected, and certification that the RI activities were completed in accordance with the NYSDEC-approved RI/FS Work Plan.

6.2 Feasibility Study

The FS will be performed according to NYSDEC TAGMs *Guidelines for Remedial Investigations/Feasibility Studies* (TAGM 4025) and *Selection of Remedial Actions at Inactive Hazardous Waste Sites* (TAGM 4030), and 6 NYCRR 357-1.10.

The FS will develop appropriate remedial alternatives, provide a preliminary screening, present a detailed analysis of the surviving alternatives, and describe the recommended remedy.

The proposed alternatives will be evaluated according to the following criteria:

- Compliance with applicable New York State Standards, Criteria and Guidelines;
- Overall protection of human health and the environment;
- Short-term impacts and effectiveness;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume;
- Implementability; and
- Cost.

These criteria will be used to prepare a comparative analysis of the screened alternatives. A remedy will be recommended based on the results of the comparative analysis. A draft of the FS will be submitted to the NYSDEC for its review, comment, and approval.

It is expected that the primary community input will be received following submission of the draft FS to NYSDEC (see the CPP in Appendix F). The public comments and questions about the proposed remedy will provide additional input to NYSDEC as it prepares its final comments and/or approval.

6.3 Progress Reports

In accordance with Section III of the Consent Order, monthly progress reports will be submitted to NYSDEC after approval of the Work Plan. These reports should contain the following information:

- A description of the actions taken toward achieving compliance with the Consent Order during the previous month;
- Results of sampling and tests and all other data received or generated in the previous month (including quality assurance/quality control information);
- A listing of work plans, reports, or other deliverables required by the Consent Order that were completed and submitted during the previous month;
- A description of actions (including, but not limited to, data collection and implementation of work plans) that are scheduled for the next month;
- Information regarding unresolved delays encountered or anticipated that may affect the future schedule for implementation of the obligations under the Consent Order, and efforts made to mitigate those delays or anticipated delays;
- Any modifications to any work plans that have been proposed to the NYSDEC or approved by the NYSDEC;
- Other information relating to the progress at the site; and
- All activities undertaken in support of the CPP during the previous month and those to be undertaken in the next month.

6.4 Project Schedule

The anticipated project schedule is provided below. The schedule assumes that access to the Site will not be overly burdensome and time consuming. However, given that Endzone, Inc. does not own any of the properties where RI sampling is to occur, and that these locations are owned or leased by several owners, gaining site access may take longer than projected in the following table. As discussed above, Endzone, Inc. representatives have identified property owners where sampling locations are proposed, and have begun the process of gaining access to these locations. If Endzone, Inc. is not able to gain access to the sampling locations as shown in this schedule, Endzone, Inc. will notify NYSDEC of the delay. The schedule listed below begins after finalizing access agreements with the owner and tenants at the Site.

In addition, during telephone conversations with the NYSDEC discussing this revised Work Plan, it was mentioned that a public meeting presenting the proposed RI investigation would take place. Details of the meeting and timing are currently unknown.

Activity	Activity Duration	Elapsed Time from Work Plan Approval
Gaining Site Access, Street Opening Permits and Mobilization	8 weeks	8 weeks
Soil and Soil Gas Investigation, Groundwater Monitoring Well Installations and Development	8 weeks	16 weeks
Groundwater Sampling and Analyses (first round), Slug Testing and Site Survey	5 weeks	21 weeks
Data validation, Site plan preparation and Data Analysis	6 weeks	27 weeks
Groundwater Sampling and Analyses (second round), assuming 1st round ends at the completion of 5th month (20 weeks) and 3 months (12 weeks) have passed	4 weeks	36 weeks
Data validation and Data Analysis	4 weeks	40 weeks
RI Report Preparation	4 weeks	44 weeks

The above schedule assumes that no sampling activities in addition to those outlined in this document are required to complete the RI sampling efforts. As described in Section 3.4 above, per discussions with NYSDEC representatives in October 2002, if evaluation of the data gathered in the sampling described in this Work Plan indicates that further data gaps exist, the approach will not be to complete the RI report with the data obtained at that time. Instead, Endzone, Inc. will propose the scope of additional investigations to the NYSDEC in a short letter submittal (rather than a formal work plan). Following NYSDEC approval, this additional round of work will be completed, and the RI report will be prepared after all data gaps have been filled. This approach will greatly streamline the process, and expedite the completion of this project. Therefore, if additional sampling is required, a revised schedule for completion of the RI/FS will be provided as the work progresses.

Endzone, Inc. will provide the NYSDEC 10 working days notice in advance of any field activities to be conducted pursuant to the Consent Order.

7.0 CITIZEN PARTICIPATION ACTIVITIES AND REFERENCES

7.1 CPP

A CPP is attached in Appendix F, which was prepared in accordance with the *Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook* (dated June 1998), and input from the NYSDEC and community officials. The CPP identifies important community issues and information needs that relate to the Site. In addition, the plan identifies information that Endzone, Inc. and NYSDEC need from the community. The CPP also describes community participation activities to be conducted during the RI/FS. The community participation activities are designed to accomplish the following objectives:

- Help the interested and affected public to understand the environmental issues at the Site, and the nature and progress of the program to investigate and clean up the Site;
- Provide open communication between the public and project staff throughout the remedial process;
- Create opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about the Site's investigation and clean up; and
- Show that public input was received and considered, and how it was factored into decision-making.

7.2 References – Site Vicinity

Phase I Environmental Site Assessment (July 13, 1995)

Ozone Industries, Inc., 101 - 132 101st Street, Ozone Park, New York

Prepared by Environmental Strategies and Applications, Inc., Somerset, NJ, Prepared for The Norwood Group, Bedford, NH

Phase I Environmental Assessment Addendum (October 23, 1995)

Ozone Industries, Inc., 101 - 132 101st Street, Ozone Park, New York

Prepared by Precision Environmental and Remediation Services, Inc., Linden, NJ, Prepared for Ozone Industries, Ozone Park, Queens, New York

Subsurface Soil Investigation Report (December 10, 1995)

Ozone Industries, 101 - 157 100th Street, Ozone Park, Queens, New York

Prepared by Precision Environmental and Remediation Services, Inc., Linden, NJ, Prepared for Ozone Industries, Ozone Park, Queens, New York

Corrective Action Report Addendum (October 15, 1999)

Ozone Industries, 101 - 132 101st Street, Ozone Park, Queens, New York

Prepared by James T. Skelcy, Cranford, NJ, Prepared for Ozone Industries, Inc., East Lyme, CT

Preliminary Site Assessment Report (January 2000)

Public School 60/62 (Former Voges Manufacturing Company) and Ozone Industries, Inc.

Prepared by Lawler, Matusky & Skelly Engineers, LLP, Prepared for NYSDEC, Division of Environmental Remediation

Immediate Investigation Work Assignment Field Investigation Letter Report (Final September 2001)

Former Ozone Industries

Prepared by URS Corporation Group Consultants, Prepared for NYSDEC, Division of Environmental Remediation

Immediate Investigation Work Assignment Interim Letter Report Phase I Field Activities (Draft Final July 2002)

Former Ozone Industries (Public School 65)

Prepared by URS Corporation Group Consultants, Prepare for NYSDEC, Division of Environmental Remediation

Field Investigation Letter Report For Phase I and Phase II Field Activities (Final September 2002)

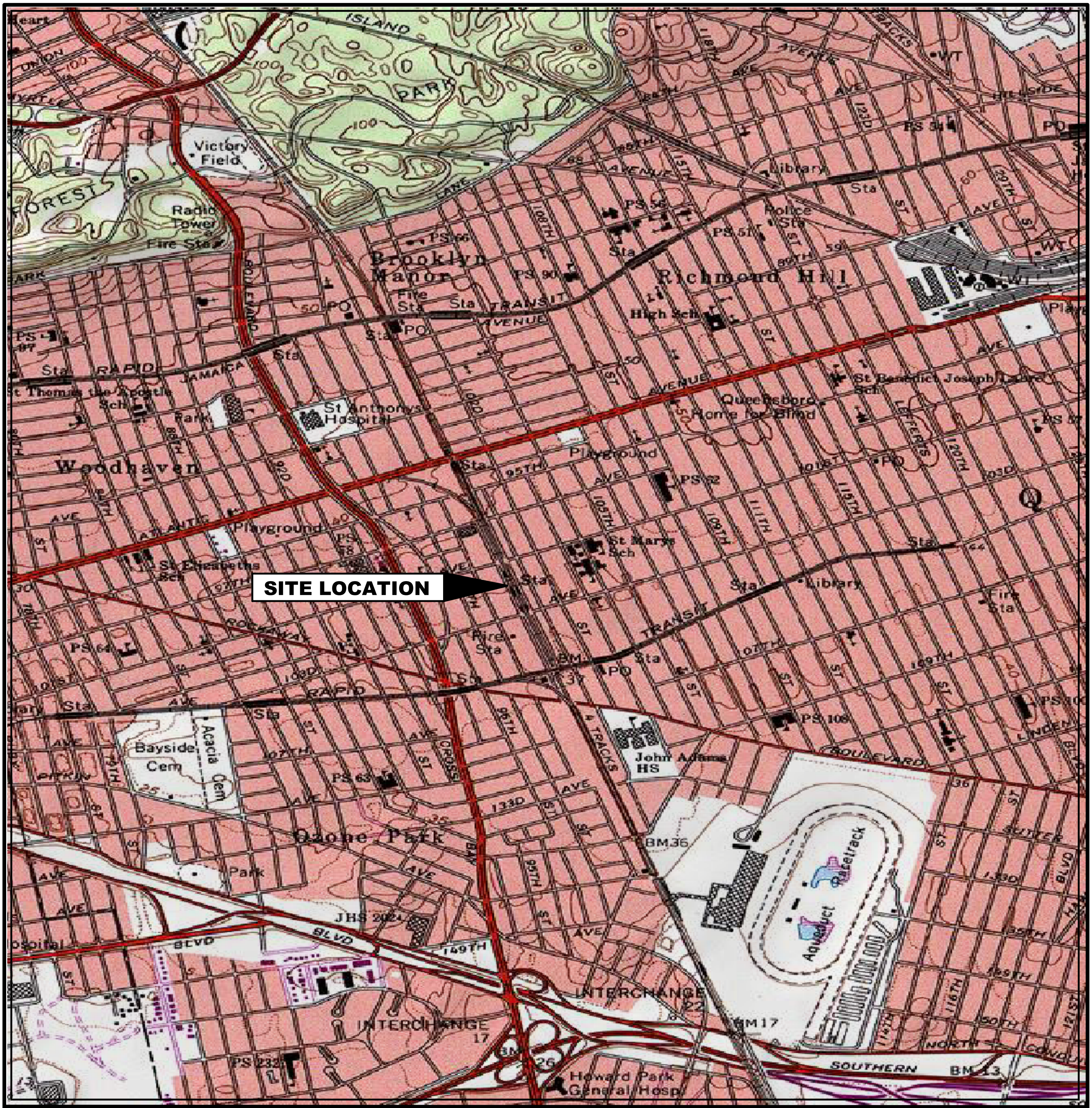
Former Ozone Industries (Public School 65)

Prepared by URS Corporation Group Consultants, Prepared for NYSDEC, Division of Environmental Remediation

Field Investigation Letter Report For The 2003 Groundwater and Soil Gas Sampling Event (Final May 2003)

Former Ozone Industries (Public School 65)

Prepared by URS Corporation Group Consultants, Prepared for NYSDEC, Division of Environmental Remediation



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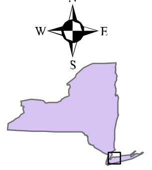

USGS Quadrangle Queens, New York

Site Locus

Former Ozone Industries, Inc.
NYSDEC Site # 2-41-033
Block Bounded by 99th & 100th Streets and 101st & 103rd Avenues
Ozone Park, Queens, New York

RI/FS Work Plan

Job Number 08734765

Figure 1

ENSR INTERNATIONAL

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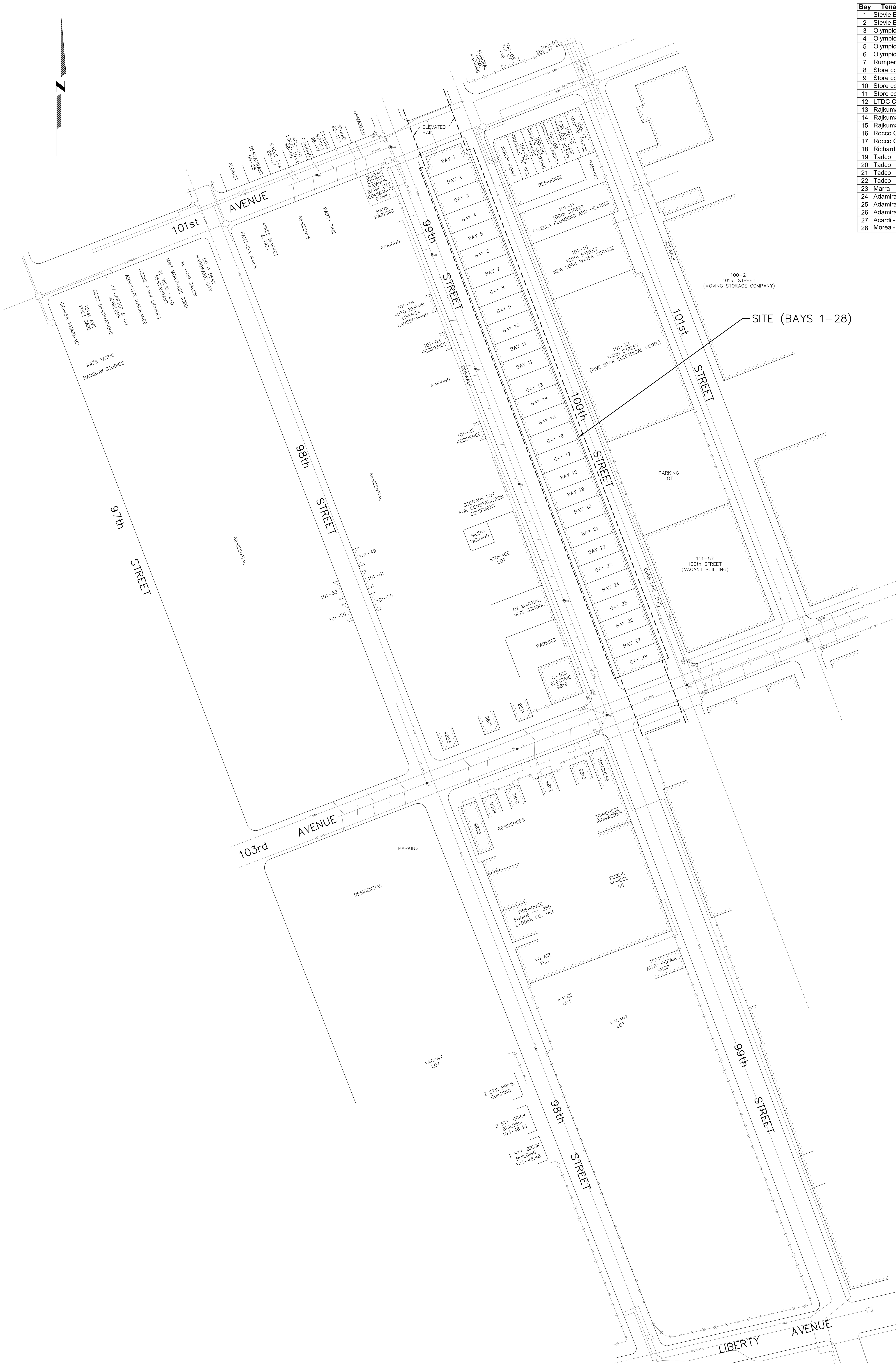

Bay	Tenant (based upon site visit by ENSR)
1	Stevie Brown
2	Stevie Brown
3	Olympic Fence
4	Olympic Fence
5	Olympic Fence
6	Olympic Fence
7	Rumpersand Iron Workshop
8	Store contruction material - Bike shop/Bar
9	Store contruction material - Bike shop/Bar
10	Store contruction material - Bike shop/Bar
11	Store contruction material - Bike shop/Bar
12	LTDC Corp
13	Rajkumar Bisram - Iron and wood working shop
14	Rajkumar Bisram - Iron and wood working shop
15	Rajkumar Bisram - Iron and wood working shop
16	Rocco Constatino
17	Rocco Constatino
18	Richard Stevens - company vehicle storage
19	Tadco
20	Tadco
21	Tadco
22	Tadco
23	Marra
24	Adamira de al Cruz - company vehicle storage
25	Adamira de al Cruz - company vehicle storage
26	Adamira de al Cruz - company vehicle storage
27	Acardi - custom auto storage
28	Morea - old truck part storage

UTILITIES:

1. DATA FROM VERIZON DRAWINGS.
2. DATA FROM KEYSPAN ENERGY DRAWINGS.
3. SANITARY AND STORM SEWER LINES FROM NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION.

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SCALE IN FEET
1" = 60'

SHEET NUMBER: 1

DRAWING NUMBER: 2

SITE AND VICINITY PLAN

OZONE INDUSTRIES, INC.
FORMER OZONE PARK, NEW YORK FACILITY

SCALE:	DATE:	PROJECT NUMBER:
1" = 60'	5/04	08734-765-300

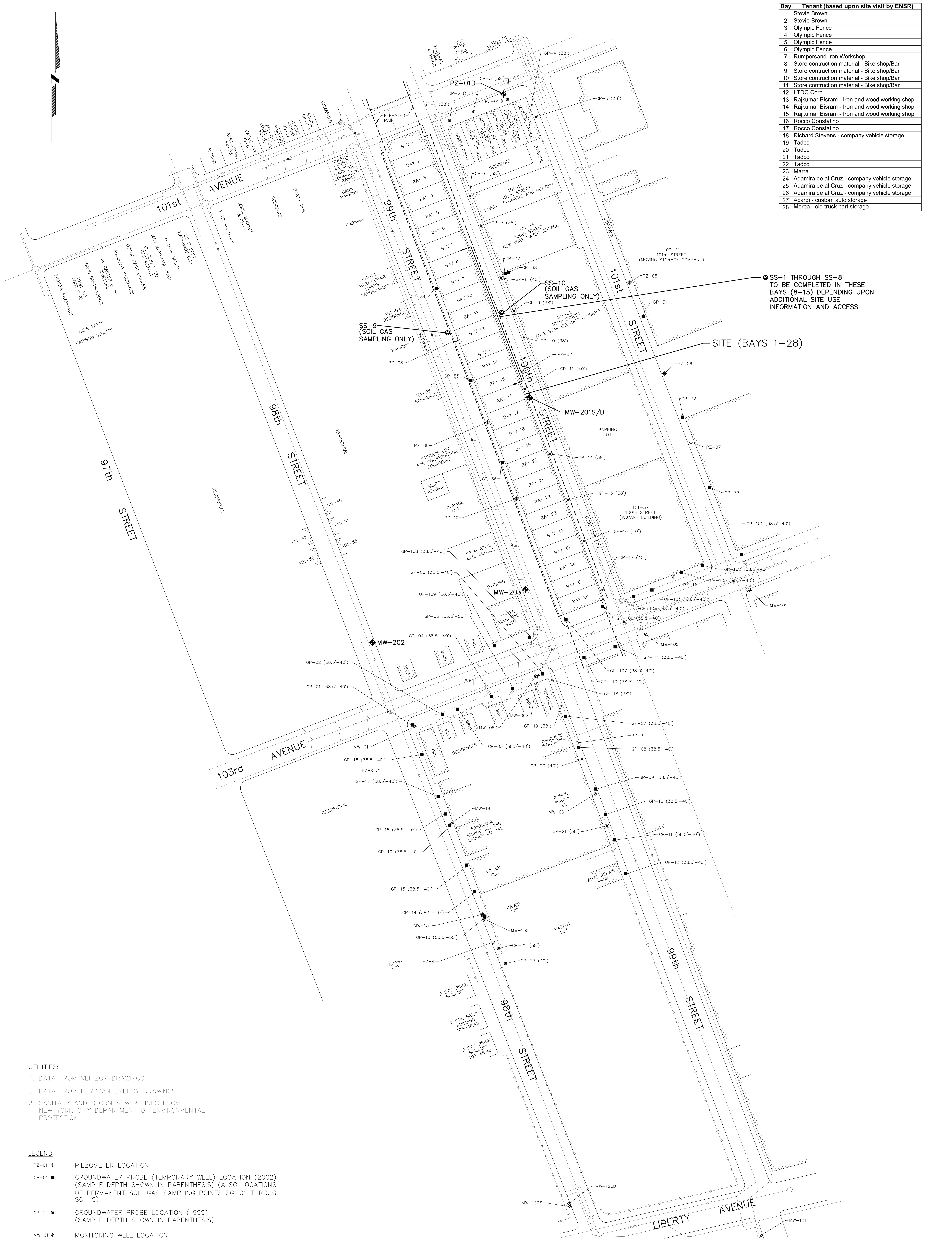
ENSR® INTERNATIONAL
2 TECHNOLOGY PARK DRIVE
WESTFORD, MASSACHUSETTS 01886
PHONE: (978) 589-3000
FAX: (978) 589-3100
WEB: HTTP://WWW.ENSR.COM

DESIGNED BY:	R.M.
DRAWN BY:	J.E.B.
CHECKED BY:	R.M.
APPROVED BY:	D.A.

REVISIONS

NO.:	DESCRIPTION:	DATE:	BY:

FILENAME: 873414D.DWG



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17	Rocco Constatino
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20	Tadco
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22	Tadco
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25	Adamira de al Cruz - company vehicle storage
26	Adamira de al Cruz - company vehicle storage
27	Acardi - custom auto storage
28	Morea - old truck part storage

UTILITIES:

1. DATA FROM VERIZON DRAWINGS.
2. DATA FROM KEYSPAN ENERGY DRAWINGS.
3. SANITARY AND STORM SEWER LINES FROM NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION.

LEGEND

PZ-01	PIEZOMETER LOCATION
GP-01	GROUNDWATER PROBE (TEMPORARY WELL) LOCATION (2002) (SAMPLE DEPTH SHOWN IN PARENTHESIS) (ALSO LOCATIONS OF PERMANENT SOIL GAS SAMPLING POINTS SG-01 THROUGH SG-19)
GP-1	GROUNDWATER PROBE LOCATION (1999) (SAMPLE DEPTH SHOWN IN PARENTHESIS)
MW-01	MONITORING WELL LOCATION
MW-201S/D	PROPOSED SOIL BORING AND MONITORING WELL LOCATION
SS-1	PROPOSED SOIL GAS SAMPLING AND SOIL BORING LOCATION (APPROXIMATE LOCATION)

60 0 60 120
SCALE IN FEET
1" = 60'

SHEET NUMBER: 1
DRAWING NUMBER: 3

SITE ASSESSMENT PLAN
OZONE INDUSTRIES, INC.
FORMER OZONE PARK, NEW YORK FACILITY

SCALE:	DATE:	PROJECT NUMBER:
1" = 60'	5/04	08734-765-300

ENSR INTERNATIONAL
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PHONE: (978) 589-3000
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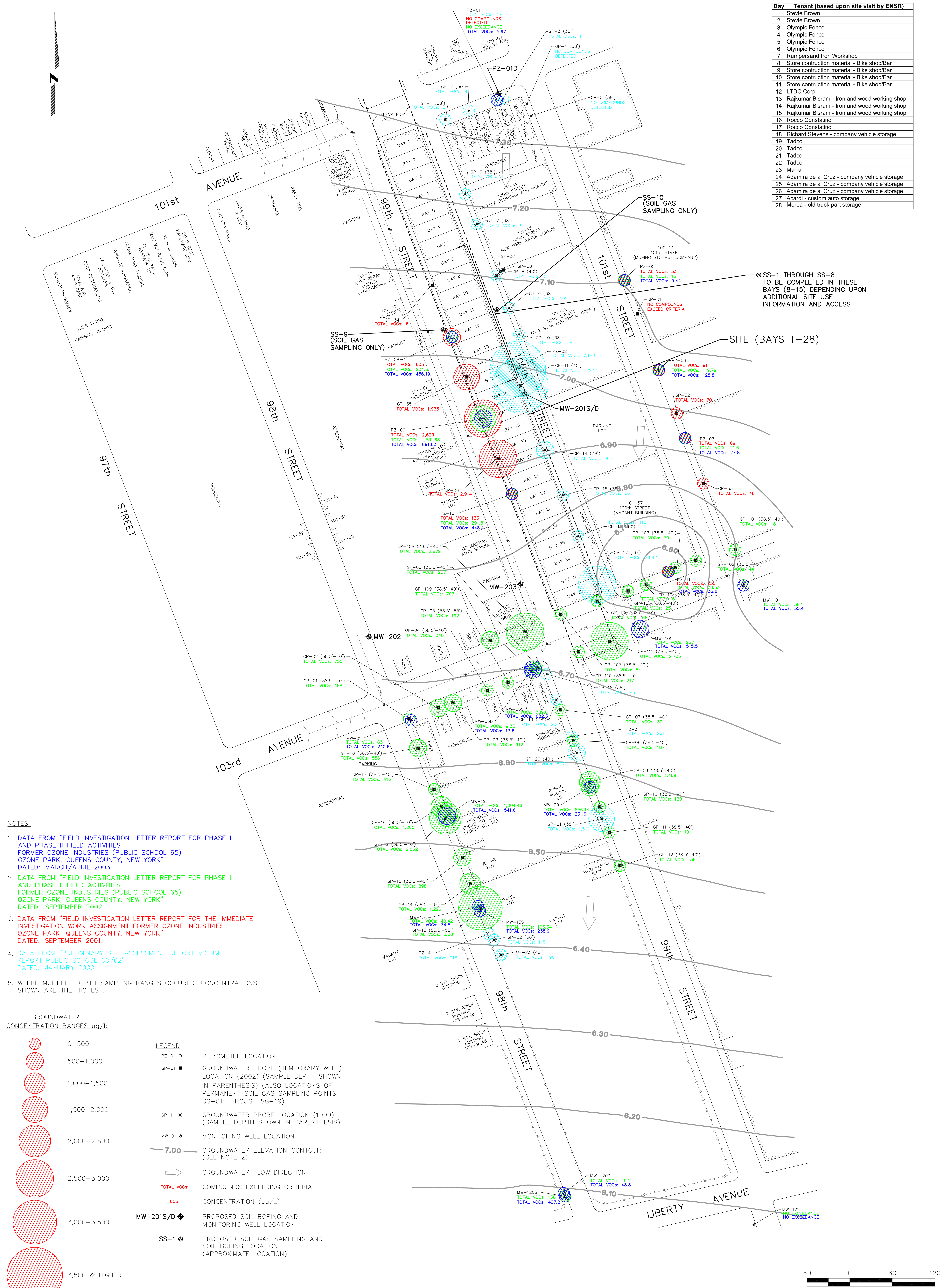
DESIGNED BY:	R.M.
DRAWN BY:	J.E.B.
CHECKED BY:	R.M.
APPROVED BY:	D.A.

REVISIONS

NO.:	DESCRIPTION:	DATE:	BY:

FILENAME: 873415D.DWG



Bay	Tenant (based upon site visit by ENSR)
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25	Adamira de al Cruz - company vehicle storage
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27	Acardi - custom auto storage
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NOTES:

1. DATA FROM "FIELD INVESTIGATION LETTER REPORT FOR PHASE I AND PHASE II FIELD ACTIVITIES FORMER OZONE INDUSTRIES (PUBLIC SCHOOL 65) OZONE PARK, QUEENS COUNTY, NEW YORK" DATED: MARCH/APRIL 2003
2. DATA FROM "FIELD INVESTIGATION LETTER REPORT FOR PHASE I AND PHASE II FIELD ACTIVITIES FORMER OZONE INDUSTRIES (PUBLIC SCHOOL 65) OZONE PARK, QUEENS COUNTY, NEW YORK" DATED: SEPTEMBER 2002
3. DATA FROM "FIELD INVESTIGATION LETTER REPORT FOR THE IMMEDIATE INVESTIGATION WORK ASSIGNMENT FORMER OZONE INDUSTRIES OZONE PARK, QUEENS COUNTY, NEW YORK" DATED: SEPTEMBER 2001.
4. DATA FROM "PRELIMINARY SITE ASSESSMENT REPORT VOLUME 1 REPORT PUBLIC SCHOOL 60/62" DATED: JANUARY 2000
5. WHERE MULTIPLE DEPTH SAMPLING RANGES OCCURED, CONCENTRATIONS SHOWN ARE THE HIGHEST.

GROUNDWATER CONCENTRATION RANGES ug/l:

0–500
500–1,000
1,000–1,500
1,500–2,000
2,000–2,500
2,500–3,000
3,000–3,500
3,500 & HIGHER

LEGEND

PZ-01	PIEZOMETER LOCATION
GP-01	GROUNDWATER PROBE (TEMPORARY WELL) LOCATION (2002) (SAMPLE DEPTH SHOWN IN PARENTHESIS) (ALSO LOCATIONS OF PERMANENT SOIL GAS SAMPLING POINTS SG-01 THROUGH SG-19)
GP-1	GROUNDWATER PROBE LOCATION (1999) (SAMPLE DEPTH SHOWN IN PARENTHESIS)
MW-01	MONITORING WELL LOCATION
7.00	GROUNDWATER ELEVATION CONTOUR (SEE NOTE 2)
	GROUNDWATER FLOW DIRECTION
TOTAL VOCs:	COMPOUNDS EXCEEDING CRITERIA
605	CONCENTRATION (ug/L)
MW-201S/D	PROPOSED SOIL BORING AND MONITORING WELL LOCATION
SS-1	PROPOSED SOIL GAS SAMPLING AND SOIL BORING LOCATION (APPROXIMATE LOCATION)

SUMMARY OF SITE AND VICINITY ASSESSMENT DATA
OZONE INDUSTRIES, INC.
FORMER OZONE PARK, NEW YORK FACILITY

SCALE:	DATE:	PROJECT NUMBER:
1" = 60'	5/04	08734-765-300

SHEET NUMBER: 1
DRAWING NUMBER: 4

ENSR INTERNATIONAL ®
2 TECHNOLOGY PARK DRIVE
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DESIGNED BY:	R.M.
DRAWN BY:	J.E.B.
CHECKED BY:	R.M.
APPROVED BY:	D.A.

REVISIONS

NO.:	DESCRIPTION:	DATE:	BY:

NIXON PEABODY LLP
ATTORNEYS AT LAW

990 Stewart Avenue
Garden City, New York 11530-4838
(516) 832-7500
Fax: (516) 832-7555
Direct Dial: (516) 832-7541
E-Mail: mtone@nixonpeabody.com

February 13, 2003

Steven E. Pazar, Esq.
BBA U.S. Holdings, Inc.
401 Edgewater Place
Suite 670
Wakefield, MA 01880

RE: Signed Consent Order

Dear Steve:

Enclosed please find the executed duplicate original DEC Order on Consent for the former Ozone Industries Site. The Order was signed on February 5, 2003 by Dale Desnoyer. We have retained a copy for our records.

I invite your attention to Paragraph VI which provides for the initial payment of the DEC's costs within forty-five (45) days of the effective date. Further, the initial submittals are due within thirty (30) days of the effective date, and the RI/FS work plan within sixty (60) days. *See* Paragraphs I and II(B)1.

The effective date of the Order is February 15, 2003. *See* Paragraph XIV (O), page 18.

I will call you to discuss the future handling. If you have any questions please feel free to give me a call.

Very truly yours,

M. J. T.

Michael J. Tone

cc: Mr. Michael E. Resch

035549/000002

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of the Development and Implementation of a Remedial Program for an Inactive Hazardous Waste Disposal Site, Under Article 27, Title 13, and Article 71, Title 27 of the Environmental Conservation Law of the State of New York by Endzone, Inc. Respondent.	**ORDER ON CONSENT** Index #W2-0922-02-05 Site # 2-41-033

WHEREAS,

1. A. The New York State Department of Environmental Conservation (the "Department") is responsible for enforcement of Article 27, Title 13 of the Environmental Conservation Law of the State of New York ("ECL") entitled "Inactive Hazardous Waste Disposal Sites." The Department asserts that any person under order pursuant to ECL 27-1313.3.a has a duty imposed by ECL Article 27, Title 13 to carry out the Inactive Hazardous Waste Disposal Site Remedial Program committed to under order. The Department asserts that ECL 71-2705 provides that any person who fails to perform any duty imposed by ECL Article 27, Title 13 shall be liable for civil, administrative, and/or criminal sanctions.

B. The Department also asserts that it has the authority, *inter alia*, to provide for the prevention and abatement of all water, land, and air pollution. *See, e.g.*, ECL 3-0301.1.i.

C. This Order is issued pursuant to the Department's authority under, *inter alia,* ECL Article 27, Title 13, ECL Article 71, Title 27, and ECL 3-0301.

2. Endzone, Inc. (registered in New York d/b/a Nojoy), f/k/a BBA Acquisition, Inc., and Ozone Industries, Inc. ("Respondent"), rented/operated a portion of the Former Ozone Industries Site (hereinafter referred to as "the Site") during the period from 1987 until 1988. The Site is located in Queens County, New York within a block that is bounded by 99th and 100th Streets to the east and west, and by 101st and 103rd Avenues to the north and south and is beneath an abandoned, elevated Long Island Railroad (LIRR) right of way. Exhibit "A" of this Order is a map of the Site showing the general location of the Site. The portion of the Site which was rented/operated by Respondent is shown as the shaded area on the drawing attached as Exhibit "A"(2).

3. The Site is currently listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site Number 2-41-033 with a Classification "2" pursuant to ECL 27-1305.

4. Respondent consents to the Department's issuance of this Order without (i) an admission or finding of liability, fault, wrongdoing, or violation of any law, regulation, permit, order, requirement, or standard of care of any kind whatsoever, or (ii) an acknowledgment that there has been a release or threatened release of hazardous waste or that the release or threatened release of hazardous waste at or from the Site constitutes a significant threat to public health or the environment.

5. The parties recognize that implementation of this Order will expedite the cleanup of the Site and may avoid prolonged and complicated litigation between the parties, and that this Order is mutually acceptable, fair, reasonable, and in the public interest.

6. Solely with regard to the matters set forth below, Respondent hereby waives its right to a hearing herein as provided by law, consents to the issuance and entry of this Order, and agrees to be bound by its terms. Respondent consents to and agrees not to contest the authority or jurisdiction of the Department to issue or enforce this Order, and agrees not to contest the validity of this Order or its terms, or the validity of the data generated by Respondent pursuant to this Order.

NOW, having considered this matter and being duly advised, **IT IS ORDERED THAT**:

I. Initial Submittal

Within thirty (30) Days after the effective date of this Order, Respondent shall submit to the Department a Records Search Report in accordance with the requirements of Exhibit "F" attached hereto. The Records Search Report can be limited if the Department notifies Respondent that prior submissions satisfy specific items required for the Records Search Report. Such Records Search Report shall be submitted in a format acceptable to the Department.

II. Development, Performance and Reporting of Work Plans

A. Work Plans

All activities at the Site that comprise any element of an Inactive Hazardous Waste Disposal Site Remedial Program shall be conducted pursuant to one or more Department-approved work plans ("Work Plan" or "Work Plans") and this Order. The Work Plan(s) under this Order shall be developed and implemented in accordance with

CERCLA, the NCP, and all applicable statutes, regulations and guidance documents then in effect. All Department-approved Work Plans shall be incorporated into and become an enforceable part of this Order and shall be attached as Exhibit "B." Upon the approval of a Work Plan, Respondent shall implement such Work Plan in accordance with the schedule contained in such Work Plan. Nothing in this Subparagraph shall mandate that any particular Work Plan be submitted. Further, each Work Plan submitted shall use one of the following captions on the cover page:

1. "Preliminary Site Assessment Work Plan" ("PSA Work Plan"): a Work Plan the objective of which is to identify the presence of any hazardous waste disposed of at the Site. Such Work Plan shall be developed in accordance with Exhibit "G";

2. "Remedial Investigation/Feasibility Study Work Plan" ("RI/FS Work Plan"): a Work Plan the objective of which is to perform a Remedial Investigation and a Feasibility Study. Such Work Plan shall be developed and implemented in accordance with the requirements set forth in Exhibit "H";

3. "IRM Work Plan": a Work Plan the objective of which is to provide for an Interim Remedial Measure. Such Work Plan shall be developed in accordance with Exhibit "I";

4. "Remedial Design/Remedial Action Work Plan" ("RD/RA Work Plan"): a Work Plan the objective of which is to provide for the development and implementation of the final plans and specifications for implementing the remedial alternative set forth in the ROD. Such Work Plan shall be developed in accordance with Exhibit "J"; or

5. "OM&M Work Plan": a Work Plan the objective of which is to provide for all activities required to maintain and monitor the effectiveness of the Remedial Action or an IRM. Such Work Plan shall be developed in accordance with Exhibit "K."

B. Submission/Implementation of Work Plans

1. (a) The RI/FS Work Plan shall be submitted to the Department within sixty (60) Days after the effective date of this Order.

(b) The Department may request that Respondent submit such other, additional, or supplemental Work Plans as are appropriate to advance the Remedial Program at the Site. Within thirty (30) Days after the Department's written request, Respondent shall advise the Department in writing whether it will submit and implement the requested additional Work Plan (or Supplemental Work Plan) or whether it elects to terminate this Order pursuant to Paragraph XIII. If Respondent elects to submit and implement such Work Plan, Respondent shall submit a Work Plan providing for implementation of the activities requested within sixty (60) Days after such election. If Respondent elects to terminate this Order or fails to make a timely election, this Order shall terminate pursuant to Paragraph XIII.

(c) Respondent can propose one or more additional or supplemental Work Plans (including one or more IRM Work Plans) at any time at the option of Respondent, which Work Plan(s) shall be reviewed for appropriateness and technical sufficiency.

(d) The Department's request under Subparagraph (b) of this Paragraph shall be subject to dispute resolution pursuant to Paragraph XII.

2. A Professional Engineer must prepare, sign, and seal all Work Plans other than a Work Plan for an RI/FS or a PSA.

3. During all field activities, Respondent shall have on-Site a representative who is qualified to supervise the activities undertaken. Such representative may be an employee or a consultant retained by Respondent to perform such supervision.

C. <u>Revisions to Work Plans</u>

The Department shall notify Respondent in writing if the Department determines that any element of a Department-approved Work Plan needs to be modified in order to achieve the objectives of the Work Plan as set forth in Subparagraph II.A or to ensure that the Remedial Program otherwise protects human health and the environment. Upon receipt of such notification, Respondent shall, subject to Respondent's right to invoke dispute resolution pursuant to Paragraph XII, submit a Work Plan for such requested work to the Department within sixty (60) Days after the date of the Department's written notice pursuant to this Subparagraph.

D. <u>Submission of Final Reports and Annual Reports</u>

1. In accordance with the schedule contained in a Work Plan, Respondent shall submit a final report which includes the caption of that Work Plan on the cover page and a certification that all requirements of the Work Plan have been complied with and all activities have been performed in full accordance with such Work Plan. Such certification shall be by the person with primary responsibility for the day to day performance of the activities under this Order and, except for RI and PSA final reports, shall be by a Professional Engineer.

2. In the event a final report sets forth construction activities performed during the implementation of a Work Plan, such final report shall include "as built" drawings showing all changes made to the remedial design or IRM.

3. In the event that the ROD or any Work Plan relies upon institutional or engineering controls, Respondent shall submit an annual report by the 15th of January each year following the initial implementation of said institutional or engineering controls. Respondent shall file such annual report until the Department determines that the remedial process is completed and so notifies Respondent in writing. Such annual report shall be signed by a Professional Engineer and shall contain a certification that the institutional and engineering controls put in place pursuant to this Order are still in place, have not been materially altered, and are still effective in achieving their objectives. Respondent can petition the Department for a determination that the institutional and/or engineering controls may be terminated. Such petition must be supported by a certification ~~by a~~ stating that such controls are no longer necessary for the protection of public health and the environment. The Department shall not unreasonably withhold its approval of such petition.

E. <u>Review of Submittals other than Progress Reports and Health and Safety Plans</u>

1. The Department shall make a good faith effort to review and respond to each of the submittals Respondent makes pursuant to this Order within sixty (60) Days. The Department's response shall include an approval or disapproval of the submittal, in whole or in part, and the notification to Respondent of the Department's determination. All Department-approved submittals shall be incorporated into and become an enforceable part of this Order.

2. If the Department disapproves a submittal, it shall specify the reasons for its disapproval. Within thirty (30) Days after the date of the Department's written notice that Respondent's submittal has been disapproved or rejected, Respondent shall elect in writing, subject to Subparagraph II.E.3, to either (i) modify the submittal to address the Department's comments, or (ii) invoke dispute resolution pursuant to Paragraph XII. If Respondent elects to modify the submittal, Respondent shall, within sixty (60) Days after it elects to modify the submittal, make a revised submittal to the Department that addresses all of the Department's stated reasons for disapproving the first submittal. In the event that Respondent's revised submittal is disapproved, Respondent shall be in violation of this Order unless it invokes dispute resolution pursuant to Paragraph XII and its position prevails. Failure to make an election or failure to comply with the election is a violation of this Order.

3. In the event the rejected submittal is a Work Plan submitted prior to the Department's approval of the RD/RA Work Plan, Respondent shall have the additional option to terminate this Order pursuant to Paragraph XIII.

4. Within thirty (30) Days after the Department's approval of a final report, Respondent shall submit such final report, as well as all data gathered and drawings and submittals made pursuant to such Work Plan, to the Department in an

electronic format acceptable to the Department. If any document cannot be converted into electronic format, Respondent shall so advise the Department and, if the Department concurs, submit such document in an alternative format acceptable to the Department.

F. Department's Issuance of a ROD

Respondent shall cooperate with and provide reasonable assistance, consistent with the Citizen Participation Plan, in soliciting public comment on the proposed remedial action plan ("PRAP"), if any. After the close of the public comment period, the Department shall select a final remedial alternative for the site in a ROD. Nothing in this Order shall be construed to abridge the rights of Respondent, as provided by law, to judicially challenge the Department's ROD.

G. Release and Covenant Not To Sue

Upon the Department's approval of either the RD/RA Work Plan final report or an IRM Work Plan final report evidencing that no further remedial action (other than OM&M activities) is required to meet the goals of the Remedial Program, then, except for the provisions of Paragraphs VI and VIII, and except for the future OM&M of the Site, and any Natural Resource Damage claims, such acceptance shall constitute a release for each and every claim, demand, remedy, or action whatsoever against Respondent, its directors, officers, employees, agents, servants, and successors and assigns (except successors and assigns who were responsible under law for the development and implementation of a Remedial Program at the Site prior to the effective date of this Order), and their respective secured creditors, which the Department has or may have pursuant to Article 27, Title 13 of the ECL or pursuant to any other provision of statutory or common law involving or relating to investigative or remedial activities relative to or arising from the disposal of hazardous wastes (or other contaminants addressed by Respondent pursuant to the ROD) at the Site; provided, however, that the Department specifically reserves all of its rights concerning, and any such release and satisfaction shall not extend to any further investigation or remediation the Department deems necessary due to environmental conditions on-Site or off-Site which are related to the disposal of hazardous wastes at the Site and which indicate that the Remedial Program is not protective of public health and/or the environment. The Department shall notify Respondent of such environmental conditions or information and its basis for determining that the Remedial Program is not protective of public health and/or the environment.

This release shall be null and void, *ab initio*, in the event of fraud relating to the implementation of this Order or Respondent's failure to materially comply with any provision of this Order. The Department's determination that Respondent has committed fraud or materially failed to comply with this Order shall be subject to dispute resolution. This release shall inure only to the benefit of Respondent, its directors, officers, employees, agents, and servants and to the benefit of those successors and assigns of

Respondent that are not otherwise responsible under law for the development and implementation of a remedial program at the Site.

Nothing herein shall be construed as barring, diminishing, adjudicating, or in any way affecting any legal or equitable rights or claims, actions, suits, causes of action, or demands whatsoever that (i) Respondent may have against anyone other than the Department, and (ii) the Department may have against anyone other than Respondent, its directors, officers, employees, agents, and servants and those successors and assigns of Respondent that are not responsible under law for the development and implementation of a remedial program at the Site prior to the effective date of this Order.

III. Progress Reports

Respondent shall submit written progress reports to the parties identified in Subparagraph XI.A.1 by the 10th Day of each month commencing with the month subsequent to the approval of the first Work Plan and ending with the Termination Date, unless a different frequency is set forth in a Work Plan. Such reports shall, at a minimum, include: all actions taken pursuant to this Order during the previous reporting period and those anticipated for the next reporting period; all approved activity modifications (changes of work scope and/or schedule); all results of sampling and tests and all other data received or generated by or on behalf of Respondent in connection with the Site, whether under this Order or otherwise, in the previous reporting period, including quality assurance/quality control information; and information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule, efforts made to mitigate such delays, and information regarding activities undertaken in support of the Citizen Participation Plan during the previous reporting period and those anticipated for the next reporting period.

IV. Penalties

A. 1. Respondent's failure to comply with any term of this Order constitutes a violation of this Order, the ECL, and 6 NYCRR Section 375-1.2(d). Nothing herein abridges Respondent's right to contest, defend against, dispute, or disprove any such claim, assertion, or allegation that it has violated this Order.

2. Within thirty (30) Days of the effective date of this Order, Respondent may elect in writing, addressed to the Department's project attorney with a copy to the Department's project manager, to opt out of the application of statutory penalties and, in lieu thereof, to have the following stipulated penalties apply in the event of Respondent's failure to comply with this Order:

Period of Non-Compliance	Penalty Per Day
First through 15th day	$ 500.00
16th through 30th day	$ 1,000.00
31st day and thereafter	$ 1,500.00

3. Payment of the penalties shall not in any way alter Respondent's obligation to complete performance under the terms of this Order.

B. 1. Respondent shall not suffer any penalty or be subject to any proceeding or action in the event it cannot comply with any requirement of this Order as a result of any event arising from causes beyond the reasonable control of Respondent, of any entity controlled by Respondent, or of Respondent's contractors, that delays or prevents the performance of any obligation under this Order despite Respondent's best efforts to fulfill the obligation ("Force Majeure Event"). The requirement that Respondent exercise best efforts to fulfill the obligation includes using best efforts to anticipate the potential force majeure event, best efforts to address the effects of any such event as it is occurring, and best efforts following the force majeure event, such that the delay is minimized to the greatest extent possible. "Force Majeure" does not include Respondent's economic inability to comply with any obligation, the failure of Respondent to make complete and timely application for any required approval or permit, and non-attainment of the goals, standards and requirements of this Order.

2. Respondent shall notify the Department in writing within seven (7) Days after it obtains knowledge of any such Force Majeure Event. Respondent shall include in such notice the measures taken and to be taken to prevent or minimize any delays and shall request an appropriate extension or modification of this Order. Failure to give such notice within such seven (7) Day period constitutes a waiver of any claim that a delay is not subject to penalties. Respondent shall be deemed to know of any circumstance of which it, any entity controlled by it, or its contractors knew or should have known.

3. Respondent shall have the burden of proving by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a Force Majeure Event; that the duration of the delay or the extension sought was or will be warranted under the circumstances; that best efforts were exercised to avoid and mitigate the effects of the delay; and that Respondent complied with the requirements of this Paragraph regarding timely notification to the Department of the event.

4. If the Department agrees that the delay or anticipated delay is attributable to a Force Majeure Event, the time for performance of the obligations under this Order that are affected by the Force Majeure Event will be extended by the Department for such time as is reasonably necessary to complete those obligations.

5. If Respondent asserts that an event provides a defense to non-compliance with this Order pursuant to Subparagraph IV.B and the Department rejects such assertion, Respondent shall be in violation of this Order unless it invokes dispute resolution pursuant to Paragraph XII and Respondent's position prevails.

V. Entry upon Site

A. Respondent hereby consents, upon reasonable notice under the circumstances presented, to entry upon the Site or areas in the vicinity of the Site which may be under the control of Respondent by any duly designated officer or employee of the Department or any State agency having jurisdiction with respect to matters addressed pursuant to this Order, and by any agent, consultant, contractor, or other person so authorized by the Commissioner, all of whom shall abide by the health and safety rules in effect for the Site for (i) inspecting, sampling, and copying records related to the contamination at the site; (ii) implementing the activities under this Order; and (iii) testing and any other activities necessary to ensure Respondent's compliance with this Order. Respondent shall provide the Department with suitable office space at the Site, including access to a telephone, to the extent same are available. Upon request, Respondent shall permit the Department full access to all non-privileged records relating to matters addressed by this Order. Raw data is not considered privileged and that portion of any privileged document containing raw data must be provided to the Department.

B. The Department shall have the right to take its own samples and scientific measurements and the Department and Respondent shall have the right to obtain split samples, duplicate samples, or both, of all substances and materials sampled. The Department shall make the results of all sampling and scientific measurements taken under this Subparagraph available to Respondent.

VI. <u>Payment of State Costs</u>

A. Within forty-five (45) Days after the effective date of this Order, Respondent shall pay to the Department the sum of $76,118.78, which shall represent reimbursement for State Costs as set forth on the cost summary attached as Exhibit "C." Respondent acknowledges that all past State Costs are not itemized on the cost summary and that additional charges may be billed at a later date for State Costs prior to the effective date of this Order.

B. Within forty-five (45) Days after receipt of an itemized invoice from the Department, Respondent shall pay to the Department a sum of money which shall represent reimbursement for State Costs, other than those in Subparagraph VI.A, for work performed at or in connection with the Site through and including the Termination Date.

C. Personal service costs shall be documented by reports of Direct Personal Service, which shall identify the employee name, title, biweekly salary, and time spent (in hours) on the project during the billing period, as identified by an assigned time and activity code. Approved agency fringe benefit and indirect cost rates shall be applied. Non-personal service costs shall be summarized by category of expense (*e.g.*, supplies, materials, travel, contractual) and shall be documented by expenditure reports. The Department shall not be required to provide any other documentation of costs, provided however, that the Department's records shall be available consistent with, and in accordance with, Article 6 of the Public Officers Law.

D. Such invoice shall be sent to Respondent at the following address:

Steven E. Pazar, Esq.
Endzone, Inc.
401 Edgewater Place, Suite 670
Wakefield, MA 01880

E. Each such payment shall be made payable to the Department of Environmental Conservation and shall be sent to: Bureau of Program Management, Division of Environmental Remediation, New York State Department of Environmental Conservation, 625 Broadway, Albany, NY 12233-7010.

F. Each party shall provide written notification to the other within ninety (90) Days of any change in the foregoing addresses.

G. Respondent may contest, in writing, invoiced costs under Subparagraph VI.B if it believes (i) the cost documentation contains clerical, mathematical, or accounting errors; (ii) the costs are not related to the State's activities with respect to the Remedial Program for the Site; or (iii) the Department is not otherwise legally entitled to such costs. If Respondent objects to an invoiced cost, Respondent shall pay all costs not objected to within the time frame set forth in Subparagraph VI.B and shall, within thirty (30) Days after its receipt of an invoice, identify in writing all costs objected to and identify the basis of the objection. This objection shall be filed with the Division of Environmental Remediation's Director of the Bureau of Program Management. The Director or the Director's designee shall have the authority to relieve Respondent of the obligation to pay invalid costs. Within forty-five (45) Days after the date of the Department's determination of the objection, Respondent shall pay to the Department the amount which the Director or the Director's designee determines Respondent is obligated to pay or commence an action or proceeding seeking appropriate judicial relief.

H. In the event any instrument for the payment of any money due under this Order fails of collection, such failure of collection shall constitute a violation of this Order, provided (i) the Department gives Respondent written notice of such failure of collection, and (ii) the Department does not receive from Respondent a certified check or bank check in the amount of the uncollected funds within fourteen (14) Days after the date of the Department's written notification.

VII. Reservation of Rights

A. Except as provided in Subparagraph II.G, nothing contained in this Order shall be construed as barring, diminishing, adjudicating, or in any way affecting any of the Department's rights or authorities, including, but not limited to, the right to require performance of further investigations and/or response action(s), to recover natural resource damages, or to exercise any summary abatement powers with respect to any party, including Respondent.

B. Except as otherwise provided in this Order, Respondent specifically reserves all rights and defenses under applicable law respecting any Departmental assertion of remedial liability against Respondent, and further reserves all rights respecting the enforcement of this Order, including the rights to notice, to be heard, to appeal, and to any other due process. The existence of this Order or Respondent's compliance with it shall not be construed as an admission of liability, fault, wrongdoing, or breach of standard of care by Respondent, and shall not give rise to any presumption of law or finding of fact, or create any rights, or grant any cause of action, which shall inure to the benefit of any third party. Further, Respondent reserves such rights as it may have to seek and obtain contribution, indemnification, and/or any other form of recovery from its insurers and from other potentially responsible parties or their insurers for past or future response and/or cleanup costs or such other costs or damages arising from the contamination at the Site as may be provided by law.

VIII. Indemnification

Respondent shall indemnify and hold the Department, the State of New York, and their representatives and employees harmless for all claims, suits, actions, damages, and costs of every name and description arising out of or resulting from the fulfillment or attempted fulfillment of this Order by Respondent and/or any of Respondent's directors, officers, employees, servants, agents, successors, and assigns except for liability arising from (i) vehicular accidents occurring during travel to or from the Site; or (ii) from willful, wanton, or malicious acts or acts constituting gross negligence or criminal behavior by the Department, the State of New York, and/or their representatives and employees during the course of any activities conducted pursuant to this Order. The Department shall provide Respondent with written notice no less than thirty (30) Days prior to commencing a lawsuit seeking indemnification pursuant to this Paragraph.

IX. Public Notice

A. Within thirty (30) Days after the effective date of this Order, Respondent shall cause to be filed a Department-approved Notice of Order, which Notice shall be substantially similar to the Notice of Order attached to this Order as Exhibit "D," with the Clerk of the County wherein the Site is located (or the City Register if the property is located in New York, Bronx, Kings or Queens County) to give all parties who may acquire any interest in the Site notice of this Order. Within thirty (30) Days of such filing (or such longer period of time as may be required to obtain a certified copy provided Respondent advises the Department of the status of its efforts to obtain same within such thirty (30) Days), Respondent shall also provide the Department with a copy of such instrument certified by such County Clerk (or the City Register) to be a true and faithful copy.

B. If Respondent proposes to convey the whole or any part of Respondent's ownership interest in the Site, or becomes aware of such conveyance, Respondent shall, not fewer than forty-five (45) Days before the date of conveyance, or within forty-five (45) Days after becoming aware of such conveyance, notify the Department in writing of the identity of the transferee and of the nature and proposed date of the conveyance and shall notify the transferee in writing, with a copy to the Department, of the applicability of this Order. However, such obligation shall not extend to a conveyance by means of a corporate reorganization or merger or the granting of any rights under any mortgage, deed, trust, assignment, judgment, lien, pledge, security agreement, lease, or any other right accruing to a person not affiliated with Respondent to secure the repayment of money or the performance of a duty or obligation.

X. Declaration of Covenants and Restrictions

A. 1. If a Department-approved Work Plan or the ROD relies upon one or more institutional controls, Respondent shall, within thirty (30) Days after the Department's approval of such Work Plan or ninety (90) Days after issuance of the ROD, whichever is earlier, submit to the Department for approval a Declaration of Covenants and Restrictions to run with the land which provides for covenants and restrictions consistent with the Work Plan or the ROD. This submittal shall be substantially similar to Exhibit "E." Respondent shall cause such instrument to be recorded with the Clerk of the County (or the City Register) wherein the Site is located within thirty (30) Days of the Department's approval of such instrument. Respondent shall provide the Department with a copy of such instrument certified by such County Clerk (or the City Register) to be a true and faithful copy within thirty (30) Days of such recording (or such longer period of time as may be required to obtain a certified copy provided Respondent advises the Department of the status of its efforts to obtain same within such thirty (30) Days).

2. Respondent may petition the Department to modify or terminate the Declaration of Covenants and Restrictions filed pursuant to this Paragraph at such time as it can certify that reliance upon such covenants and restrictions is no longer required to meet the goals of the Inactive Hazardous Waste Disposal Site Remedial Program. Such certification shall be made by a Professional Engineer. The Department will not unreasonably withhold its consent.

B. If the ROD provides for "no action" other than implementation of one or more institutional controls, the Department shall request Respondent to cause same to be recorded under the provisions of Subparagraph X.A. If Respondent does not cause such institutional control(s) to be recorded, Respondent cannot obtain a Qualified Release pursuant to Subparagraph II.G.

XI. Communications

A. All written communications required by this Order shall be transmitted by United States Postal Service, by private courier service, or hand delivered as follows:

1. Communication from Respondent shall be sent to:

Tara King
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

Note: four copies (one unbound) of work plans are required to be sent.

with copies to:

Gary Litwin
Bureau of Environmental Exposure Investigation
New York State Department of Health
Flanigan Square
547 River Street
Troy, New York 12180-2216

Note: two copies of work plans are required to be sent, and

Guy Bobersky
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

Alali M. Tamuno
Division of Environmental Enforcement
New York State Department of Environmental Conservation
200 White Plains Road, 5th Floor
Tarrytown, New York 10591

2. Communication to be made from the Department to Respondent shall be sent to:

Steven E. Pazar, Esq.
Endzone, Inc.
401 Edgewater Place, Suite 670
Wakefield, MA 01880

B. The Department and Respondent reserve the right to designate additional or different addressees for communication upon written notice to the other.

C. Each party shall notify the other within ninety (90) Days after any change in the addresses in this Paragraph XI or in Paragraph VI.

XII. Dispute Resolution

A. If Respondent disagrees with the Department's notice under (i) Subparagraph II.B requesting other, additional, or supplemental Work Plans; (ii) Subparagraph II.E disapproving a submittal, a proposed Work Plan or a final report; (iii) Subparagraph II.C requesting modification of a Department-approved Work Plan; (iv) Subparagraph II.G finding that Respondent materially failed to comply with the Order; (v) Subparagraph IV.B rejecting Respondent's assertion of a Force Majeure Event; or (vi) Subparagraph XIV.H.2.iii, Respondent shall, within thirty (30) Days of its receipt of such notice, request in writing informal negotiations with the Department in an effort to resolve the dispute. A copy of such request shall be sent by Respondent to the appropriate Remedial Bureau Chief in the Department's Central Office. The Department and Respondent shall consult together in good faith and exercise best efforts to resolve any differences or disputes without resort to the procedures described in Subparagraph XII.B. The period for informal negotiations shall not exceed thirty (30) Days from Respondent's request for informal negotiation. If the parties cannot resolve a dispute by informal negotiations during this period, the Department's position shall be considered binding unless Respondent notifies the Department in writing within thirty (30) Days after the conclusion of the thirty (30) Day period for informal negotiations that it invokes the dispute resolution provisions provided under Subparagraph XII.B.

B. 1. Respondent shall serve upon the ADD a request for formal dispute resolution and a written statement of the issues in dispute, the relevant facts upon which the dispute is based, factual data, analysis, or opinion supporting its position, and all supporting documentation upon which Respondent relies (hereinafter called the "Statement of Position"). A copy of such request and written statement shall be provided to the parties listed under Subparagraph XI.A.

2. The Department shall serve its Statement of Position no later than twenty (20) Days after receipt of Respondent's Statement of Position.

3. Respondent shall have the burden of proving by a preponderance of the evidence that the Department's position is not in accordance with law or otherwise should not prevail. The ADD can conduct meetings, in person or via telephone conferences, and request additional information from either party if such activities will facilitate a resolution of the issues.

4. The ADD will issue a final decision resolving the dispute in a timely manner. The final decision shall constitute a final agency action and Respondent shall have the right to seek judicial review of the decision pursuant to Article 78 of the CPLR provided that Respondent commences such proceeding within forty-five (45) Days after receipt of a copy of the decision. Respondent shall be in violation of this Order if it fails to comply with the final decision resolving this dispute within forty-five (45) Days after such final decision, or such other time period as may be provided in the final decision, unless it seeks judicial review of such decision within the forty-five (45) Day period provided. In the event that Respondent seeks judicial review, Respondent shall be in violation of this Order if it fails to comply with the final court order or settlement within thirty (30) Days after the effective date of such order or settlement, unless otherwise directed by the Court. For purposes of this Paragraph, a determination shall not be final until the time to perfect an appeal of that determination has expired.

5. The invocation of dispute resolution shall not extend, postpone, or modify Respondent's obligations under this Order with respect to any item not in dispute unless or until the Department agrees or a court determines otherwise.

6. Nothing contained in this Order shall be construed to authorize Respondent to invoke dispute resolution with respect to the remedy selected by the Department in the ROD or any element of such remedy, nor to impair any right of Respondent to seek judicial review of the Department's selection of any remedy.

7. The Department shall keep an administrative record which shall be available consistent with Article 6 of the Public Officers Law.

XIII. Termination of Order

A. This Order will terminate upon the earlier of the following events:

1. Respondent's election to terminate pursuant to Subparagraphs II.B.1.b or II.E.3 so long as such election is made prior to the Department's approval of Respondent's proposed RD/RA Work Plan. In the event of termination in accordance with this Subparagraph, this Order shall terminate effective the 5th Day after the Department's receipt of the written notification terminating this Order or the 5th Day after the time for Respondent to make its election has expired, whichever is earlier,

provided, however, if there are one or more Work Plan(s) for which a final report has not been approved at the time of Respondent's notification of its election to terminate this Order pursuant to Subparagraphs II.B.1.b or II.E.3 or its failure to timely make such an election pursuant to Subparagraphs II.B.1.b or II.E.3, Respondent shall promptly complete the activities required by such previously approved Work Plan(s)consistent with the schedules contained therein. Thereafter, this Order shall terminate effective the 5th Day after the Department's approval of the final report for all previously approved Work Plans; or

2. the Department's written determination that Respondent has completed all phases of the Remedial Program (including OM&M), in which event the termination shall be effective on the 5th Day after the Department issues its approval of the final report relating to the final phase of the Remedial Program.

B. Notwithstanding the foregoing, the provisions contained in Paragraphs VI and VIII shall survive the termination of this Order and any violation of such surviving Paragraphs shall be a violation of this Order, the ECL and 6 NYCRR Section 375-1.2(d) subjecting Respondent to penalties as provided under Paragraph IV so long as such obligations accrued on or prior to the Termination Date.

C. If the Order is terminated pursuant to Subparagraph XIII.A.1, neither this Order nor its termination shall affect any liability of Respondent to remediate the Site and/or for payment of the State's response costs, including implementation of removal and remedial actions, interest, enforcement, and any and all other response costs as defined under CERCLA. Respondent shall also ensure that it does not leave the Site in a condition, from the perspective of human health and environmental protection, worse than that which prevailed before any activities under this Order were commenced. Further, the Department's efforts in obtaining this Order and requesting additional Work Plan(s) shall constitute "reasonable efforts" under law to obtain a voluntary commitment from Respondent for any further activities to be undertaken as part of an Inactive Hazardous Waste Disposal Site Remedial Program for the Site.

XIV. Miscellaneous

A. The activities and submittals under this Order shall address both on-Site and off-Site contamination resulting from the disposal of hazardous wastes at the Site.

B. Respondent shall retain professional consultants, contractors, laboratories, quality assurance/quality control personnel, and third party data validators ("Respondent's Contractors") acceptable to the Department to perform the technical, engineering, and analytical obligations required by this Order. To the extent that the Department has not previously approved Respondent's Contractors for the work contemplated by this Order, Respondent shall submit the experience, capabilities, and qualifications of Respondent's Contractors to the Department within ten (10) Days after the effective date of this Order or at least thirty (30) Days before the start of any activities for which Respondent and such firms or individuals will be responsible. The Department's approval of these firms or individuals shall be obtained prior to the start of any activities for which such firms or individuals will be responsible. The responsibility for the performance of the professionals retained by Respondent shall rest solely with

Respondent. Subject to the requirements of this Subparagraph, Respondent retains the right to select or change firms or individuals in its sole discretion.

C. Respondent shall allow the Department to attend and shall notify the Department at least seven (7) Days in advance of any field activities as well as any pre-bid meetings, job progress meetings, the substantial completion meeting and inspection, and the final inspection and meeting.

D. 1. Respondent shall use "best efforts" to obtain all Site access, permits, easements, rights-of-way, rights-of-entry, approvals, institutional controls, or authorizations necessary to perform Respondent's obligations under this Order, except that the Department may exempt Respondent from the requirement to obtain any permit issued by the Department for any activity that is conducted on the Site and that the Department determines satisfies all substantive technical requirements applicable to like activity conducted pursuant to a permit. If any necessary Site access, permits, easements, rights-of-way, rights-of-entry, approvals, or authorizations required to perform this Order are not obtained despite best efforts within forty-five (45) Days after the effective date of this Order, or within forty-five (45) Days after the date the Department notifies Respondent in writing that additional access beyond that previously secured is necessary, Respondent shall promptly notify the Department, and shall include in that notification a summary of the steps Respondent has taken to obtain access. The Department may, as it deems appropriate and within its authority, assist Respondent in obtaining access.

2. If access to the Site or other approvals set forth in Subparagraph XIV.D.1 are needed to implement an institutional control required by a Work Plan and such access or approvals are not obtained despite Respondent's best efforts and the Department's assistance, if any, then the Department may require that Respondent modify the Work Plan pursuant to Subparagraph II.C of this Order to reflect changes necessitated by the lack of access and/or approvals.

E. Respondent and Respondent's successors and assigns shall be bound by this Order. Any change in ownership or corporate status of Respondent including, but not limited to, any transfer of assets or real or personal property, shall in no way alter Respondent's responsibilities under this Order.

F. Respondent shall provide a copy of this Order to each contractor hired to perform work required by this Order and shall condition all contracts entered into in order to carry out the obligations identified in this Order upon performance in conformity with the terms of this Order. Respondent or its contractor(s) shall provide written notice of this Order to all subcontractors hired to perform any portion of the work required by this Order. Respondent shall nonetheless be responsible for ensuring that Respondent's contractors and subcontractors perform the work in satisfaction of the requirements of this Order.

G. The paragraph headings set forth in this Order are included for convenience of reference only and shall be disregarded in the construction and interpretation of any of the provisions of this Order.

H. 1. The terms of this Order shall constitute the complete and entire agreement between the Department and Respondent concerning implementation of the activities required by this Order. No term, condition, understanding, or agreement purporting to modify or vary any term of this Order shall be binding unless made in writing and subscribed by the party to be bound. No informal advice, guidance, suggestion, or comment by the Department shall be construed as relieving Respondent of Respondent's obligation to obtain such formal approvals as may be required by this Order. In the event of a conflict between the terms of this Order and any Work Plan submitted pursuant to this Order, the terms of this Order shall control over the terms of the Work Plan(s) attached as Exhibit "B."

2. i. Except as set forth herein, if Respondent desires that any provision of this Order be changed, other than a provision of a Work Plan or a time frame, Respondent shall make timely written application to the Commissioner with copies to the parties listed in Subparagraph XI.A.1. The Commissioner or the Commissioner's designee shall timely respond.

ii. Changes to the Work Plan shall be accomplished as set forth in Subparagraph II.C of this Order.

iii. Changes to a time frame set forth in this Order shall be accomplished by a written request to the Department's project attorney and project manager, which request shall be timely responded to in writing. The Department's decision relative to the request for a time frame change shall be subject to dispute resolution pursuant to Paragraph XII.

I. 1. Respondent shall perform the work required pursuant to this Order. If there are multiple parties signing this Order collectively as "Respondent," the term "Respondent" shall be read in the plural where required to give meaning to this Order. Further, the obligations of Respondents under this Order are joint and several and the "bankruptcy" or failure by any Respondent to implement the obligations under this Order shall not affect the obligations of the remaining Respondent(s) to carry out the obligations under this Order.

2. If Respondent is a partnership, the obligations of all general partners, including limited partners who act as a general partner, to finance and perform obligations under this Order and to pay amounts owed the Department under this Order are joint and several. In the event of the insolvency or other failure of any one or more of the general partners to implement the requirements of this Order, the remaining general partners shall complete all such requirements.

3. Notwithstanding the foregoing Subparagraphs XIV.I.1 and 2, if multiple responsible parties sign this Order but not all of the signing responsible parties elect, pursuant to Subparagraph II.B, to implement a Work Plan, then all Respondents are jointly and severally liable for each and every obligation under this Order through the completion of the activities in such Work Plan that all such parties consented to; thereafter, only those responsible parties electing to perform additional work shall be jointly and severally liable under this Order for the obligations and activities under such additional Work Plan(s). The responsible parties electing not to implement the additional

Work Plan(s) shall have no obligations under this Order relative to the activities set forth in such Work Plan(s). Further, only those responsible parties electing to implement such additional Work Plan(s) shall be eligible to receive the covenant not to sue as provided under Subparagraph II.G.

J. To the extent authorized under 42 U.S.C. Section 9613, New York General Obligations Law § 15-108, and any other applicable law, Respondent shall be deemed to have resolved its liability to the State for purposes of contribution protection provided by CERCLA Section 113(f)(2) for "matters addressed" pursuant to and in accordance with this Order. "Matters addressed" in this Order shall mean all response actions taken to implement this Order for the Site and all response costs incurred and to be incurred by any person or party in connection with the work performed under this Order, including reimbursement of the State's costs pursuant to this Order.

K. All activities undertaken by Respondent pursuant to this Order shall be performed in accordance with the requirements of all applicable federal and State laws and regulations.

L. Unless otherwise expressly provided herein, terms used in this Order which are defined in ECL Article 27, Title 13 or in regulations promulgated under such statute shall have the meaning assigned to them under said statute or regulations. Whenever terms listed in the Glossary attached hereto are used in this Order or in the attached Exhibits, the definitions set forth in the Glossary shall apply. In the event of a conflict, the definition set forth in the Glossary shall control.

M. Respondent's obligations under this Order represent payment for or reimbursement of response costs, and shall not be deemed to constitute any type of fine or penalty.

N. This Order may be executed for the convenience of the parties hereto, individually or in combination, in one or more counterparts, each of which for all purposes shall be deemed to have the status of an executed original and all of which shall together constitute one and the same.

O. The effective date of this Order is the 10th Day after the date the Commissioner or the Commissioner's designee signs this Order.

DATED: FEB - 5 2003

ERIN M. CROTTY
Commissioner
New York State Department
of Environmental Conservation

By:

Dale A. Desnoyers

CONSENT BY RESPONDENT

Respondent hereby consents to the issuing and entering of this Order, waives Respondent's right to a hearing herein as provided by law, and agrees to be bound by this Order.

By: Steven E. Pazar
(TYPE NAME OF SIGNER)

Title: Assistant Secretary

Date: 1/20/03

STATE OF ~~NEW YORK~~ Massachusetts)
) s.s.:
COUNTY OF Middlesex)

On the 20th day of January, in the year 200~~2~~3, before me, the undersigned, personally appeared Steven E. Pazar, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Signature and Office of individual taking acknowledgment Notary Public

My Commission Expires: 6/20/08

EXHIBIT "A"

Map of Site

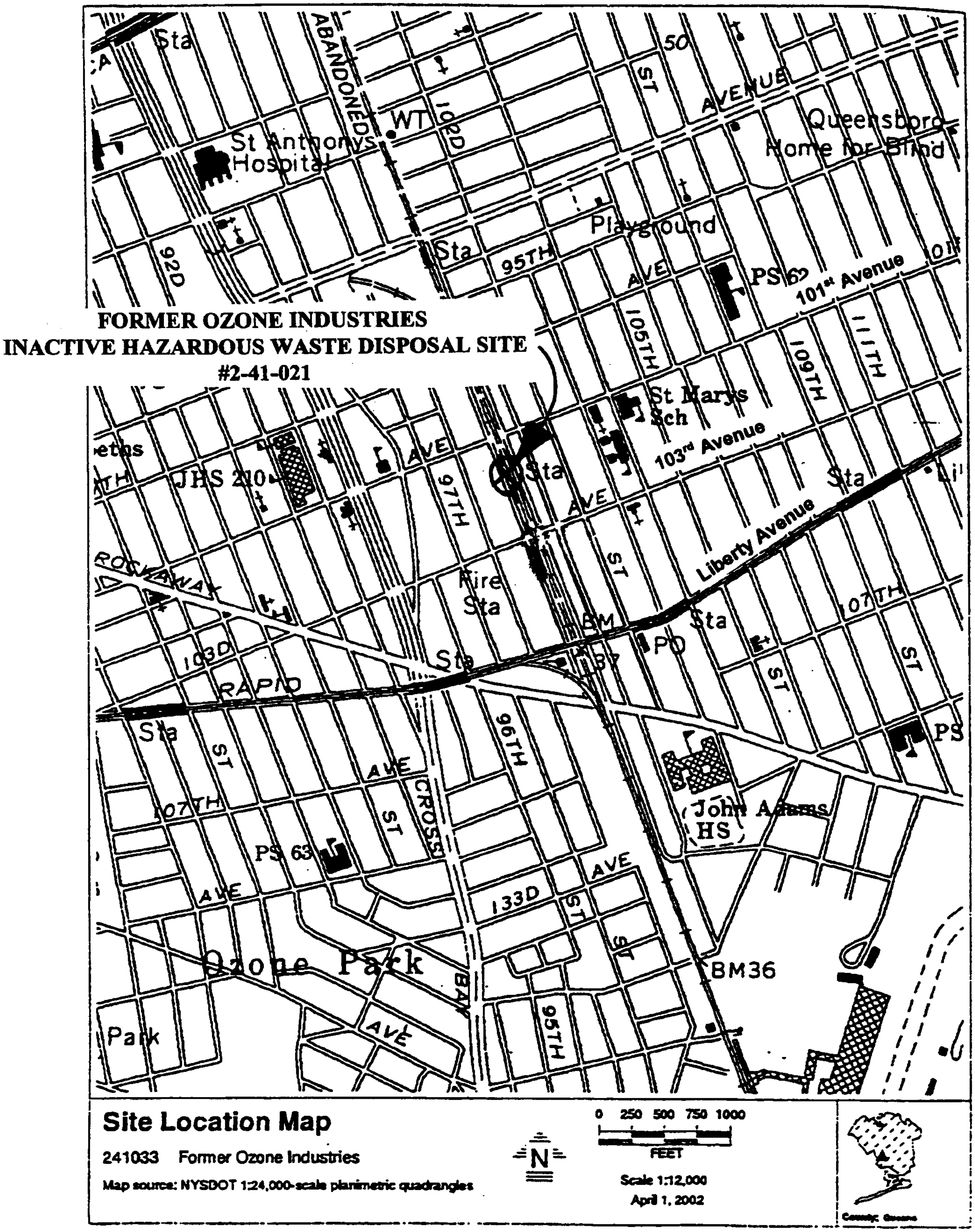
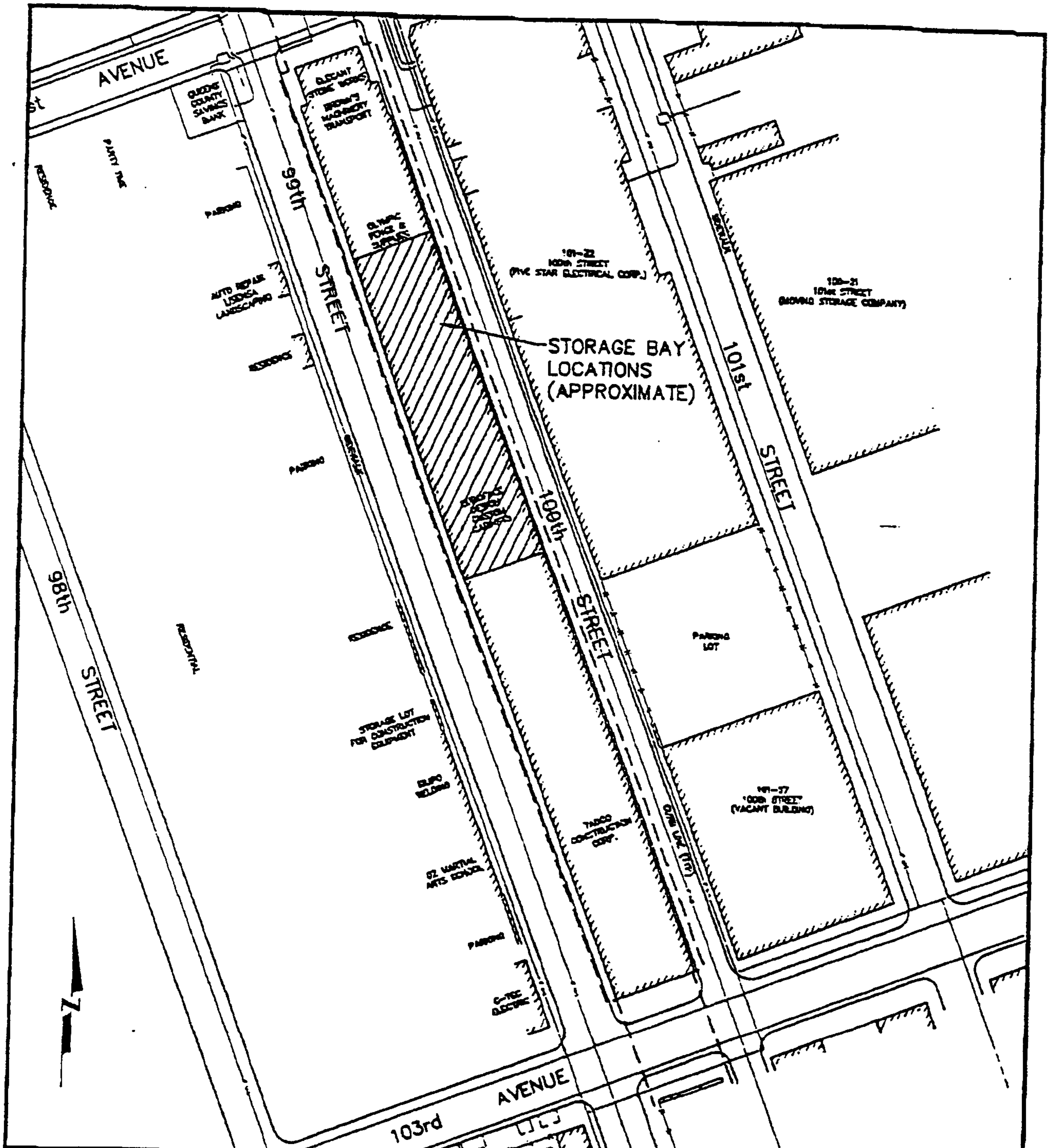

FORMER OZONE INDUSTRIES
INACTIVE HAZARDOUS WASTE DISPOSAL SITE
#2-41-021
Site Location Map
241033 Former Ozone Industries
Map source: NYSDOT 1:24,000-scale planimetric quadrangles
0 250 500 750 1000
FEET
Scale 1:12,000
April 1, 2002
N
St Anthonys Hospital
Queensboro Home for Blind
ABANDONED
WT
102D
Playground
95TH
AVE
PS 62
101st Avenue
105TH
109TH
111TH
St Marys Sch
103rd Avenue
JHS 210
97TH
Sta
Liberty Avenue
ROCKAWAY
Fire Sta
BM
PO
107TH
103D
RAPID
96TH
CROSS
John Adams HS
PS 63
PS
133D
ST
Ozone Park
BAY
BM36
Park
50
AVENUE
92D

EXHIBIT “A”2



0 100 200

SCALE IN FEET
1" = 100'

ENSR INTERNATIONAL
2 TECHNOLOGY PARK DRIVE
WESTFORD, MASSACHUSETTS 01886
PHONE: (978) 589-3000
FAX: (978) 589-3100
WEB: HTTP://WWW.ENSR.COM

FILENAME: 873476A.DWG

EXHIBIT A (2)

FIGURE NUMBER:
1

DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
K.P.B.	11/02	08734-765-100	1

EXHIBIT "B"

Department-Approved Work Plan(s)

EXHIBIT "C"
Cost Summary

EXHIBIT I

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL REMEDIATION
BUREAU OF PROGRAM MANAGEMENT

COST SUMMARY

SITE NAME: OZONE INDUSTRIES
SITE NO.: 2-41-033

COST CATEGORY	AMOUNTS
* DIRECT PERSONAL SERVICES	$18,524.43
* FRINGE	$5,719.94
* INDIRECT	$7,765.39
* PERSONAL SVCS SUBTOTAL	$32,009.76
** CONTRACTUAL	$44,109.02
TRAVEL	$0.00
OTHER	$0.00
DEC SUBTOTAL	$76,118.78
DOH (UNAVAILABLE)	$0.00
TOTAL	$76,118.78

* SEE EXHIBIT II FOR PERSONAL SERVICES COST BREAKDOWN

** SEE EXHIBIT III FOR CONTRACTUAL COST BREAKDOWN

NYSDEC DIRECT PERSONAL COSTS HAVE BEEN INCLUDED THROUGH MARCH 27, 2002

NYSDEC NON-PERSONAL SERVICE COSTS HAVE BEEN INCLUDED THROUGH JULY 5, 2002

NYSDOH COSTS HAVE NOT BEEN INCLUDED

New York State Department of Environmental Conservation
Bureau of Federal and Municipal Accounts
Time & Activity Detail Report

EXHIBIT II

T&A Period	T&A Code	Description	Item No.	Payroll Header (Cost Center)	Name	Title	Progm & Loc Code	Average Biweekly Salary	Time Hours	Amount (Including Leave)
*Time & Activity Code :	B980									
11/11/1998	B980	241XXX OZONE INDUSTR	80251	676534 KE 86	HARRINGTON, DAVID K	ENVIRNL ENGINEER 1	QC/00	1844.30	15.00	447.27
06/23/1999	B980	241XXX OZONE INDUSTR	80251	676534 KE 99	HARRINGTON, DAVID K	ENVIRNL ENGINEER 1	QC/00	1891.36	36.00	1075.49
07/21/1999	B980	241XXX OZONE INDUSTR	80251	676534 KE 99	HARRINGTON, DAVID K	ENVIRNL ENGINEER 1	QC/00	1891.36	30.00	897.13
01/05/2000	B980	241XXX OZONE INDUSTR	80251	676534 KE 99	HARRINGTON, DAVID K	ENVIRNL ENGINEER 1	QC/00	1891.36	29.00	866.13
01/05/2000	B980	241XXX OZONE INDUSTR	15183	208894 99	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	1976.70	9.00	280.95
/24/2000	B980	241XXX OZONE INDUSTR	80251	676534 KE 00	HARRINGTON, DAVID K	ENVIRNL ENGINEER 1	QC/00	1896.55	19.50	594.77
05/24/2000	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2043.65	2.00	62.49
08/16/2000	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2293.65	3.00	107.90
09/13/2000	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	3199.10	2.00	99.36
10/11/2000	B980	241XXX OZONE INDUSTR	47118	430221 L2 00	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2163.01	30.00	1046.16
11/08/2000	B980	241XXX OZONE INDUSTR	47118	430221 L2 00	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2163.01	32.50	1098.89
11/08/2000	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2172.99	12.50	424.62
12/06/2000	B980	241XXX OZONE INDUSTR	47118	430221 L2 00	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2163.01	49.50	1706.67
12/06/2000	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2172.99	2.50	83.05
01/03/2001	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2172.99	6.00	199.96
01/31/2001	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2172.99	10.00	333.76
02/28/2001	B980	241XXX OZONE INDUSTR	47153	430221 L2 00	SWARTWOUT, JOHN B	ENVIRNL ENGINEER 3	QC/00	2872.86	5.00	222.36
02/28/2001	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2172.99	2.00	67.38
03/28/2001	B980	241XXX OZONE INDUSTR	47118	430221 L2 00	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2163.01	25.00	873.46
03/28/2001	B980	241XXX OZONE INDUSTR	15183	208894 00	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2172.99	2.50	84.11
04/25/2001	B980	241033 OZONE INDUSTR	47118	430221 L2 01	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2238.72	34.50	1091.59
04/25/2001	B980	241033 OZONE INDUSTR	15183	208894 01	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2319.08	3.00	105.12
05/23/2001	B980	241033 OZONE INDUSTR	47118	430221 L2 01	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2238.72	33.50	1035.41
06/20/2001	B980	241033 OZONE INDUSTR	47118	430221 L2 01	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2238.72	137.00	3674.81
07/18/2001	B980	241033 OZONE INDUSTR	47118	430221 L2 01	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2238.72	15.00	537.85

New York State Department of Environmental Conservation
Bureau of Federal and Municipal Accounts
Time & Activity Detail Report

T&A Period	T&A Code	Description	Item No.	Payroll Header (Cost Center)	Name	Title	Progm & Loc Code	Average Biweekly Salary	Time Hours	Amount (Including Leave)
**										
*Time & Activity Code :		B980								
11/07/2001	B980	241033 OZONE INDUSTR	47118	430221 L2 01	HARRINGTON, DAVID K	ENVIRNL ENGINEER 2	QC/00	2886.24	27.50	1271.14
11/07/2001	B980	241033 OZONE INDUSTR	15183	208894 01	BREVDO, VADIM	ENVIRNL ENGINEER 2	QA/20	2319.08	7.00	234.60
* Subsubtotal *										
** Subtotal **									580.50	18524.43
*** Total ***									580.50	18524.43
						*** Total ***			580.50	18524.43

Calculated Fringe Benefits Costs	5,719.94
Calculated Indirect Overhead Costs	7,765.39
Total T&A Costs plus Fringe and Indirect	32,009.76

EXHIBIT III

New York State - Department of Environmental Conservation

Payments/Encumbered Amounts - Summary (Based on Sites)

Site Code: 241033

Project Type	Fund Source	Cont. No.	WA_No.	Site Name	Encumbered Amount	Payment Amount
HWA	86 EQBA	D003825	24	FORMER OZONE INDUSTRIES	$50,000.00	$44,109.02
				Total Enc. Amt:	$50,000.00	$44,109.02

EXHIBIT "D"

NOTICE OF ORDER

Endzone, Inc. (registered in New York d/b/a Nojoy), f/k/a BBA Acquisition, Inc., and Ozone Industries, Inc.("Respondent") has entered into an Order On Consent Index #W2-0922-02-05, (the "Order") with the New York State Department of Environmental Conservation (the "Department") relative to an Inactive Hazardous Waste Disposal Site under Article 27, Title 13, and Article 71, Title 27 of the Environmental Conservation Law of the State of New York ("ECL") for the Former Ozone Industries Site located in Queens County, New York within a block that is bounded by 99th and 100th Streets to the east and west, and by 101st and 103rd Avenues to the north and south and beneath an abandoned, elevated Long Island Railroad (LIRR) right of way (the "Site" or "facility").

The Site has been designated by the Department as an inactive hazardous waste disposal site, as that term is defined at ECL Section 27-1301.2, and it has been listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site # 2-41-033. The Department has classified the Site as a Class "2" site pursuant to ECL Section 27-1305.4.b. This classification means that the Department has determined that the Site presents a significant threat to the public health or environment. The Site is more particularly described in the legal description that is attached hereto as Schedule "A."

The purpose of the Order is to address the environmental conditions at or migrating from the Site. The effective date of the Order was **[date to be inserted]**. A copy of the Order, as well as any and all Department-approved Work Plans under this Order can be reviewed at the Department's Central Office located at 625 Broadway, Albany New York by contacting Tara King.

This Notice of Order is being filed with the New York City Register in accordance with Paragraph IX of the Order to give all parties who may acquire any interest in the Site notice of this Order.

WHEREFORE, the undersigned has signed this Notice of Order in compliance with the terms of the Order.

Respondent's name

By:______________________________

Title:____________________________

Date:____________________________

STATE OF NEW YORK

) ss.:

COUNTY OF_________

On the ______ day of ______________ in the year 2001 before me, the undersigned, a notary public in and for said State, personally appeared ______________ ________________________________ personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name(s) is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individuals) or the person upon behalf of which the individual(s) acted, executed this instrument.

____
Notary Public

Appendix "A"

(to Exhibit "D")

Map of the Property

Exhibit "E"

DECLARATION of COVENANTS and RESTRICTIONS

THIS COVENANT, made the __ day of __________ 2001, by Endzone, Inc. (registered in New York d/b/a Nojoy), f/k/a BBA Acquisition, Inc., and Ozone Industries, Inc., a {natural person residing at / partnership organized and existing under the laws of the State of [state name] and having an office for the transaction of business at / corporation organized and existing under the laws of the State of [state name] and having an office for the transaction of business at : {address}

WHEREAS, Endzone, Inc. (registered in New York d/b/a Nojoy), f/k/a BBA Acquisition, Inc., and Ozone Industries, Inc. is the owner of an inactive hazardous waste disposal site, namely, the Former Ozone Industries Site (New York State Department of Environmental Conservation's Hazardous Waste Site Registry Number 2-41-033), located within a block that is bounded by 99th and 100th Streets to the east and west, and by 101st and 103rd Avenues to the north and south, beneath an abandoned, elevated Long Island Railroad (LIRR) right-of-way, in the County of Queens, State of New York, which is part of lands conveyed by { } to { } by deed dated { } and recorded in the ___________ County Clerk's Office on {date} in Book ____ of Deeds at Page ____ and being more particularly described in Appendix "A," attached to this declaration and made a part hereof, and hereinafter referred to as "the Property"; and

WHEREAS, the Property is the subject of a consent order issued by the State of New York on the consent of Endzone, Inc. (registered in New York d/b/a Nojoy), f/k/a BBA Acquisition, Inc., and Ozone Industries, Inc.; and

WHEREAS, the New York State Department of Environmental Conservation set forth a remedy to eliminate or mitigate all significant threats to the environment presented by hazardous waste disposed at the Property in a Record of Decision ("ROD") dated _______________, and such ROD or the Work Plan for the implementation of the ROD required that the Property be subject to restrictive covenants.

NOW, THEREFORE, Endzone, Inc. (registered in New York d/b/a Nojoy), f/k/a BBA Acquisition, Inc., and Ozone Industries, Inc., for itself and its successors and/or assigns, covenants that:

First, the Property subject to this Declaration of Covenants and Restrictions, is as shown on a map attached to this declaration as Appendix "B" and made a part hereof, and consists of [insert metes and bounds description]

Second, unless prior written approval by the New York State Department of Environmental Conservation or, if the Department shall no longer exist, any New York State agency or agencies subsequently created to protect the environment of the State and the health of the State's citizens, hereinafter referred to as "the Relevant Agency," is first obtained, no person shall engage in any activity that will, or that reasonably is anticipated to, prevent or interfere significantly with any proposed, ongoing or completed program at the Property or that will, or is reasonably foreseeable to, expose the public health or the environment to a significantly increased threat of harm or damage.

Third, the owner of the Property shall maintain the cap covering the Property by maintaining its grass cover or, after obtaining the written approval of the Relevant Agency, by capping the Property with another material.

Fourth, the owner of the Property shall prohibit the Property from ever being used for purposes other than for **[define Use]** without the express written waiver of such prohibition by the Relevant Agency.

Fifth, the owner of the Property shall prohibit the use of the groundwater underlying the Property without treatment rendering it safe for drinking water or industrial purposes, as appropriate, unless the user first obtains permission to do so from the Relevant Agency.

Sixth, the owner of the Property shall continue in full force and effect any institutional and engineering controls the Department required Respondent to put into place and maintain unless the owner first obtains permission to discontinue such controls from the Relevant Agency.

Seventh, this Declaration is and shall be deemed a covenant that shall run with the land and shall be binding upon all future owners of the Property and shall provide that the owner, and its successors and assigns, consent to the enforcement by the Relevant Agency of the prohibitions and restrictions that Paragraph X of the Order requires to be recorded, and hereby covenants not to contest the authority of the Department to seek enforcement.

Eighth, any deed of conveyance of the Property, or any portion thereof, shall recite, unless the Relevant Agency has consented to the termination of such covenants and restrictions, that said conveyance is subject to this Declaration of Covenants and Restrictions.

IN WITNESS WHEREOF, the undersigned has executed this instrument the day written below.

[acknowledgment]

Exhibit "F"
Records Search Report

1. Detail all environmental data and information within Respondent's or Respondent's agents or consultants possession or control, regarding environmental conditions at or emanating from the Site.

2. A comprehensive list of all existing relevant reports with titles, authors, and subject matter, as well as a description of the results of all previous investigations of the Site and of areas immediately surrounding the Site which are or might be affected by contamination disposed at the Site, including all available topographic and property surveys, engineering studies and aerial photographs.

3. A concise summary of information held by Respondent and Respondent's attorneys and consultants with respect to:

i. a history and description of the Site, including the nature of operations;

ii. the types, quantities, physical state, locations, methods and dates of disposal or release of hazardous waste at or emanating from the Site; and

iii. a description of current Site security (i.e. fencing, posting, etc)

iv. the names and addresses of all persons responsible for such disposal of hazardous waste, including the dates of such disposal and any proof linking each such person responsible with hazardous wastes identified.

Exhibit "G"
PSA Work Plan Requirements

The PSA Work Plan shall include but not be limited to:

1. A chronological description of the anticipated PSA activities together with a schedule for the performance of these activities.

2. A Sampling and Analysis Plan that shall include:

(i) A quality assurance project plan that describes the quality assurance and quality control protocols necessary to achieve the initial data quality objectives. This plan shall designate a data validation expert and must describe such individual's qualifications and experience.

(ii) A field sampling plan that defines sampling and data gathering methods in a manner consistent with the "Field Methods Compendium," OSWER Directive 9285.2-11 (draft June 1993), as supplemented by the Department.

(iii) A health and safety plan to protect persons at and in the vicinity of the Site during the performance of the PSA which shall be prepared in accordance with 29 CFR 1910 and all other applicable standards by a certified health and safety professional. Respondent shall add supplemental items to this plan necessary to ensure the health and safety of all persons at or in the vicinity of the Site during the performance of any work pursuant to this Order.

3. The Work Plan shall incorporate all elements of a PSA as set forth in Department technical and administrative guidance documents including, but not limited to, investigations of surface and subsurface soils, surface waters, ground water, and air.

4. The PSA must be sufficiently comprehensive to allow the Department to determine whether a consequential amount of hazardous waste has been disposed at the site and, if so, whether the contamination presents a significant threat to human health and/or the environment.

Exhibit "H"
RI/FS Work Plan Requirements

The Investigation Work Plan shall include but not be limited to:

1. A chronological description of the anticipated RI/FS activities together with a schedule for the performance of these activities.

2. A Sampling and Analysis Plan that shall include:

(i) A quality assurance project plan that describes the quality assurance and quality control protocols necessary to achieve the initial data quality objectives. This plan shall designate a data validation expert and must describe such individuals qualifications and experience.

(ii) A field sampling plan that defines sampling and data gathering methods in a manner consistent with the "Field Methods Compendium," OSWER Directive 9285.2-11 (draft June 1993), as supplemented by the Department.

(iii) A health and safety plan to protect persons at and in the vicinity of the Site during the performance of the RI/FS which shall be prepared in accordance with 29 CFR 1910 and all other applicable standards by a certified health and safety professional. Respondent shall add supplemental items to this plan necessary to ensure the health and safety of all persons at or in the vicinity of the Site during the performance of any work pursuant to this Order.

(iv) A citizen participation plan that is, at a minimum, consistent with the Department's publication "Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook," dated June 1998, and any subsequent revisions thereto, and 6 NYCRR Part 375.

3. The Work Plan shall incorporate all elements of an RI/FS as set forth in CERCLA, as amended, the NCP, the USEPA guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," dated October 1988, and any subsequent revisions to that guidance document in effect at the time the RI/FS Work Plan is submitted, and appropriate USEPA and Department technical and administrative guidance documents.

4. The Work Plan shall provide for an FS evaluating on-Site and off-Site remedial actions to restore the Site to pre-disposal conditions, to the extent feasible and authorized by law. At a minimum, alternatives shall evaluate the elimination or mitigation of all significant threats to the public health and to the environment presented by hazardous waste disposed at the Site through the proper application of scientific and engineering principals.

EXHIBIT "I"

IRM Work Plan Requirements

The IRM Work Plan shall include, at a minimum, the following:

A. a summary of the data supporting the extent of the proposed IRM;

B. a chronological description of the anticipated IRM activities;

C. a schedule for performance of the IRM activities;

D. detailed documents and/or specifications prepared, signed, and sealed by a to providing sufficient detail to implement the Department-approved IRM, including as appropriate, a description of soil and sediment erosion control, storm water management and monitoring, and dust, odor and organic vapor control and monitoring procedures to be implemented during remedial activities, a detailed description of confirmation sampling and site restoration plans;

E. a health and safety plan, including a community air monitoring plan;

F. a contingency plan, including description of procedures for dismantling and removal of remedial structures and equipment from the site, if applicable;

G. a citizen participation plan, if required, that incorporates appropriate activities outlined in the Department's publication "Citizen Participation in New York's Hazardous Waste Site Remediation Program - A Guidebook", dated June 1998, and any subsequent revisions thereto, and 6 NYCRR Part 375;

H. an OM&M Plan, if the performance of the Department-approved IRM results in a treatment system which is expected to operate for greater than 18 months. If the system will not operate for greater than 18 months, or if only monitoring is required, a monitoring plan only will be needed, and;

I. a description of institutional controls to be implemented and written approval from the owner of the property where the institutional control will be placed, if the remedy selected requires implementation of an institutional control at an off-site location or if the person responsible for the remedy is not the site owner.

Exhibit "J"
Remediation Work Plan Requirements

The Remediation ("RD/RA") Work Plan shall include the following:

1. A detailed description of the remedial objectives and the means by which each element of the selected remedial alternative will be implemented to achieve those objectives, including, but not limited to:

   a. the construction and operation of any structures;

   b. the collection, destruction, treatment, and/or disposal of hazardous wastes and substances and their constituents and degradation products, and of any soil or other materials contaminated thereby;

   c. the collection, destruction, treatment, and/or disposal of contaminated groundwater, leachate, and air;

   d. physical security and posting of the Site;

   e. quality control and quality assurance procedures and protocols to be applied during implementation of the Remedial Construction; and

   f. monitoring which integrates needs which are present on-Site and off-Site during implementation of the Department-selected remedial alternative.

2. "Biddable Quality" documents for the Remedial Design including, but not limited to, documents and specifications prepared, signed, and sealed by a. These plans shall satisfy all applicable local, state and federal laws, rules and regulations;

3. A time schedule to implement the Remedial Design;

4. The parameters, conditions, procedures, and protocols to determine the effectiveness of the Remedial Design, including a schedule for periodic sampling of all media of concern including groundwater monitoring wells on-Site and off-Site;

5. A description of operation, maintenance, and monitoring activities to be undertaken after the Department has approved construction of the Remedial Design, including the number of years during which such activities will be performed (where appropriate) a specific description of the criteria to be used to decide when an operation of the remedy may be discontinued.

6. A contingency plan to be implemented if any element of the Remedial Design fails to achieve any of its objectives or otherwise fails to protect human health or the environment;

7. A health and safety plan for the protection of persons at and in the vicinity of the Site during construction and after completion of construction. This plan shall be prepared in accordance with 29 CFR 1910 by a certified health and safety professional; and

8. A citizen participation plan which incorporates appropriate activities outlined in the Department's publication "Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook," dated June 1998, and any subsequent revisions thereto, and 6 NYCRR Part 375.

Exhibit "K"
OM&M Work Plan Requirements

The OM&M Plan shall provide for the:

1. Operation and maintenance of engineering controls and/or treatment systems;

2. Maintenance of institutional controls, where applicable;

3. Yearly certification by a Professional Engineer of the continued effectiveness of any institutional and/or engineering controls, where applicable. The certification must identify the required controls and evaluate whether the controls remain in place and effective for the protection of public health and the environment;

4. A monitoring plan which describes the measures for monitoring the performance and effectiveness of the remedy at a site.

5. A contingency plan which describes procedures to be conducted in the event of an emergency, such as a fire, spill, tank or drum overflow or rupture, severe weather or vandalism, which may be required to protect and/or maintain the operation of the remedy.

6. A health and safety plan and a list of records and references;

7. Monitoring and reporting of the performance and effectiveness of the remedy, both short and long-term, by:

    i. Assessing compliance with actual or equivalent discharge permit limits;

    ii. Assessing achievement of the remedial performance criteria; and,

    iii. Sampling and analysis of appropriate media;

8. Determination when the remedy is complete by demonstrating that the remedial action objectives have been achieved.

Exhibit "L"
Record of Decision

Glossary of Terms

The following terms shall have the following meanings:

"ADD": Assistant Division Director, Division of Environmental Remediation

"CERCLA": the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq.

"Day": a calendar day unless expressly stated to be a Business Day. "Business Day" shall mean a day other than a Saturday, Sunday or State holiday. In computing any period of time under this Order, where the last day would fall on a Saturday, Sunday or State holiday, the period shall run until the close of business of the next working day.

"Department": the New York State Department of Environmental Conservation.

"ECL": the Environmental Conservation Law, Chapter 43-B of the Consolidated Laws of New York, as amended.

"Feasibility study": a study undertaken to develop and evaluate options for remedial action. The feasibility study emphasizes data analysis and is generally performed concurrently and in an interactive fashion with the remedial investigation, using data gathered during the remedial investigation. The term also refers to a report that describes the results of the study. (See 6 NYCRR 375-1.3(j))

"Inactive Hazardous Waste Disposal Site Remedial Program" or "Remedial Program": activities undertaken to eliminate, remove, abate, control or monitor existing health hazards, existing environmental hazards, potential health hazards and/or potential environmental hazards in connection with the Site and all activities to manage wastes and contaminated materials at or removed from the Site. (See ECL 27-1301(3) and 6 NYCRR 375-1.3(m))

"IRM": a discrete set of activities, including removal activities, to address both emergency and non-emergency site conditions, which can be undertaken without extensive investigation or evaluation, to prevent, mitigate, or remedy environmental damage or the consequences of environmental damage attributable to the Site. (See 6 NYCRR Part 375-1.3(n))

"National Contingency Plan" or "NCP": the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. 9605 and codified at 40 C.F.R. Part 300, and any amendments thereto.

"NL": the Navigation Law, Chapter 37 of the Consolidated Laws of New York, as amended.

"Order": this Order and all appendices attached hereto.

"Professional engineer": an individual registered as a professional engineer in accordance with Article 145 of the New York State Education Law. If such individual is a member of a firm, that firm must be authorized to offer professional engineering services in the State of New York in accordance with Article 145 of the New York State Education Law.

"Record of Decision" or "ROD": the document reflecting the Department's selection of a remedy relative to the Site or any Operable Unit thereof. The ROD shall be attached to and made enforceable under this Order as Exhibit "L."

"Remedial Action": those activities, except for OM&M, to be undertaken under this Order to implement the ROD.

"Remedial Investigation": a process undertaken to determine the nature and extent of contamination. The remedial investigation emphasizes data collection and site characterization, and generally is performed concurrently with the feasibility study. It includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for, and the proposed extent of, the program and to support the evaluation of proposed alternatives. (See 6 NYCRR 375-1.3(t))

"Spill Fund": the New York State Environmental Protection and Spill Compensation Fund as established by Article 12, Part Three of the NL

"State Costs": all the State's response expenses related to this Site, including, but not limited to, direct labor, fringe benefits, indirect costs, travel, analytical costs, and contractor costs incurred by the State of New York for reviewing and developing work plans, reports or other items pursuant to this Order, verifying or otherwise implementing, overseeing, or enforcing this Order and any other response costs as defined under CERCLA. Approved agency fringe benefit and indirect cost rates will be applied.

"Termination Date": the date that this Order is terminated pursuant to Paragraph XIII.

"USEPA": the United States Environmental Protection Agency.

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B, 12th Floor
625 Broadway, Albany, New York 12233-7016
Phone: (518) 402-9774 • FAX: (518) 402-9773
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

December 22, 2003

Mr. David Austin
ENSR Corporation
2 Technology Park Drive
Westford, MA 01886

RE: Former Ozone Industries, Inc. Site
Site No. 2-41-033
Ozone Park, Queens, NY
Work Plan Review Comments

Dear Mr. Austin,

The New York State Department of Environmental Conservation (NYSDEC) has reviewed the Remedial Investigation and Feasibility Study (RI/FS) Work Plan for the Former Ozone Industries, Inc., dated April 15, 2003. This RI/FS Work Plan is for the NYSDEC Class 2 Inactive Hazardous Waste Disposal Site No. 2-41-033 located beneath an abandoned elevated Long Island Railroad between 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south. The following comments are offered which also incorporated comments from the New York State Department of Health (NYSDOH);

Work Plan:

The primary purpose of a Remedial Investigation (RI) is typically to define the "nature and extent" of contamination identified at a site, both vertically and horizontally. This includes contamination in both groundwater and soil. Given the limited number of proposed sampling locations, it is likely the primary purpose of an RI would not be fulfilled during this investigation. Although this Work Plan allows for additional sampling as part of a separate phase, the study area, at a minimum, should be expanded to include a soil gas survey and allow the delineation and the extent of contamination that has already been identified.

1. Section 2.4 (page 11): In paragraph 7, the Work Plan references that this RI/FS will evaluate "the potential migration of vapors from impacted groundwater to indoor air...". Past soil gas samples from the area have documented the presence of a volatile organic compounds (VOC) plume, which is mainly comprised of trichloroethene (TCE), in soil gas. Field work to define the extent of this soil gas plume must be included in this Work Plan. An adequate soil gas survey must be conducted along 100th Street (approx. every 50 feet) to evaluate the potential migration of vapors from impacted groundwater to indoor air.

2. During the soil gas survey, a representative ambient air sample should be collected.

3. A minimum of four soil gas samples are needed in the "Site Vicinity" of the Firehouse, PS-65 and 103rd Avenue to update past soil gas samples which have documented a presence of a VOC plume. Permanent soil gas wells exist in the sidewalks. SG-16, SG-13, SG-09 and SG-03 would be representative locations to sample.

4. Section 2.2.1: Delete the last sentence in the second paragraph which begins with "Subsequently, the NYSDEC...". In any text, references to PS-65 should be minimized to avoid any confusion between PS-65 and the listed Ozone Industries Site. "Site Vicinity" should be utilized whenever possible.

5. Section 2.4 (page 11): In paragraph 5, delete the last sentence beginning with "Subsurface soil does not...." since there is no data to support this statement.

6. Section 2.4.1, Data Gaps (page 12): The last bullet indicates that "other potential source areas contributing to groundwater contamination" will be identified. Please provide details on how this will be accomplished.

7. The Work Plan includes collecting a groundwater sample from piezometer PZ-01 which is forty-one feet deep and up-gradient of the Ozone Industries Site (on 101st Avenue). Any potential off-site source of contamination up-gradient of the Site at a depth greater than forty-one feet would be undetected. In addition, groundwater samples from deeper monitoring wells at the Site or Site Vicinity might detect a potential up gradient off-site source which could be interpreted as an on-site source. It is recommended to have a deep up-gradient monitoring well as a sentinel well for any potential source of up-gradient contamination (i.e. Adams Brush site).

8. All buildings in the vicinity of the site must be identified as to whether they have basements or not. As an initial reference, there are detailed field notes of buildings and apartment locations in Attachment H of the September 2002 Letter Report by URS.

9. Page 13 of work plan: SS-1 thru SS-8 will include 8 subsurface soil borings 16 feet deep. Why are the boring only 16 feet deep? Soil gas should also be sampled in these eight locations.

10. Do GP-12 and GP-13 (January 2000 data) exist? If they exist, provide the locations and the total volatile organic compound (TVOC) data on Figure 3.

11. Surface soil samples in the bay areas will be collected to show that there is no threat to the public. This requires a representative number of surface soil samples at a 0" to 2" depth below the ground surface for SVOCs and metals.

12. Provide a soil and groundwater map in the RI/FS Report which shows a profile of the depths of TCE contamination (depth of plume).

13. A map showing the horizontal extent of the TCE plume and concentrations is needed.

14. Please provide all final and approved documents in PDF format.

Figure 3 of the Work Plan:

1. Show the specific location of the former Ozone rental areas including the bay numbers (bays #9 through #15?). Show and label the location of the drum storage area (bay 13?).

2. Describe the types of businesses that are in the rented bays along 99th Street. Identify any potential generators of waste (solvent users, USTs, air discharges) in these spaces that could contribute to the groundwater, soil or air contamination in the area.

3. Show and describe the properties along the north side of 103rd Avenue between 98th Street and 99th Street.

4. Show and describe the properties along the east side of 98th Street between 103rd Avenue and 101st Avenue.

5. Show the apparent dry cleaning facility near the corner of 101st Avenue and 100th Street.

6. Provide the location and depth of utilities in the area of the site (storm, sewers, waterlines) since these could act as conduits for contamination. Provide any information on floor drains, subsurface collections systems and vents/exhaust fans in buildings.

7. Show the residential homes on the north side of 103rd Avenue between 98th Street and 99th Street.

8. Show on Figure 3 the location and total VOCs of GP-37 and GP-38 (near GP-8 on 100th Street). See survey map (and figure 3) in NYSDEC IIWA Letter Report, September 2001.

9. Include a note on Figure 3 which states that locations on Figure 3 designated as GP-01 through GP-19 are also the locations of soil gas sampling points SG-01 to SG-19 (July 2002 Report).

Appendix A, Signed Consent Order:

1. Insert the (attached) corrected site map in Appendix A.

Sampling Plan:

1. Section 3.1 Focus Soil Investigation – The collection of surface soil samples is discussed in this section. However, the interval that will be collected to represent "surface soil" has not been defined. Typically the NYS Department of Health considers surface soil to be 0" to 2" below grade surface, since this is the depth to which people are likely exposed

through non-intrusive activities. Please provide a definition of surface soil and add a section to the Field Sampling Plan, Appendix B, to explain how surface soil samples will be collected.

2. Appendix B, Field Sampling Plan, Section 3.2.1, Vacuum Excavation (page B-7) and Section 3.3.1 (page B-9): To avoid hitting buried utilities, a vacuum excavator (vac ex) system will be utilized to bore a 10 inch diameter hole to a depth of approximately 6 feet. However, representative subsurface soil samples must be collected in the top six feet for VOCs. As indicated, this will be accomplished by using hand tools. Please describe the potential impact this technique may have on the collection of VOC soil vapors in soil. It would appear that the vac ex boring system could vacuum out some or all of the volatiles in the boring prior to sampling. Explain how a representative VOC soil sample can be collected using this method.

3. Section 2.1, Soil Investigation (page B-2): Which bay is considered to be "the bay that is potentially most likely to be impacted from past solvent storage and/or use"?

4. MW-19 has been destroyed. Replacing the MW-19 can not be reasonably done due to scaffolding that now exists overhead. Another representative sampling point must be selected.

5. Based on the groundwater flow in the area, the location of proposed MW-202 should be moved south on 98th Street closer to 103rd Avenue to better capture the edge of any potential TCE contaminated groundwater plume.

6. Groundwater samples were collected from three depths in each temporary well GP-108, GP-06, GP-13 thru GP-18. This should be done during the installation of the new wells MW-201S, MW-201D, MW-202 and MW-203 to identify any contaminate layer in the groundwater.

7. Why is the new well MW-201D proposed to be 100 feet to 140 feet deep? The existing site data indicates that the TCE contamination could likely be at the 35 foot to 55 foot range. The depths of the new proposed wells should be in this range. Describe the location of the well screens in all the proposed wells.

8. Section 3.2 Groundwater Investigation (page 14): This Section of the Work Plan proposes to sample sixteen existing piezometers or monitoring wells. All the monitoring wells are screened at either 20 feet to 35 feet or 65 feet to 75 feet. Since the existing groundwater data indicates that the TCE contamination could likely be at the 35 foot to 55 foot range, any potential TCE plume at this depth could be missed. In defining the extent of the TCE plume, groundwater sampling must include this 35 to 55 foot range.

9. If the groundwater analytical results from proposed MW-202 are above standards, then additional investigation in the area of this well will be required along 98th Street.

10. Change reference from Tara King to John Durnin on page B-20 of the Sampling Plan.

11. Section 5 of the Sampling Plan: The sampling and analysis for the second round of sampling will take more than one week unless the turn around times are shorter than the normal turn around times.

12. ENSR SOP Number 7116 has duplicate pages in the beginning.

Quality Assurance Project Plan (QAPP):

1. The distribution list at the beginning of the QAPP section should remove Tara King's name as the NYSDEC contact and replace it with John Durnin.

2. Section 17.2.2-Laboratory Data: "The consultant will provide an independent validation of the laboratory data." Is Richard L. Wellman the qualified individual that will perform the data validation?

Health and Safety Plan (HASP):

1. Page D-iii of the Table of Contents indicates Figure 1: Site Locus Map. There is no map in the HASP. Please include this map.

2. In Section 2.3, Environmental History (page D-5): Delete the last sentence in the second paragraph which begins with "Subsequently, the NYSDEC...". In any text, references to PS-65 should be minimized to avoid any confusion between PS-65 and the listed Ozone Industries Site.

3. Page D-9: Change the end of the sentence to include the seven existing wells referenced on page 15 of the Work Plan text (Section 3.5).

4. Following page D-30 of the HASP, a map should be included which shows how to get to the nearest hospital.

5. The designated hospital(s) should be contacted to be sure they can accept individuals that are contaminated with the contaminates of concern (TCE).

6. Section 6.0: Air Monitoring: The general weather conditions should be recorded during periods of PID use.

7. Section 7.1: Protective Clothing by Task, page D-22: Please clarify why leather gloves are not required to be worn by operators of Geoprobe equipment (Task 1) and rotary drill rig operators (Task 2).

Community Air Monitoring Plan (CAMP):

1. Appendix E Community Air Monitoring Plan Action 2.1 Air Monitoring Objectives – The purpose of a community air monitoring plan is to be protective of public health, not simply "worker safety". Please revise the second bullet to reflect this.

2. Section 2.1 discusses the use of a PID in the breathing zone to determine when to require respiratory protection (excess of 25 units). How does this relate to Section 3: Real Time Air Monitoring which describes stopping work in the work area if the PID exceeds 5 ppm above background (under certain conditions)?

Citizen Participation Plan (CPP):

1. Section 3.2, Preliminary Conceptual Site Model (page F-4): Paragraph 5, delete the last sentence beginning with "Subsurface soil does not...." since there is no data to support this statement.

2. Section 3.2.1: Data Gaps, indicates that further investigation will be conducted to "Identify other potential source areas contributing to groundwater contamination". Explain what will be done to identify other source areas.

3. Section 6.0, Project Contacts (Page F-7): Remove the NYSDEC Toll-free telephone number since it no longer exists. Change the NYSDEC Project Manager from Tara King to John Durnin, 402-9774, fax is 402-9773, zip code is 12233-7016. Also, make these changes on page F-9 (Section 7).

4. Section 7.0 Citizen Participation Activities and References – Please discuss the location(s) of a document depository.

5. Appendix F, Citizen Participation Plan, Section 6.0, Project Contacts: Under "NYSDOH", please remove the line with contact information for the Health Liaison Program. This group no longer exists. Please provide the toll-free phone number, 1-800-458-1158, Extension 2-7870 and indicate Dawn Hettrick as the NYSDOH contact.

6. Remove the Toll-free telephone number from page 5 of Attachment 1, Fact Sheets. The NYSDEC toll free number no longer exists.

7. Attachment 1, RI/FS fact Sheet: This attachment provides a good overall summary of the RI/FS process, however, any fact sheet that will be sent to the public must first be reviewed and approved by NYSDEC and NYSDOH.

8. A physical canvas of Site and Site Vicinity must be conducted to ensure all apartment addresses are included. Just sending a Fact Sheet to the building owners is not enough. Fact Sheets must be delivered to all tenants of buildings in the area.

Records Search and Report:

1. What is the foundation construction of the abandoned elevated railroad?

2. What is the typical foundation construction of the area buildings?

3. When did the Long Island Railroad abandon this section of railroad?

4. When did the NYC Authority begin renting the space under the elevated Railroad?

5. What was the use of the Ozone space prior to Ozone renting the area?

6. What was the use of the adjacent spaces to the ozone area prior to, during and after Ozone occupied the rented space?

7. What time period did Ozone rent the space (1987 to 1988)?

8. On a map, provide the location of the trench, 1000 gallon UST and grease trap that are referenced in the Records Search Report. Also show Building 8, Lot 27.

9. Figure 2 of the Multi-Site PSA by Lawler Matusky & Skelly Engineers shows the locations of TCE tanks #1, #4 and #9. These tanks and their history should be included in the Records Search Report.

It would be helpful to arrange a meeting in the near future to discuss these comments. As the Project Manager, I am available at (518) 402-9774 to answer any questions.

Sincerely,

P.E.

John Durnin, P.E.
Environmental Engineer
Division of Environmental Remediation

Listing of Response to Comments included in this Revised RI/FS Work Plan (by ENSR)

Former Ozone Industries, Inc. Site
Site No. 2-41-033, Ozone Park, Queens, NY

The following is a listing of the review comments by the NYSDEC (presented in a letter dated December 22, 2003) on the original Remedial Investigation / Feasibility Study (RI/FS) Work Plan (Dated April 15, 2003). Each comment is followed by a response noting how and where the comments are addressed in the revised RI/FS Work Plan if applicable.

Work Plan:

Comment 1.

Section 2.4 (page 11): In paragraph 7, the Work Plan references that this RI/FS will evaluate "the potential migration of vapors from impacted groundwater to indoor air…". Past soil gas samples from the area have documented the presence of a volatile organic compounds (VOC) plume, which is mainly comprised of trichloroethene (TCE), in soil gas. Field work to define the extent of this soil gas plum must be included in this Work Plan. An adequate soil gas survey must be conducted along 100th Street (approx. every 50 feet) to evaluate the potential migration of vapors from impacted groundwater to indoor air.

Response:

Soil gas evaluation at the Site has been incorporated in the proposed RI program pursuant to conversations between ENSR and NYSDEC (the scope of the soil gas evaluation was discussed during a telephone conference call on March 8, 2004).

Comment 2.

During the soil gas survey, a representative ambient air sample should be collected.

Response:

This has been incorporated into the RI Work Plan.

Comment 3.

A minimum of four soil gas samples are needed in the "Site Vicinity" of the Firehouse, PS-65 and 103rd Avenue to update past soil gas samples which have documented a presence of a VOC plume. Permanent soil gas wells exist in the sidewalks. SG-16, SG-13, SG-09 and SG-03 would be representative locations to sample.

Response:

This has been incorporated into the RI Work Plan.

Comment 4.

Section 2.2.1: Delete the last sentence in the second paragraph which begins with “Subsequently, the NYSDEC…”. In any text, references to PS-65 should be minimized to avoid any confusion between PS-65 and the listed Ozone Industries Site. “Site Vicinity” should be utilized whenever possible.

Response:

Completed (see revised text).

Comment 5.

Section 2.4 (Page 11): In paragraph 5, delete the last sentence beginning with “Subsurface soil does not…” since there is no data to support this statement.

Response:

Completed (see revised text).

Comment 6.

Section 2.4.1, Data Gaps (page 12): The last bullet indicates that “other potential source areas contributing to groundwater contamination” will be identified. Please provide details on how this will be accomplished.

Response:

See revised text.

Comment 7.

The Work Plan includes collecting a groundwater sample from piezometer PZ-01 which is forty-one feet deep and up-gradient of the Ozone Industries Site (on 101st Avenue). Any potential off-site source of contamination up-gradient of the Site from deeper than forty-one feet would be undetected. In addition, groundwater samples from deeper monitoring wells at the Site or Site vicinity might detect a potential up gradient off-site source which could be interpreted as an on-site source. It is recommended to have a deep up-gradient monitoring well as a sentinel well for any potential source up-gradient contamination (i.e. Adams Brush Site).

Response:

Installations of deep wells near PZ-01 have been incorporated into the Work Plan (Section 3.3).

Comment 8.

All building in the vicinity of the site must be identified as to whether they have basements or not. As an initial reference, there are detailed field notes of buildings and apartment locations in Attachment H of the September 2002 Letter Report by URS.

Response:

See revised text. Additional documentation will be provided in the RI report as applicable.

Comment 9.

Page 13 of work plan: SS-1 thru SS-8 will include 8 subsurface soil borings 16 feet deep. Why are the boring only 16 feet deep? Soil gas should also be samples in these eight locations.

Response:

See revised text (Sections 3.1 and 3.2).

Comment 10.

Do GP-12 and GP-13 (January 2000 data) exist? If they exist, provide the locations and the total volatile organic compound (TVOC) data on Figure 3.

Response:

Page 2-4 of the Preliminary Site Assessment Report Volume 1 states, “Two additional probes were to have been installed in the Ozone parking lot but permission was denied by Five Star Electrical Corporation.” These are thought to be the proposed GP-12 and GP-13. There is no data or record that either point ever existed.

Comment 11.

Surface soil samples in the bay areas will be collected to show that there is no threat to the public. This requires a representative number of surface soil samples at a 0” to 2” depth below the ground surface for SVOCs and metals.

Response:

This has been incorporated into the Work Plan (Section 3.2).

Comment 12.

Provide a soil and groundwater map in the RI/FS Report, which shows a profile of the depths of TCE contamination (depth of plume).

Response:

As discussed with the NYSDEC, this will be completed as applicable for the RI report.

Comment 13.

A map showing the horizontal extent of the TCE plume and concentrations needed.

Response:

As discussed with the NYSDEC, this will be completed as applicable for the RI report.

Comment 14.

Please provide all final and approved documents in PDF format.

Response:

ENSR will provide all final and approved documents in PDF format.

<u>Figure 3 of the Work Plan:</u>

Comment 1.

Show the specific location of the former Ozone rental areas including the bay numbers (bays #9 through 15?). Show and label the location of the drum storage area (bay 13?).

Response:

Bay numbers are noted in revised Figures 3 and 4. As discussed in Work Plan, the Bays actually used by Ozone Industries, Inc. and the one containing the former drum storage area are still being researched and confirmed.

Comment 2.

Describe the types of businesses that are in the rented bays along 99th street. Identify any potential generators of waste (solvent users, UST's, air discharges) in these spaces that could contribute to the groundwater, soil or air contamination in the area.

Response:

Descriptions of current businesses/tenants based upon limited access and information from the City of New York are included Section 2.1 of the Work Plan. The information will be updated as applicable as part of the RI.

Comment 3.

Show and describe the properties along the north side of 103rd Avenue between 98th Street and 99th Street.

Response:

See revised Figures 3 and 4. The information will be updated as applicable as part of the RI.

Comment 4.

Show and describe the properties along the east side of 98th Street between 103rd Avenue and 101st Avenue.

Response:

See revised Figures 3 and 4. The information will be updated as applicable as part of the RI.

Comment 5.

Show the apparent dry cleaning facility near the corner of 101st Avenue and 100th Street.

Response:

Not found during April 2004 Site reconnaissance by ENSR. The information will be updated as applicable as part of the RI.

Comment 6.

Provide the location and depth of utilities in the area of the site (storm, sewers, waterlines) since these could act as conduits for contamination. Provide any information on floor drains, subsurface collections systems and vents/exhaust fans in buildings.

Response:

See revised text in Work Plan (Section 2.1).

Comment 7.

Show the residential homes on the north side of 103rd Avenue between 98th Street and 99th Street.

Response:

See revised Figures 3 and 4.

Comment 8.

Show on Figure 3 the location and total VOCs of GP-37 and GP-38 (near GP-8 on 100th Street). See Survey map (and figure 3) in NYSDEC IIWA Letter Report, September 2001.

Response:

Figure 3 does not depict soil VOC concentrations, and no groundwater data is included in the September 2001 report.

Comment 9.

Include a note on Figure 3, which states that locations on Figure 3 designated as GP-01 through GP-19 are also the locations of soil gas sampling points SG-01 to SG-19 (July 2002 Report).

Response:

See revised Figures 3 and 4.

<u>Appendix A, Signed Consent Order:</u>

Comment 1.

Insert the (attached) corrected site map in Appendix A.

Response:

Completed (see copy of Consent Order in Appendix A).

Sampling Plan:

Comment 1.

Section 3.1 Focus Soil Investigation – The collection of surface soil samples is discussed in this section. However, the interval that will be collected to represent "surface soil" has not been defined. Typically the NYS Department of Health considers surface soil to be 0" to 2" below grade surface, since this is the depth to which people are likely exposed through non-intrusive activities. Please provide a definition of surface soil and add a section to the Field Sampling Plan, Appendix B, to explain how surface soil samples will be collected.

Response:

Surface soil sampling (if applicable) has been incorporated into the Work Plan and Field Sampling Plan.

Comment 2.

Appendix B, Field Sampling Plan, Section 3.2.1, Vacuum Excavation (page B-7) and Section 3.3.1 (page B-9): To avoid hitting buried utilities, a vacuum excavator (vac ex) system will be utilized to bore a 10 inch diameter hole to a depth of approximately 6 feet. However, representative subsurface soil samples must be collected in the top 6 feet for VOCs. As indicated, this will be accomplished by using hand tools. Please describe the potential impact this technique may have on the collection of VOC soil vapors in soil. It would appear that the vac ex boring system could vacuum out some or all of the volatiles in the boring prior to sampling. Explain how a representative VOC soil sample can be collected using this method.

Response:

See revised Field Sampling Plan (Section 3.3).

Comment 3.

Section 2.1, Soil Investigation (page B-2): Which bay is considered to be "the bay that is potentially most likely to be impacted from past solvent storage and/or use"?

Response:

See revised Work Plan and Field Sampling Plan text.

Comment 4.

MW-19 has been destroyed. Replacing the MW-19 can not be reasonably done due to scaffolding that now exists overhead. Another representative sampling point must be selected.

Response:

See revised text (MW-13S, south of MW-19 has been added).

Comment 5.

Based on the groundwater flow in the area, the location of proposed MW-202 should be moved south on 98th Street closer to 103rd Avenue to better capture the edge of any potential TCE contaminated groundwater plume.

Response:

See revised Figures 3 and 4.

Comment 6.

Groundwater samples were collected from three depths in each temporary well GP-108, GP-06, GP-13 through GP-18. This should be done during the installation of the new wells MW-201S, MW-201D, MW-202 and MW-203 to identify any contaminate layer in the groundwater.

Response:

See revised Work Plan and Field Sampling Plan text (Sections 3.3 in each).

Comment 7.

Why is the new well MW-201D proposed to be 100 feet to 140 feet deep? The existing site data indicates that the TCE contamination could likely be at the 35 foot to 55 foot range. The depths of the new proposed wells should be in this range. Describe the location of the well screens in all the proposed wells.

Response:

See revised Work Plan and Field Sampling Plan text (Sections 3.2 and 3.3, respectively).

Comment 8.

Section 3.2 Groundwater Investigation (page 14): This Section of the Work Plan proposes to sample sixteen existing piezometers or monitoring wells. All the monitoring wells are screened at either 20 feet to 35 feet or 65 feet to 75 feet. Since the existing groundwater data indicates that the TCE contamination could likely be at the 35 foot to 55 foot range, any potential TCE plume at this depth could be missed. In defining the extent of the TCE plume, groundwater sampling must include this 35 to 55 foot range.

Response:

See revised Work Plan and Field Sampling Plan text (Sections 3.0 and 3.3, respectively).

Comment 9.

If the groundwater analytical results from proposed MW-202 are above standards, then additional investigation in the area of this well will be required along 98th Street.

Response:

This will be evaluated in the RI once results from proposed MW-202 location are collected.

Comment 10.

Change reference from Tara King to John Durnin on page B-20 of the Sampling Plan.

Response:

Completed (see revised text).

Comment 11.

Section 5 of the Sampling Plan: The sampling and analysis for the second round of the sampling will take more than one week unless the turn around times are shorter than the normal turn around times.

Response:

See revised text.

Comment 12.

ENSR SOP Number 7116 has duplicate pages in the beginning.

Response:

Duplicate page has been removed.

<u>Quality Assurance Project Plan (QAPP):</u>

Comment 1.

The distribution list at the beginning of the QAPP section should remove Tara King's name as the NYSDEC contact and replace it with John Durnin.

Response:

Completed (see revised text).

Comment 2.

Section 17.2.2-Laboratory Data: "The consultant will provide an independent validation of the laboratory data." Is Richard L. Wellman the qualified individual that will perform the data validation?

Response:

As stated in Section 1.1 pg. C-2 of the QAPP, "The Project QA Officer will also be responsible for validating the analytical data." However, Richard L. Wellman is no longer with ENSR. Replacing Richard Wellman as Consultant Project QA Officer is Waverly Braunstein (her resume is now attached to the QAPP).

<u>Health and Safety Plan (HASP):</u>

Comment 1.

Page D-iii of the Table of Contents indicates Figure 1: Site Locus Map. There is no map in the HASP. Please include this map.

Response:

A site locus map (Figure 1) has been added to Section 2 of the HASP.

Comment 2.

In Section 2.3, Environmental History (page D-5): Delete the last sentence in the second paragraph which begins with "Subsequently, the NYSDEC…". In any text, references to PS-65 should be minimized to avoid any confusion between PS-65 and the listed Ozone Industries Site.

Response:

This sentence has been deleted as requested (see revised text).

Comment 3.

Page D-9: Change the end of the sentence to include the seven existing wells referenced on page 15 of the Work Plan text (Section 3.5).

Response:

This sentence has been changed as requested (see revised text).

Comment 4.

Following page D-30 of the HASP, a map should be included which shows how to get to the nearest hospital.

Response:

A map that depicts the route from the site to the hospital has been included in the HASP.

Comment 5.

The designated hospital(s) should be contacted to be sure they can accept individuals that are contaminated with the contaminates of concern (TCE).

Response:

This communication has been completed, and the hospital is capable of handling chemically-related incidents.

Comment 6.

Section 6.0: Air Monitoring: The general weather conditions should be recorded during periods of PID use.

Response:

This information has been added (see revised text).

Comment 7.

Section 7.1: Protective Clothing by Task, page D-22: Please clarify why leather gloves are not required to be worn by operators of Geoprobe equipment (Task 1) and rotary drill rig operators (Task 2).

Response:

The requirement for drillers to wear leather gloves was inadvertently omitted from the table. This requirement is now included (see revised text).

Community Air Monitoring Plan (CAMP):

Comment 1.

Appendix E Community Air Monitoring Plan Action 2.1 Air Monitoring Objectives – The purpose of a community air monitoring plan is to be protective of public health, not simply "worker safety". Please revise the second bullet to reflect this.

Response:

See revised text.

Comment 2.

Section 2.1 discusses the use of a PID in the breathing zone to determine when to require respiratory protection (excess of 25 units). How does this relate to Section 3: Real Time Air Monitoring which describes stopping work in the work area if the PID exceeds 5 ppm above background (under certain conditions)?

Response:

See revised text.

Citizens Participation Plan (CPP):

Comment 1.

Section 3.2, Preliminary Conceptual Site Model (page F-4): Paragraph 5, delete the last sentence beginning with "Subsurface soil does not…" since there is no data to support this statement.

Response:

Completed (see revised text).

Comment 2.

Section 3.2.1: Data Gaps, indicates that further investigation will be conducted to "Identify other potential source areas contributing to groundwater contamination". Explain what will be done to identify other source areas.

Response:

Completed (see revised text).

Comment 3.

Section 6.0, Project Contracts (Page F-7): Remove the NYSDEC Toll-free telephone number since it no longer exists. Change the NYSDEC Project Manager from Tara King to John Durnin, 402-9774, fax is 402-9773, zip code is 12233-7016. Also, make these changes on page F-9 (Section 7).

Response:

Completed (see revised text).

Comment 4.

Section 7.0 Citizens Participation Activities and References – Please discuss the location(s) of a document depository.

Response:

Completed (see revised text).

Comment 5.

Appendix F, Citizens Participation Plan, Section 6.0, Project Contacts: Under "NYSDOH", please remove the line with contact information for the Health Liaison Program. This group no longer exists. Please provide the toll-free phone number, 1-800-458-1158, Extension 2-7870 and indicate Dawn Hettrick as the NYSDOH contact.

Response:

Completed (see revised text).

Comment 6.

Remove the Toll-free telephone number from page 5 of Attachment 1, Fact Sheets. The NYSDEC toll free number no longer exists.

Response:

Completed (see revised text).

Comment 7.

Attachment 1, RI/FS fact sheet: This attachment provides a good overall summary of the RI/FS process, however, any fact sheet will be sent to the public must first be reviewed and approved by NYSDEC and NYSDOH.

Response:

Fact sheets will be reviewed and approved by the NYSDEC and NYSDOH.

Comment 8.

A physical canvas of Site and Site Vicinity must be conducted to ensure all apartment addresses are included. Just sending a Fact Sheet to the building owners is not enough. Fact Sheets must be delivered to all tenants of buildings in the area.

Response:

The list of property owners in the Site vicinity is attached to the CPP, and includes properties (as agreed to with the NYSDEC) east of 97th street and west of 101st street, and south of 101st Avenue and north of Liberty Avenue (Contact List Area). When fact sheets are submitted, all reasonably attempts to distribute to residents within the Contact List Area will be made.

Records Search and Report:

Comment 1.

What is the foundation construction of the abandoned elevated railroad?

Response:

See revised text of Work Plan (Section 2.1).

Comment 2.

What is the typical foundation construction of the area buildings?

Response:

See revised text of Work Plan (Section 2.1).

Comment 3.

When did the Long Island Railroad abandon this section of railroad?

Response:

See revised text of Work Plan (Section 2.1).

Comment 4.

When did the NYC Authority begin renting the space under the elevated Railroad?

Response:

To be further researched and documented in the RI report as applicable.

Comment 5.

What was the use of the Ozone space prior to Ozone renting the area?

Response:

To be further researched and documented in the RI report as applicable.

Comment 6.

What was the use of the adjacent spaces to the ozone area prior to, during and after Ozone occupied the rented space?

Response:

To be further researched and documented in the RI report as applicable.

Comment 7.

What time period did Ozone rent the space (1987-1988)?

Response:

See revised text (to be further researched and documented in the RI report as applicable).

Comment 8.

On a map, provide the location of the trench, 1,000 gallon UST and grease trap that are referenced in the Records Search Report. Also show Building 8, Lot 27.

Response:

To be documented in the RI report as applicable.

Comment 9.

Figure 2 of the Multi-Site PSA by Lawler Matusky & Skelly Engineers shows the locations of TCE tanks #1, #4, and #9. These tanks and their history should be included in the Records Search Report.

Response:

To be documented in the RI report as applicable.

1996 Sanborn Library, LLC Maps of Site and Vicinity

Please see hardcopy

Former Ozone Industries, Inc. Site
Site Photos
Queens, New York
April 2004

101st Ave/99th St (looking South down 99th Street – Site Bays on left)

100th St (looking South down 100th Street – Site Bays on the right)

Former Ozone Industries, Inc. Site
Site Photos
Queens, New York
April 2004

100th St (looking South down 100th Street – Site Bays on the right)

100th St (looking toward Bays 8-11)

Former Ozone Industries, Inc. Site
Site Photos
Queens, New York
April 2004

100th St (looking toward Bays 8-11)

Appendix B

FIELD SAMPLING PLAN

Former Ozone Industries, Inc. Site

NYSDEC Site # 2-41-033

Order on Consent Index # W2-0922-02-05 (with Endzone, Inc.)

Queens, New York

ENSR Corporation
May 14, 2004
Project No. 08734765

CONTENTS

APPENDICES

A Standard Operating Procedures for the Field Investigation

1. ENSR SOP Number 7110, Surface Soil Sampling
2. ENSR SOP Number 7115, Subsurface Soil Sampling
3. ENSR SOP Number 7116, Subsurface Soil Sampling by Geoprobe™ Methods Operating Procedures
4. ENSR SOP Number 7510, Packaging and Shipment of Samples
5. ENSR SOP Number 7315, Operation/Calibration of a Photoionization Detector (PID)
6. ENSR SOP Number 7220, Monitoring Well Construction and Installation
7. ENSR SOP Number 7221, Monitoring Well Development
8. US EPA Region I, "Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", Revision 2, July 1996
9. ENSR SOP No. 7600, Decontamination of Equipment
10. EPA SOP# 2042, Soil Gas Sampling
11. August 8, 2001 NYSDOH indoor Air Sampling & Analysis Guidance
12. ENSR Emission Isolation Flux Chamber Sampling for Building Floors
13. Instructions for Canister (SUMMA) Sampling with Soil Gas 2 Micron Filters
14. Instructions for Regulator and Canister (SUMMA) Use

1.0 INTRODUCTION

This Field Sampling Plan (FSP) is an attachment (Appendix B) to the revised Remedial Investigation and Feasibility Study (RI/FS) Work Plan that has been prepared by ENSR Corporation for an area located within a city block in Ozone Park, Queens, New York that is bounded by 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south (Site). This RI/FS also pertains to areas in the vicinity of the Site, referred to as the Site vicinity. These plans have been prepared in accordance with the Order on Consent between the New York State Department of Environmental Conservation (NYSDEC) and Endzone, Inc., with an effective date of February 15, 2003. The investigation is intended to further evaluate the presence of volatile organic compounds (VOCs) in soil, soil gas and groundwater at the Site and Site vicinity.

This FSP presents a detailed description of scoping and field activities planned as part of the RI. The FSP is intended to complement the Quality Assurance Project Plan (QAPP), creating a comprehensive Sampling and Analysis Plan (SAP) for the Former Ozone Industries, Inc. RI. This FSP has been prepared using the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (DER-10 Guidance), December 2002.

The original RI/FS Work Plan has been revised following written comments from the NYSDEC in a letter dated December 22, 2003 and subsequent telephone conversations. The original RI/FS Work Plan was submitted to the NYSDEC on April 15, 2003. A copy of the NYSDEC review comment letter is attached in Appendix A of the Work Plan. The comments have been addressed and included in the revised RI/FS Work Plan as applicable. Also attached in Appendix A of the Work Plan, is a copy of the review comments by the NYSDEC with notes following each indicating how and where the comments are addressed in the revised RI/FS Work Plan if applicable.

The information presented in this FSP includes:

Section 2.0 - presents planned site characterization activities;

Section 3.0 - describes general field procedures;

Section 4.0 - outlines site management procedures to be implemented during the RI/FS program; and

Section 5.0 - presents the field activity schedule.

Standard Operating Procedures (SOPs) are included in Appendix A of this FSP.

2.0 REMEDIAL INVESTIGATION FIELD SAMPLING PROGRAM

This section presents the planned RI field activities and objectives. Soil, soil gas and groundwater sampling methods are presented below. The rationale for the number of samples to be collected is presented below, and the names and locations of sampling points are presented on Figures 3 and 4. Location identification numbers (IDs), sample IDs and analytical parameters and methods are presented in the QAPP.

The proposed investigation is based on the results of the background assessment work previously conducted in the Site vicinity (no assessment data has been collected at the Site), potential data gaps identified for the Site, comments presented in the December 22, 2003 NYSDEC letter concerning the original RI/FS Work Plan, discussions with NYSDEC officials and a Site visit in April 2004 by ENSR. Data collected during the prior investigations will be used in conjunction with data collected as part of the RI as applicable.

Endzone, Inc. does not own the bays at the Site. The bays are owned by the City of New York and leased to various tenants for different uses. In response to NYSDEC comments concerning the historic and current uses of the bays, and to determine what bays are of most concern (i.e., utilized by former Ozone Industries, Inc.), ENSR completed a Site visit in April 2004 with City of New York officials. Only certain bays were accessible because of access issues with the City of New York and the tenants, which could potentially take weeks to resolve for a return Site visit. The insides of bays 8 – 12 were not accessed or viewed as part of the Site visit, and these are the bays believed to have been rented by former Ozone Industries, Inc., one or more of which would be the bay(s) that stored waste material. Instead of arranging another Site visit to view the insides of these bays of concern to finalize the plan for the RI investigation included herein, the plans for conducting field work will contain contingencies for responding to various conditions. (Ultimately, a more encompassing access agreement between the City of New York and its tenants, and Endzone, Inc. will be completed prior to beginning the proposed RI investigation field work.) In addition, the actual locations of proposed sampling points presented herein and the Work Plan Figures 3 and 4 will be adjusted in the field at the time of the actual field program based upon Site information collected just prior to the field work. Therefore, the sampling locations within the bays are generally discussed and depicted on the accompanying plans. However, the intent is to assess the subsurface conditions in the area where waste material was presumably stored.

2.1 Focused Soil Gas Investigation (and Ambient Air Sampling)

The purpose of this soil gas investigation is to assess potential impacts to indoor air quality by sampling subsurface soil vapors for the presence of VOCs by EPA Method TO-15. The sampling will be conducted at 10 locations (SG-1 through SG-10) depicted on Figures 3 and 4. Eight locations (SG-

1 through SG-8) are located within the bays at the Site and SG-9 and SG-10 are located outside the bays along 99th and 100th Streets. The grab samples will be collected from approximately 8 feet bgs.

Pursuant to the NYSDEC December 22, 2003 comment letter, soil gas samples will be collected from existing soil gas wells SG-03, SG-09, SG-13 and SG-16 (located in the southern part of the Site vicinity) for VOCs by EPA Method TO-15. In addition, a representative ambient air sample will be collected for VOC analyses by EPA Method TO-15 from a bay of concern at the Site during the soil gas sampling, if it can be determined that other potential sources of VOCs are not present in the bay (it is highly unlikely that ambient air sampling will be completed until soil gas samples are collected and evaluated, because Endzone, Inc. does not own the Site and access and control of other sources of VOCs will be very difficult). If conducted, the sample will be collected over a two to four hour time frame, depending upon access issues and the amount of field investigation time allowed in the bay. Alternatively, an air sample could be collected utilizing an emission isolation flux chamber located on the floor of one of the bays. This would eliminate interference from VOC sources in the bays unrelated to Site contaminants and directly measure potential VOCs migrating through the floor from the subsurface. The air sample collected in the sealed flux chamber would be collected into a SUMMA canister for off-site laboratory analysis.

The soil gas and ambient air sampling methodologies are presented in Section 3.2.

2.2 Focused Soil Investigation

The purpose of this soil sampling program is to further assess the distribution of VOCs in subsurface soils (beneath an impervious surface) at the Site and Site vicinity. In addition, if present, surface soils in area of no impervious cover will be sampled for laboratory analyses. Soil sample collection and field screening procedures are presented in Section 3.3.

The soil sampling program will consist of:

- One initial deep exploratory soil boring (with groundwater sampling);
- Soil borings within the Site area (beneath bays);
- Surface soil sampling (if applicable); and
- Soil borings in the Site vicinity.

The initial deep exploratory soil boring will be completed in the proposed MW-201 location (along 100th Street next to the Site) to characterize the soil stratigraphy and VOC levels, and groundwater VOC levels through field screening of soil and groundwater samples. This will assist with subsequent subsurface investigations and ensure that subsequent drilling does not breach a subsurface confining layer, allowing for potential cross contamination of different geologic zones if present. The initial deep exploratory soil boring will be completed to an estimated depth of 100 feet bgs, unless conditions are present that require deeper or shallower drilling.

The soil borings within the bays at the Site will consist of approximately eight soil borings (SS-1 through SS-8, same locations as the soil gas investigation), and will be completed to depths extending to potentially the groundwater table (approximately 35 feet bgs at the Site) based upon the capability of the drilling method which will be determined by access to the bays. At least four of the soil borings will be located within the storage bays formerly leased by the former Ozone Industries, Inc., and two in each of the storage bays north and south of the subject storage bays. At least two of the four borings located within the storage bays formerly leased by the former Ozone Industries, Inc. will be located in the bay that is potentially most likely to be impacted from past solvent storage and/or use (as discussed above, the final determination of what bay subsurface areas are assessed will be based upon access to the bays prior to initiating field work).

As discussed above, one deep soil boring (MW-201) will be completed in the area of GP-11 adjacent to the Site (to a depth of approximately 100 feet bgs) and two soil borings (MW-202 and MW-203) will be completed in the Site vicinity to depths of approximately 75 bgs. As part of utility clearance work, each subsurface investigation location will be initially cleared with vacuum extraction to a depth of approximately 6 feet, except for the borings completed within the bays, which will be initially cleared by use of a hand auger.

Soil samples will be collected continuously during performance of the borings and each sample will be field screened for total VOCs with a photoionization instrument. Soil samples will be collected with a hand auger within the utility clearance zone from ground surface to 6 feet bgs. Up to 36 soil samples will be collected for laboratory VOC analysis from the borings. Vertically, the samples submitted for VOC laboratory analysis will in general include one shallow sample (from the first foot of soil beneath the floor), one groundwater interface sample (if encountered in the borings completed beneath the bays) and the sample with the highest field screening result (if different from the first two locations). Soil sample collection and field screening procedures are presented in Section 3.3. The planned soil boring locations are presented in Figures 3 and 4.

As discussed in the December 22, 2003 comment letter by the NYSDEC, surface soil (present in areas without an impervious surface) samples will be collected at the Site wherever surface soils are exposed (i.e., no pavement or floor covering the ground surface). The samples will be collected from ground surface to approximately 2-inches bgs (per NYSDEC comments) for laboratory analytical parameters to include metals and semi-VOCs. Based upon the April 2004 Site visit, no bays accessed and viewed contained exposed soil. Therefore, this sampling will only be conducted if the bays of concern do not contain flooring or some impervious barrier over the soil, prohibiting access to the soil by people. If sampling occurs, one representative sample from at least one exposed soil area per bay that contains no flooring will be collected. At the time of sampling, it will also be ascertained if existing operations could or have impacted the surface soils, thus differentiating potential impacts from former operations by Ozone Industries, Inc.

2.3 Groundwater Investigation

The specific objectives of groundwater sampling are to provide groundwater quality data in the vicinity of the Site, to assess deep groundwater conditions, and to expand the groundwater monitoring well network horizontally to evaluate groundwater conditions and flow direction. Four new groundwater monitoring wells will be installed during completion of the soil borings outside of the bays, and one groundwater well will be installed in an upgradient location pursuant to the NYSDEC December 22, 2003 comment letter. The planned monitoring well locations are shown on Figures 3 and 4. The groundwater investigation procedures are presented in Section 3.3.

As requested by the NYSDEC, groundwater samples will be collected at certain depth intervals during advancement of the soil borings discussed above and prior to monitoring well placement in order to identify potential zones of elevated groundwater contamination. The existing groundwater data indicates that the trichloroethene plume is mainly present in the zone of 35 to 55 feet bgs. Therefore, it is important to identify in the field where the highest zone of groundwater contamination is present. In order to accomplish this, groundwater samples will be collected at five different intervals of approximately 35-38’, 44-47’, 52-55’, 62-65’ and 72-75’ during the completion of soil borings. These are the similar depth intervals previously targeted by URS during work in the Site vicinity; however, the intervals will be determined by actual field conditions encountered (e.g., soil headspace readings and groundwater elevations). The groundwater samples will be screened on-site using a portable gas chromatograph. Additional details are provided in Section 3.3.

The depths and well screen intervals of proposed monitoring wells MW-201S, MW-202 and MW-203 will be based upon the soil and groundwater sampling and field screening results, with the intent to capture or intercept the zone of greatest impact. Monitoring well MW-201D will complete a cluster at the MW-201 location, and will be installed based upon field screening results and at least 10 feet beneath the bottom of the shallower well. The deep upgradient well (PZ-01D) will be installed and screened also based upon field screening results and deeper than the exiting PZ-01 well.

2.3.1 Monitoring Well Development and Groundwater Sampling

A surge and purge method will be used to perform well development on all newly installed monitoring wells and existing wells proposed for sampling. The specific objectives of well development are to:

- Improve the hydraulic connection between the well and the aquifer;

- Reduce the amount of suspended solids in the groundwater samples; and

- Remove silt and other solids that may accumulate during well construction.

After development, the monitoring wells will be allowed to equilibrate for a minimum of seven days prior to water level measurements or groundwater sampling activities. Water levels will be measured in each of the monitoring wells. Groundwater elevations will be used to confirm the groundwater flow direction.

Following well development and water level gauging, all new wells and approximately 16 existing wells will be sampled, including PZ-01, -05, -07, -8, -09, and –10, and MW-01, -6S, -6D, -9, -12S, -12D, -13D, -19, -101 and –105. There is the potential that some of these existing wells may no longer be available for sampling, and/or their integrity may have been compromised. In this case, nearby wells (if applicable) will be substituted for those wells that are no longer available. Groundwater samples will be collected for analysis of VOCs. A second groundwater sampling round will take place approximately three months after the first.

All investigation-derived wastes generated during the field program (i.e., soil cuttings, wash water from decontamination activities, groundwater generated during well development and sampling, etc.) will be transported off-site on a daily basis to a facility licensed to accept such wastes. However, consistent with URS field work in the Site vicinity for the NYSDEC, ENSR will investigate the possibility of discharge of liquid investigation-derived waste to the New York City sewer system.

2.4 Community Air Monitoring Plan (CAMP)

Consistent with New York State Department of Health guidance for Generic CAMPs, attached in Appendix E of the Work Plan is a CAMP specific for the intended soil gas sampling, drilling and groundwater sampling programs proposed in Sections 3.2 and 3.3 that include (ground) intrusive and non-intrusive activities. The CAMP specifies real-time air monitoring requirements for VOCs to be performed during intrusive activities (soil gas sampling and drilling), and periodic monitoring for VOCs during non-intrusive activities (i.e. groundwater sampling).

2.5 In-Situ Hydraulic Conductivity Testing

Rising head permeability tests (slug tests) will be performed at each of the newly installed monitoring wells and at a selection of existing wells (MW-01, -06S, -06D, -09, -13S, -13D and –101) to assess the permeability of the soils.

2.6 Site Survey

The coordinates of all RI soil borings and monitoring wells will be surveyed by a New York registered surveyor to establish the horizontal and vertical coordinates. The information will be utilized to establish well elevations for the determination of groundwater depths and flow directions.

3.0 GENERAL FIELD OPERATIONS

This section describes general field activities and operations that will be conducted during the RI. Pertinent SOPs are included in Appendix A of this FSP. (In all cases, the text of this section supercedes the procedures written in the SOPs.) Sample preservation, packaging and shipping, chain-of-custody documentation, and other analytical quality procedures are described in the QAPP.

In summary, the RI program consists of advancing 12 soil borings across the Site and Site vicinity to assess the nature and extent of VOCs detected previously in the soil and groundwater. Specifically, eight borings will be advanced at the Site to approximately 35 feet bgs with a direct push sampling system, and two water table monitoring wells, one shallow/deep well couplet and one deep well to complete a couplet with an existing well (PZ-01) will be installed in the overburden in the Site vicinity. The five new wells will be developed and sampled per EPA's low purge/low stress method. In-situ hydraulic conductivity tests (i.e., rising head) will also be performed on the five new wells and a select number of existing wells. The following information describes the methods and procedures associated with these field activities.

3.1 Mobilization/Demobilization

Mobilization and demobilization activities include obtaining access to sampling locations equipment procurement and transport, subcontractor procurement and coordination, location and setup of areas for decontamination and temporary waste storage, establishment of an on-site temporary staging area, and utility clearance. A kick-off meeting will also be conducted prior to the start of the field sampling to discuss the objectives of this FSP, the roles and responsibilities of the project team, and the content of the site-specific Health and Safety Plan (HASP).

Note that Endzone, Inc. does not own any property in and around the Site and therefore access agreements must be obtained prior to performing any sampling efforts. Endzone, Inc. representatives have begun the process of gaining access to these locations.

Equipment requirements will be finalized by the Field Team Leader (FTL) following NYSDEC approval of the Work Plan. The FTL will review the scope of work and assemble equipment (e.g., vehicles, sampling, personal protection, and decontamination equipment) to implement and complete the field investigations. This equipment and supply list will be reviewed by the project team and by the Project Manager. The FTL will be responsible for packaging and loading of equipment, and ensuring that all equipment is operable and calibrated.

The FTL will be responsible for tracking equipment used in the field. It is anticipated that the following services will be subcontracted: drilling and monitoring well installation, analytical laboratory services, and surveying. Following the procurement of these services, the FTL will be responsible for coordinating these activities. The Project Chemist will be responsible for coordinating the analytical services, as well as the acquisition and delivery of sample bottles to the site.

The Site Safety Officer (SSO) will be responsible for reviewing the HASP with the field team members and subcontractors.

3.1.1 Field Team Responsibilities

The FTL will have overall responsibility and authority for the various field activities. The FTL will be responsible for coordinating and managing the field sampling team and subcontractors. The FTL will report directly to the Project Manager.

A field team consisting of at least two people will be used during the RI field activities. The team will coordinate directly with the FTL and Project Manager.

The SSO will be responsible for implementing the HASP and monitoring site conditions. The SSO may also be the FTL and will report directly to the Project Manager.

A Quality Assurance (QA) Officer (defined in QAPP, Appendix C of Work Plan) will be responsible for ensuring that all field work is being conducted in accordance with this FSP. The QA Officer will be responsible for reporting of deficiencies and following through to make sure the necessary corrective actions have been implemented. The QA Officer will report directly to the Project Manager.

3.1.2 Field Changes Corrective Action

If changes become necessary due to field conditions (e.g., weather problems, obstructions to drilling or sampling, etc.), or other unanticipated conditions, the planned change will be communicated from the FTL to the Project Manager, and then to Endzone, Inc. (i.e., the client), and the NYSDEC. Upon agreement of the best corrective action, the method will be implemented and the change will be documented, with the documentation placed in the project file and documented in the RI report.

Specific conditions considered to warrant corrective action include (1) relocation of soil borings or monitoring wells from their proposed location, (2) changes in the completion depth of proposed borings, and (3) changes in sampling the existing wells for groundwater analysis.

3.1.3 Utility Screening Survey

Prior to conducting intrusive activities, ENSR will conduct a utility screening survey for the site to identify underground and overhead utilities. To meet this objective, ENSR will follow the procedure outlined below:

1) Identify and mark each of the proposed drilling locations with white paint. Overhead obstructions, if any, will be evaluated to determine if sampling locations must be relocated.

2) Call New York City's – Long Island One Call Center to request a utility mark-out for these proposed drilling locations. This procedure is also discussed in the HASP (Appendix D).

3) As needed, additional utility information may be researched at the city level.

3.2 Focused Soil Gas Investigation (and Ambient Air Sampling)

The purpose of this soil gas investigation is to assess potential impacts to indoor air quality by sampling subsurface soil vapors for the presence of VOCs. The sampling will be conducted at 10 locations (SG-1 through SG-10) depicted on Figures 3 and 4. Eight locations (SG-1 through SG-8) are located within the Site and SG-9 and SG-10 are located in the Site vicinity. Each location will be advanced to approximately 8 feet bgs using a portable push-probe system that uses an electric hammer to drive the steel probe to depth. The probe is a hollow, steel shaft (7/8-inch OD and ¼-inch ID) that is fitted with an expendable drive point. Once the target depth is reached, the probe will be retracted leaving in place a slotted anchor point attached to 1/8-inch polyethylene tubing. The hole will be sealed at the ground surface with partially hydrated bentonite. The tubing will be purged for 5 minutes, a quick soil gas reading will be measured with a photoionization instrument (PID) equipped with a 10.6 electron volt (eV) lamp and then a soil gas sample will be collected in a SUMMA canister for lab analysis by EPA Method TO-15. This process roughly follows the SOP attached in Appendix A (EPA SOP# 2042 Soil Gas Sampling).

Soil gas samples from existing soil gas sampling points in the Site vicinity will be collected with similar methods as completed by URS and their subcontractor for NYSDEC as documented in the Field Investigation Letter Report for the 2003 Groundwater and Soil Gas Sampling Event report (dated May 2003). The samples will be laboratory analyzed for VOCs by EPA Method TO-15.

The ambient air sample will be collected into a SUMMA canister following the August 8, 2001 NYSDOH indoor Air Sampling & Analysis Guidance and ENSR instructions for SUMMA canister use (attached with SOPs) as applicable. The sample will be laboratory analyzed for VOCs by EPA Method TO-15. Alternatively, if a flux chamber sample is collected, it will be collected following the attached

ENSR SOP (Appendix A) Emission Isolation Flux Chamber Sampling for Building Floors with modifications as necessary. The flux chamber sample would be collected in the bay at the Site that is believed to have formerly stored waste material. The sample collection time will be up to 8 hours long, depending upon access. The sample will be analyzed for VOCs by EPA Method TO-15.

3.3 Subsurface Investigation – Soil and Groundwater

Subsurface explorations are proposed at 12 locations (with one location including deep and shallow wells) across the Site and Site vicinity as depicted on Figures 3 and 4 of the Work Plan. Drilling locations at the Site (beneath bays) will be advanced from ground surface to approximately 6 feet bgs using a hand auger for utility clearance and soil sampling, and drilling locations in the Site vicinity will be advanced from ground surface to approximately 6 feet bgs using hand auger for soil sampling and then the vacuum excavation method. The reason for vacuum excavation is to exercise caution and identify any unknown underground utilities that were not identified during the utility screening process.

Once the Site boring locations have been advanced to 6 feet bgs, a Geoprobe™ (or equivalent direct push method) soil sampling system will be utilized to collect soil samples for field screening and laboratory analyses. For the drilling locations in the Site vicinity an appropriate drilling and sampling method and procedure will be utilized to collect the desired information. The field data that needs to be collected during the drilling in the Site vicinity includes:

- Vertical soil sampling and screening data;
- Vertical groundwater sampling and screening data; and
- Construction of a permanent 2-inch diameter monitoring well with a well screen interval based upon results of on-site soil and groundwater sample screening.

There are various technologies and procedures available for conducting this work. ENSR has recently completed field work of a similar nature where vertical profiling of soil and groundwater was conducted. Some of the drilling and sampling methods have been successful and some have not. Prior to beginning the actual RI field investigation work, an appropriate drilling and sampling technology and procedure that meets the objective of this field program and collects the desired data will be finalized based upon actual site uses of the various technologies elsewhere between now and the start of field work, and further discussions with vendors and regulatory officials, as necessary. Drilling and sampling technologies available and most likely capable of completing the desired sampling program include the Waterloo Profiler™, the Johnson Company, Inc. Rapid Adaptive Site Characterization process incorporating Direct Push Technology and the Waterloo Profiler™, the Geoprobe™ DT21 Groundwater Profiler (also allows for retrieving soil samples), and a drilling and soil and groundwater sampling system utilizing hollow-stem augers utilized by Aquifer Drilling & Testing, Inc. (who has conducted similar work in the New York City area). The drilling program in the Site vicinity will involve at least two boreholes at each proposed location; one boring for the collection of soil and groundwater samples for on-site screening and soil samples for off-site laboratory analyses, and one borehole for the installation of the monitoring well.

Therefore, this section and the attached SOPs present procedures for:

- Utility clearance with vacuum excavation;
- Use of a Geoprobe^{TM} soil sampling system;
- Use of hollow-stem auger drilling for at a minimum installation of the permanent 2-inch diameter monitoring wells;
- Soil Sampling;
- Permanent monitoring well installations with a hollow-stem auger rig and development; and
- Groundwater measurements and sampling from permanent wells.

Surface soil sampling (if completed) is presented below in Section 3.3.3.

3.3.1 Vacuum Excavation

At each of the drilling locations in the Site vicinity, vacuum excavation (vac ex) will be used to safely advance the boring beyond the expected zone in which high-energy and unknown subsurface utilities are expected to be encountered. Vacuum excavation will be performed after collecting soil samples with a hand auger from the first six feet of soil beneath the ground surface. With the vacuum excavation method, an approximately 10-inch diameter hole will be advanced from ground surface to approximately 6 feet bgs using a truck-mounted vacuum excavator. The soil will be temporarily contained within a vessel on the vac ex. Excavated soil will be managed as described in Section 3.8 of this FSP. If utilities are encountered but do not pose a concern, the boring will be advanced to 6 feet bgs. If the utility encountered poses a concern, the hole will be abandoned and another attempt will be made approximately 5 feet away.

After completing the boring, ENSR will collect samples, as needed, in accordance with the procedures discussed below.

3.3.2 Geoprobe^{TM}

Soil samples collected with the Geoprobe^{TM} soil sampling system (or equivalent direct push method) will be performed in accordance with ENSR SOP Number 7115, Subsurface Soil Sampling and ENSR SOP Number 7116, Subsurface Soil Sampling by Geoprobe^{TM} Methods Operating Procedures. This system consists of a vehicle-mounted hydraulic probing (or manual, depending upon access within the bays) device that pushes a 2-inch O.D. stainless steel sampling tool into the subsurface. The Macro-Core sampler consists of a 45-inch long by 1.5-inch diameter open-ended steel sampling tool with liners made of clear plastic (cellulose acetate butyrate), stainless steel, or Teflon. The tool is designed for use in a continuous sampling capacity in an open borehole. The borehole walls are required to stay open in order to collect a sample from the next depth interval. Once the sampling tool is removed from the ground, the inserted liner containing the soil sample is removed from the tool. The soil sample is then cut from or extracted from the liner.

Geoprobe^{TM} equipment will be appropriately decontaminated before and after sampling at each location. Sampling equipment (stainless steel bowls/spoons, split-spoon samplers) will be manually decontaminated before and after each sample is collected. Decontamination procedures are discussed in more detail in Section 3.7 of this FSP.

All excess soil, decontamination fluids, disposable sampling equipment, and used PPE will be managed in accordance with Section 3.8 of this FSP. To the extent possible, the generation of investigation-derived waste (IDW) will be minimized, and waste types segregated.

3.3.3 Soil Sampling (including Surface Soils) and Classification

Soil samples will be collected in accordance with ENSR SOP Number 7115, Subsurface Soil Sampling and Subsurface Soil Sampling by Split Spoon (as applicable), and ENSR SOP Number 7116, Subsurface Soil Sampling by Geoprobe^{TM}, included in the Appendix A. The purposes for soil sample collection include: soil classification, on-site field headspace screening, and/or laboratory analysis. To insure the integrity of soil samples for these purposes, the soil collection procedures, soil classification procedures, and field-screening procedures discussed below will be exercised during this investigation. Refer to the QAPP (Appendix C in the Work Plan) for details regarding sample labeling, storage, handling, and submission protocol. These activities will be performed in accordance with ENSR SOP Number 7510; Packaging and Shipment of Samples, included in Appendix A of this FSP.

The top 6 feet of soil from ground surface is located within the utility clearance zone. In order to prevent breaching any utilities that may be present in this zone, a vacuum excavator will be used to remove the top 6 feet of soil at drilling locations in the Site vicinity as discussed above. However, because the powerful vacuum can essentially “strip” any volatile organic compounds that may be present in this 6-foot zone, a hand auger will be used to collect the soil samples before using the vacuum excavator. Soil samples collected below 6 feet will be obtained using a Geoprobe^{TM} Macro-Core sampler or with one of the soil sampling technologies listed above.

Surface soil sampling will be completed in accordance with the attached ENSR SOP Number 7110, Surface Soil Sampling, included in Appendix A. As discussed above, the samples will be collected from ground surface to approximately 2-inches bgs (per NYSDEC comments) for laboratory analytical parameters to include metals and semi-VOCs. Based upon the April 2004 Site visit, no bays accessed and viewed contained exposed soil. Therefore, this sampling will only be conducted if the bays of concern do not contain flooring or some impervious barrier over the soil, prohibiting access to the soil by people. One representative sample from at least one exposed soil area per bay that contains no flooring will be collected. At the time of sampling, it will also be ascertained if existing operations could or have impacted the surface soils, thus differentiating potential impacts from former operations by Ozone Industries, Inc.

Geologic logs for each boring will be prepared by the field geologist(s) documenting collection method, soil sample characteristics following the Unified Soil Classification System (color, sorting, density, grain size/shape, composition, moisture, soil type, maximum grain diameter, angularity and plasticity), sample recovery, headspace screening readings, and other observations or comments. This information will be recorded on an ENSR boring log form.

3.3.3.1 Field Headspace Soil Screening

Soil samples collected during the RI will be screened in the field with a PID for total volatile organic vapors using the methodology discussed below. The PID will be calibrated daily at the beginning and end of the day, or more frequently if needed, in accordance with ENSR SOP Number 7315, Operation/Calibration of a Photoionization Detector (PID).

1) Fill a clean glass jar (8-16 oz.) approximately one-half full of soil;

2) Place a sheet of aluminum foil over the opening of the jar, then screw on the lid;

3) Shake the jar vigorously for 15 to 30 seconds to develop a headspace;

4) Record the time that the sample was collected on the jar's lid (in order to keep track of the measurement time window);

5) Place the jar in a warm location (such as the dashboard of the field vehicle) for 5 to 10 minutes; and

6) Remove the lid of the jar and insert the tip of the PID through the aluminum foil to acquire a reading.

3.3.4 Monitoring Well Installation

Conventional monitoring wells will be installed at four locations (five wells total) to monitor groundwater quality in accordance with ENSR SOP Number 7220, Monitoring Well Construction and Installation. A truck-mounted, hollow-stem auger drill rig will be utilized to install the 2-inch diameter monitoring wells (unless one of the drilling, soil and groundwater sampling and screening technologies listed above allows for installation of 2-inch diameter wells, and is utilized for the RI).

Based upon data collected by others at the Site vicinity as discussed in the Work Plan, the most impacted zone is located between 35 and 55 feet bgs, and the intent of the monitoring well placement is to capture this zone. As discussed above, vertical soil and groundwater sampling and screening will be conducted to assist with the eventual placement of the monitoring wells. The three wells (MW-201S, MW-202, MW-203) will be constructed as shallow wells screening the most impacted zone based upon soil and groundwater sampling and field screening, and will consist of 2-inch schedule 40 PVC, most likely with a 10-foot length of PVC screen (0.01-inch slot). Two wells (MW-201D and PZ-01D) will be installed as deep overburden monitoring wells in the same manner as the other wells, but most likely with a 5-foot length of PVC screen. The deeper wells will be screened for monitoring conditions beneath the most impacted zone, and the top of the deep well screen will be at least 10 feet below the bottom of the shallow well screen. The shallow and deep wells creating a cluster (MW-201S/-201D) will be completed in separate boreholes. The screened section will be threaded riser so that no cements, glues, or binding agents are used. If the shallow wells are screened near the water table, the well screen will be set with approximately 3 feet above the water table observed at the time of drilling to accommodate seasonal fluctuations in the water table. The annular space between the monitoring well and the borehole wall will be filled with clean Silica sand to a height approximately 1 to 2 feet above the top of the screen (one foot minimum). A 1 to 2-foot thick bentonite seal will be placed above the sand pack as bentonite chips in the annular space. The remaining annulus will be grouted (i.e., tremie tube method) to ground surface using a bentonite/cement grout at a ratio of 1:9.

Each monitoring well will be completed with either a locking, protective steel casing or a flush-mounted road box. If a protective steel riser is installed, it will be cemented in with a sloping concrete apron designed to prevent storm water runoff from collecting at the head of the monitoring well. Construction logs will be maintained for each monitoring well to document installation and construction details.

3.3.4.1 Monitoring Well Development

Each newly installed monitoring well will be developed by the "surge and purge" method in order to remove fine-grained materials and collect representative groundwater samples. Well development will be performed in accordance with ENSR SOP Number 7221, Monitoring Well Development. A discussion of well development procedures is provided below.

Monitoring wells will be developed no sooner than 3 days following installation to allow the construction materials sufficient time to properly set. The wells will be developed using pumps, bailers, and/or surge block and pump systems. Clean plastic sheeting will be placed around each well to prevent the contact of development equipment with the ground surface. All development details will be recorded on the ENSR well development form.

In accordance with ENSR's SOP, each well will be developed until the discharge water is relatively free of fine-grained material (i.e., below 50 NTUs as measured with a turbidity meter), if possible. Purge time, purge volume, flow rate and turbidity will be noted and recorded at regular intervals throughout the development process. A minimum of three (3) and a maximum of ten (10) well volumes will be extracted during development.

Subsequent to each use, non-disposable well development equipment will be decontaminated according to decontamination procedures outlined in Section 3.7. Disposable development equipment (i.e., gloves, nylon rope, tubing, plastic sheeting, etc.) will be contained in a plastic garbage bag for eventual disposal as general refuse. Groundwater extracted from the wells will be managed as IDW in accordance with Section 3.8 of this FSP.

3.3.5 Water Level Measurements

Water level measurements will be recorded in each of the monitoring wells (all accessible existing wells and proposed four wells) immediately prior to purging the wells (which occurs before sampling). Measurements will be obtained with an electronic water level indicator with an accuracy of 0.01 feet. These measurements will be recorded from the highest point of the top of the PVC riser (marked in black). All measurements will be recorded in the field logbook and on the respective field log.

3.3.6 Groundwater Sampling from Monitoring Wells - Low-Flow Groundwater Sampling

As discussed above, groundwater samples will be collected during the drilling process at certain depths for on-site VOC screening. After the wells have been installed and developed, they will be sampled (along with existing wells) for lab analysis in accordance with the following procedure.

Subsequent to water level measurements, all wells will be sampled using low stress (low-flow) purging and sampling procedures per the EPA Region I SOP, "*Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", Revision 2, July 1996* (Appendix A of this FSP). This method emphasizes minimizing water level draw down and groundwater pumping rates, to collect samples with minimal alterations to groundwater chemistry.

At each groundwater sampling location, clean plastic sheeting will be placed around the sampling area so that the sampling equipment will not directly contact the ground surface. Once a clean working environment has been established and the monitoring well has been accessed, the following information will be recorded on the groundwater sample collection record forms:

- Well ID, date and time;
- Depth to water measured from the surveyed top of the PVC well casing;
- Depth to bottom of monitoring well measured from the surveyed top of the PVC well casing;
- Length of protective outer casing from surveyed datum to ground surface, if applicable; and
- Monitoring well diameter.

On the basis of these measurements, the volume of standing water in each monitoring well (3 well volumes) will be calculated. Purge water will be collected in a bucket of known capacity and transferred to a 55-gallon drum for temporary storage as IDW (as necessary). The handling of IDW is discussed in more detail in Section 3.8. The remainder of this section describes how groundwater will be sampled from monitoring wells for laboratory analysis.

Bladder pumps equipped with dedicated polyethylene bladders and tubing will be used for low-flow groundwater sampling. The pump intake will be placed at the mid-point of the screen length, or in those cases where the saturated screen interval is less than 5 feet, the pump intake will be set at a distance approximately equal to 25% of the saturated screen interval from the surface of the water, but not less than 0.5 feet from the water table. In the case where excessive draw down causes the water level to drop below the pump intake, the pump may be lowered in 6-inch intervals. After lowering the pump, the flow rate will be reduced in an effort to stabilize water level draw down. To minimize groundwater turbidity, the pump will be moved very slowly, and the intake will remain at least 6 inches above the bottom of the well. The pump intake depth, and any changes to the depth made during sampling, will be documented on groundwater sample collection forms.

During well purging, the water level will be measured with an electronic water level. Water level draw down and flow rate will be recorded on groundwater collection forms. Groundwater will be pumped through a flow-through cell (i.e., YSI Model 6820 or equivalent) in order to measure the following field parameters: pH, specific conductivity, temperature, DO, and ORP. Turbidity will be measured separately with a nephelometer. Field parameters including groundwater measurements will be recorded every 5 minutes for the first 20 minutes of sampling, and then every 15 minutes thereafter, until the required volume has been purged and parameters have stabilized. Every effort will be made to lower the turbidity to less than 10 Nephelometric Turbidity Units (NTU) before sampling. If the turbidity can not be reduced below 10 NTU, samples may be collected if all other parameters are stable and the turbidity is less than 50 NTU. Purging is considered complete and sampling may begin when three screen volumes have been removed and all other parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at 2- to 5-minute intervals, are within the following guidelines:

- Turbidity (+/- 5 NTU);
- DO (10% for values greater than 2 mg/L; 0.5 mg/L for values less than 2 mg/L);
- Specific conductance (3%);
- Temperature (3%);
- pH (+/- 0.2 units);
- ORP (+/- 10 millivolts); and
- Drawdown (no more than 0.3 feet).

The well will be purged at a maximum rate of 0.5 L/min. and field measurements for the groundwater parameters will be conducted at 5-minute intervals during purging until one of the following conditions has been met: (1) three well volumes have been purged, (2) the well has been purged dry, or (3) all field parameter measurements meet the applicable criteria of each other. If the 50 NTU criteria can not be met within 3 well volumes and all other parameters have stabilized (differences less than ten percent), then the water will be considered characteristic of the formation water and sampling will begin. In the event, a well is purged dry prior to sampling, the bladder pump will be removed and the well will be allowed to recharge for an adequate period of time in order to produce a sufficient volume of water for the VOC analysis.

In preparation of sampling, the flow rate of the pump will be reduced to 0.1 L/min or less. Groundwater sampling will not commence until the tubing and bladder volumes have been displaced at the lower flow rate (or roughly one 5-minute interval). All field measurements will be documented on the field sampling logs along with final purge time and total volume.

Subsequent to each use, non-disposable groundwater sampling equipment will be decontaminated according to the procedures outlined in Section 3.7. Disposable equipment (e.g., gloves, nylon rope, tubing, plastic sheeting, etc.) will be contained in a plastic garbage bag and disposed as general refuse.

3.4 In-situ Hydraulic Conductivity Tests

In-situ hydraulic conductivity tests (i.e., rising head) will be completed at each of the five proposed monitoring wells (MW201S/D, MW-202, MW-203 and PZ-01D) and existing wells listed above to determine hydraulic conductivity in the shallow overburden and deep overburden aquifers. The tests will be performed using the rising head method. This method involves removing a known volume of water from the well and then measuring the rate at which water flows back into the well using a pressure transducer, which can precisely record rapid changes in water level.

The elapsed time and water level data will be analyzed by the method developed by Bouwer and Rice (1976) and Bouwer (1989). This method allows for the analysis of data collected from wells screened across the water table, as well as from wells with screens positioned below the water table surface. The recorded data will be downloaded directly from the data logger into a computer software program for analysis and estimation of aquifer hydraulic conductivity.

3.5 Photographic Log

A photographic log will be maintained by field personnel who will document:

1) Any unusual surface conditions, such as staining observed on the ground, that warranted sampling at that location;

2) The sample location prior to the initiation of intrusive activities to document "pre-existing" conditions;

3) Any unusual conditions encountered during boring advancement;

4) Composite of all soil samples collected at a sampling location if there exists a unique field condition (e.g., significantly different lithology than previously identified in the area being sampled) or samples are collected from an unsampled area; and

5) At the field geologist's discretion, any determination made through visual observations of contamination.

The photographic log will contain a description of the object and field of view being photographed, direction faced, time and date the photograph was taken, and identification and size of the dimensional standard being used.

3.6 Location and Elevation Survey

Following the completion of field activities, all soil borings, newly installed monitoring wells and any other pertinent sampling locations will be surveyed by a New York State licensed surveyor. The location and elevation survey will include the horizontal location (i.e., northing and easting) of each survey point, and vertical elevation of the ground surface, and when appropriate, top of protective steel casing, and top of PVC well (top of casing), at each survey point. Top of casing elevation for wells will be surveyed at a datum marked or notched on the top of the riser. The datum will be exposed only when the protective cap is removed. All water level measurements will be relative to this datum. All vertical measurements will be surveyed in 1929 USGS National Geodetic Vertical Datum (NGVD 1929) coordinates, and all horizontal measurements will be in New York State Plane coordinates, using 1983 North American Datum (NAD83).

3.7 Decontamination

All sampling equipment used in the field investigations will be cleaned thoroughly before and after sample collection in accordance with ENSR SOP No. 7600, Decontamination of Equipment (Appendix A). Cleaning of the equipment will be performed to prevent cross-contamination between samples, reduce the potential for tracking impacted media to different parts of the site, and to maintain a clean working environment for all personnel.

3.7.1 Sampling Equipment

Sampling equipment (e.g., split-spoons, sampling trowels, bucket augers, etc.) will be decontaminated prior to sampling and between samples, according to the sequence established in the SOP. Decontamination will generally consist of (1) tap water rinse to remove gross contamination (if needed), followed by (2) a non-phosphate detergent (e.g., Alconox) water rinse, (3) a methanol rinse, and finally (4) a deionized water rinse. If equipment is to be stored or transported, it will be wrapped in aluminum foil after air-drying. Water generated during decontamination procedures will be placed into 55-gallon drums and managed as IDW in accordance with Section 3.8 of this FSP.

3.7.2 Heavy Equipment

All heavy equipment, including the drilling rig, rods and augers, and other downhole equipment used during site investigation activities, will be decontaminated prior to beginning work and between all boreholes (including between wells within a cluster) using a high-pressure steam wash at the point closest to generation. The washwater will be containerized and managed as IDW in accordance with the procedures referenced in Section 3.8 of this FSP. The water to be used during steam cleaning will be from a potable source.

3.7.3 Personnel

Personnel decontamination is discussed in the site-specific HASP (Appendix D in the Work Plan).

3.8 Management of Investigation Derived Waste (IDW)

It is anticipated that the following wastes will be generated during the field investigation.

- Soil generated during vacuum excavation and drilling;
- Soil samples not submitted for laboratory analysis;
- Groundwater from developing and purging monitoring wells;
- Wash water from steam-cleaning and manual decontamination;
- Used Personal Protective Equipment (PPE); and
- Potential drilling water associated with the hollow-stem auger “drive and wash” method to install permanent monitoring wells.

All containers used to store IDW will be properly labeled and an inventoried. All IDW containers will be transported off-site on a daily basis to a facility licensed to accept the following wastes. All shipments of IDW will be tracked via the appropriate paperwork (i.e., hazardous waste manifest, bill of lading, etc.). These wastes will be handled in the following manner:

1. Soils generated during the drilling activities will be segregated based upon the following criteria. Soils generated during vacuum excavation activities will be combined and transferred within the vacuum excavation truck.

    - Non-impacted soils – soils that do not exhibit any evidence of contamination during field sampling activities will be placed in 55-gallon drums separate from other soils referenced below. Non-impacted soil is considered to exhibit no visual or olfactory evidence of contamination and yield field headspace readings less than or equal to 10 parts per million vapor (ppmv).

* Impacted soils – soils which exhibit slight to moderate evidence of contamination during field sampling activities will be placed in 55-gallon drums separate from other soils referenced below. This type of soil is considered to exhibit some visual or olfactory evidence of contamination and yield field headspace readings greater 10 ppmv but less than 100 ppmv.

* Heavily-impacted soils - soils that exhibit significant evidence of contamination during field sampling activities will be placed in 55-gallon drums separate from other soils referenced above. This type of soil is considered to exhibit significant visual (i.e., staining) or olfactory evidence of contamination and yield field headspace readings greater than 100 ppmv.

Soils saturated with water will be segregated from dry soils, dewatered, solidified if necessary and managed according to procedures specified herein.

2. Consistent with URS during their sampling for NYSDEC, ENSR will investigate and arrange for the discharge of development and purge water to the New York City sewer system. If this is not possible, then development and purge water from monitoring wells will be segregated in a similar manner as the soil and containerized in drums. For example, based upon past groundwater quality data, groundwater from non-impacted areas would be combined into one drum and groundwater from impacted areas would be combined into another drum. The drums of groundwater will be characterized for disposal based on groundwater quality data obtained from those monitoring wells.

3. Used PPE and plastic sheeting will be sealed and bagged, and disposed as general refuse.

ENSR and their subcontractors will be responsible for proper labeling of the containers. All 55-gallon drums will be sealed with a lid, a lid ring, and a bolt prior to being transported.

3.9 Site Restoration

During the course of the RI, boreholes will be opened around the site. After completion of sampling activities, every effort will be made to restore the site to pre-investigation conditions as soon as practically possible. The following guidelines will be used to maintain site conditions:

* Work sites will be kept neat. Wastes generated during sampling activities will be picked-up and containerized immediately after the field activities have been completed.

* All sampling locations not completed as monitoring wells will be backfilled with clean fill and restored to pre-existing conditions.

4.0 SITE MANAGEMENT

This section outlines the overall project organization for the implementation of the RI, in addition to the identification of key personnel and their responsibilities. Also provided are details related to site access, security, and control to be exercised during the field investigation.

4.1 Site Access

Endzone, Inc. does not own the properties where the proposed assessment activities will take place. Therefore, access agreements will be arranged with the property owners in order to conduct this investigation.

4.2 Project Organization and Responsibilities

ENSR will be responsible for the overall management and conduct of the RI covered by this Work Plan. The following information presents the name and organization of the key personnel associated with this project

Endzone, Inc.
Steven E. Pazar, Assistant General Counsel
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(781) 246-1068

New York State Department of Environmental Conservation
John Durnin, Project Manager
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ENSR, 2 Technology Park Drive, Westford, MA 01886

Main Number: (978) 589- 3000

David Austin, Project Manager

ext. 3495

Field Team Leader, To Be Determined

Waverly Braunstein, Project Chemist (QA Officer)

ext. 3660

Kathy Harvey, Health and Safety Officer

ext. 3325

5.0 FIELD PROGRAM SCHEDULE

The estimated schedule for the activities associated with the field investigation is summarized below. The overall schedule for the RI/FS is discussed in the Work Plan. The schedule begins after finalizing access agreements with the owner and tenants at the Site.

Activity	Activity Duration	Elapsed Time from Work Plan Approval
Gaining Site Access, Street Opening Permits and Mobilization	8 weeks	8 weeks
Soil and Soil Gas Investigation, Groundwater Monitoring Well Installations and Development	8 weeks	16 weeks
Groundwater Sampling and Analyses (first round), Slug Testing and Site Survey	5 weeks	21 weeks
Data validation, Site plan preparation and Data Analysis	6 weeks	27 weeks
Groundwater Sampling and Analyses (second round), assuming 1st round ends at the completion of 5th month (20 weeks) and 3 months (12 weeks) have passed	4 weeks	36 weeks
Data validation and Data Analysis	4 weeks	40 weeks
RI Report Preparation	4 weeks	44 weeks

ENSR SOP Number 7110, Surface Soil Sampling

ENSR®

SOP NUMBER: 7110

Surface Soil Sampling

Date:	2nd Qtr. 1994
Revision Number:	1
Author:	Charlie Martin
Discipline:	Geosciences

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This standard operating procedure (SOP) describes the methods used for obtaining surface soil samples for physical and/or chemical analysis. For purposes of this SOP, surface soil (including shallow subsurface soil) is loosely defined as soil that is present within 5 feet of the ground surface and can be sampled with the use of readily available and easy-to-operate sampling equipment. Various types of sampling equipment are used in the collection of surface soil samples and include spoons or scoops, trowels, shovels, and hand or bucket augers.

The purpose of this SOP is to provide a specific method and/or procedure to be used in the collection of surface soil samples which, if followed properly, will promote consistency in sampling and provide a basis for sample representativeness.

This SOP is generally applicable to surface and shallow depth soils which are unconsolidated and are of low to moderate density. Higher density or compacted soils may require use of drill rigs or other powered equipment to effectively obtain representative samples.

It should be noted that other specific state and/or federal agency standard operating procedures may be in existence in certain areas which may require deviation from this sampling procedure. The applicability of other agency operating procedures, which may differ from ENSR's SOP, needs to be determined prior to start of the sampling program. Deviations from this SOP to accommodate other regulatory requirements should be reviewed in advance of the field program, should be explained in the project work plan, and must be documented in the field project notebook when they occur.

1.2 General Principles

Surface soil sampling generally involves use of hand-operated equipment to obtain representative soil samples from the ground surface and to shallow depths below the ground surface. If soil conditions are appropriate, surface soil sampling, following the procedures described in this SOP, can provide representative soil samples in an efficient manner.

1.3 Quality Assurance Planning Considerations

Project personnel should follow specific quality assurance guidelines for sampling as outlined in the site-specific QAPP and/or Sampling Plan. Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements typically suggest the collection of a sufficient quantity of field duplicate, field blank, and equipment blank samples.

1.4 Health and Safety Considerations

Surface soil sampling may involve chemical exposure hazards associated with the type of contaminants present in surface soil. When surface soil sampling is performed, adequate Health and Safety measures must be taken to protect sampling personnel. These measures must be addressed in the project Health and Safety Plan (HASP). This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

2.0 RESPONSIBILITIES

2.1 Sampling Personnel

It will be the responsibility of the sampling personnel to conduct surface soil sampling in a manner consistent with this SOP. The above individual will be responsible for the proper use and maintenance of all types of equipment used for obtaining surface soil samples, and the collection, labeling, handling and storage of all samples until further chain-of-custody procedures are undertaken.

2.2 Sampling Coordinator

Large sampling programs may require additional support personnel such as a sampling coordinator. The sampling coordinator is responsible for providing management support such as maintaining an orderly sampling process, providing instructions to sampling personnel regarding sampling locations, and fulfilling sample documentation requirements, thereby allowing sampling personnel to collect samples in an efficient manner.

2.3 Project Manager

It is the responsibility of the project manager to ensure that the sampling activity is properly staffed, planned, and executed.

3.0 REQUIRED MATERIALS

3.1 Spoons or Scoops

Spoons or scoops should preferably be constructed of stainless steel as this material is abrasion resistant, can be easily decontaminated, and can be used to manually extract low to moderate density soil samples directly from the ground surface. Other spoon/scoop construction materials such as high-density polyethylene and teflon may be suitable in some applications but are difficult to use in higher density soils.

3.2 Trowel

Stainless steel construction is preferred. The blade of a trowel is generally flat or slightly curved and is 5 to 6 inches in length. Some trowels are available with depth calibrations marked on the blade.

3.3 Shovel

Shovels may be long or short-handled and are most often used for preparation of the sample collection area, i.e., for removal of surface debris or penetration of a high density/compacted surface prior to collection of the sample with another more appropriate device. Shovels may be used for the collection of samples that require large volumes of material for analysis (i.e., for bench-scale treatability studies). Shovels can also be used for scraping of test pit sidewalls in preparation for sidewall sampling using another device.

3.4 Hand Auger

This tool, commonly referred to as a soil auger, consists of a short spiral-bladed metal rod (solid-stem auger) attached to a handle. Clockwise rotation of the handle provides the cutting motion for the auger. Most of the loose soil is discharged upwards as the auger moves downwards. However, if the soil is cohesive some of it will stick to the auger flight providing a collectable sample at a measurable depth. Samples of surface soil can also be collected using a tube sampler which is attached to the end of the auger rods and advanced into the soil to extract a sample.

3.5 Bucket Auger

This device consists of a short length of hollow tube with cutting teeth at the bottom. As the handle is rotated, the sample is brought into and retained within the tube. When the auger is removed from the ground surface, the sample is retrieved from the tube with a spoon, or, if loosely consolidated, is poured directly into a collection pan or into the sample containers. Typically constructed of stainless steel, bucket augers are commonly available in diameters varying from two to four inches.

3.6 Collection Pan

A soil collection pan is often used as an intermediate sample container between removal of the sample from the ground and final bottling of the sample. Soil collection pans should preferably be constructed of stainless steel, although common household steel cooking pans may be used if the pan is lined with aluminum foil during sample collection.

3.7 Supporting Materials

- Teaspoon or spatula
- Aluminum foil
- Sample kit (i.e., bottles, labels, custody records, cooler, etc.)
- Sample logs/boring logs
- Decontamination materials
- Six-foot folding rule or tape measure for depth measurement
- Personal protective equipment (as required by the HASP)
- Field project notebook/pen

4.0 METHOD

4.1 General Procedures

Site-specific soil characteristics such as soil density and moisture will generally dictate the preferred type of sampling equipment for use at a particular site. Similarly, other project-specific requirements such as sampling depth and requested type of analysis such as physical testing (e.g., grain-size distribution) and/or chemical analysis will dictate the use of a preferred type of sampling equipment. Analytical testing requirements will indicate sample volume requirements that also will influence the selection of the appropriate type of sampling tool. The project sampling plan should define the specific requirements for collection of surface soil samples at a particular site. Should site-specific characteristics remain unidentified prior to start of the sampling program, sampling personnel should be equipped with a variety of sampling equipment to address the most likely sampling situations to be encountered.

As indicated, sample volume and sampling depth requirements should be defined in the sampling plan. This information should define the size of the hole which will be created during collection of the sample. For instance, if only a 500-ml sample will be required for analysis from a depth interval of 0 to 6 inches, an approximate 2 to 3-inch diameter hole will be needed. The indicated types of sampling equipment will generally make a minimum diameter hole of approximately 3 inches, therefore, an excess volume of soil may be generated during collection of a small volume soil sample. For samples requiring a large volume of soil, multiple holes and soil compositing may be necessary. Collection of the requisite volume of soil to meet sample volume requirements without underestimating the sample volume is the overall objective and is a technique which improves with experience.

It should be noted that some sampling programs may require the use of a sampling grid for the purpose of obtaining a statistically representative number of soil samples. This SOP does not provide information relative to construction of a sampling grid. This information may be found in other documents.

4.2 Equipment Decontamination

Regardless of the specific type of equipment used, each piece of equipment needs to be decontaminated prior to its initial use and following collection of each individual soil sample. Site-specific requirements for equipment decontamination should be outlined within the project sampling plan. Equipment decontamination procedures are specified within ENSR SOP 7600 - Decontamination of Equipment.

4.3 Collection of Samples for Volatile Organics Analysis

Collection of surface soil samples for volatile organics analysis (VOA) is different than collection of soil samples for other routine physical or chemical testing primarily because of the concern for potential loss of volatiles during the normal sample collection procedure. To limit the potential for loss of volatiles, the soil sample must be obtained as quickly and as directly as possible. This generally means that if a VOA sample is to be collected as part of a multiple analyte sample, the VOA sample portion should be obtained first. The VOA sample should also be obtained from a discrete portion of the entire collected sample and not from a sample which has been composited or homogenized from the entire sample interval. In general, it is best to collect the VOA sample by transferring the sample directly from the sampling tool into the sample bottles. Intermediate sample containers such as collection pans should not be used during collection of VOA samples.

4.4 Standard Procedures

4.4.1 Surface Preparation

At some sampling locations, the ground surface may require preparation in advance of sampling. Surface preparation can include removal of surface debris which blocks access to the actual soil surface or loosening of dense surface soils such as those encountered in heavy traffic areas, or frozen soils. If sampling equipment is used for both removal of surface debris and for collection of the soil sample, the equipment should be decontaminated prior to sample collection to reduce the potential for sample interferences between the surface debris and the underlying soil.

4.4.2 Shovel Sampling Procedure

A detailed operating procedure for proper use of a shovel for soil sampling is unnecessary. Specific requirements for sample quantity and sampling depth should be outlined within the project sampling plan.

Decontaminate the shovel in accordance with established procedures prior to use.

Once the soil sample is obtained and placed into the appropriate sample container(s) the hole from which the sample was retrieved should be filled with surrounding soils to eliminate a potential surface hazard.

4.4.3 Spoon, Scoop, and Trowel Sampling Procedure

Spoons, scoops, and trowels are of similarly designed construction and can therefore be operated in accordance with the following procedure.

Select the sampling location and prepare the surface by removal of surface debris if present. If the sample depth interval is at some depth below the ground surface, the surface soil material should also be removed as part of the surface preparation step. Surface preparation should be completed using other appropriately decontaminated sampling equipment.

Decontaminate the sampling tool in accordance with established procedures prior to use.

The soil sample should be obtained by inserting the sampling tool into the ground and rotating the tool so that a representative "column" of soil is removed from the ground.

The immediate objective is to collect the VOA sample fraction first if this is required. If the VOA sample is to be collected from the upper sampling interval, then the first scoop of soil should be used to directly fill the sample containers. If a specific depth below the ground surface has been targeted for the VOA sample, the overlying soils should be removed and discarded or placed into a soil collection pan as part of the remaining composite sample.

Regardless of whether or not a VOA sample is required, one or more cores or scoops of soil may be needed until the desired sampling depth is achieved. Removal of a representative column of soil in cohesionless soils may be difficult to achieve, however. If more soil is needed to meet sample volume requirements, additional soil cores may be collected from an immediately adjacent location.

Except for VOA samples, as each portion of the sample is removed from the ground, it should be placed into an intermediate sample container (collection pan) until the entire sample interval of soil is removed.

Once the sample interval has been collected, the soil sample should be thoroughly homogenized within the collection pan prior to bottling. Sample homogenizing is accomplished by manually mixing the entire soil sample in the collection pan with the sampling tool or with a clean teaspoon or spatula until a uniform mixture is achieved.

The appropriate sample containers should be filled with soil from the collection pan. The sampling tool may be used to fill the sample bottles. If packing of the samples into the bottles is necessary, a clean stainless steel teaspoon or spatula may be used. Use of fingers/hands to fill or pack sample containers should be avoided (this also includes VOA samples).

Once each sample container is filled, the rim and threads of the sample container will be cleaned of gross soil by wiping with a paper towel, then capped and labeled. Do not submerge the sample containers in water to clean them. Once labeled the sample containers should be placed into a cooler for protection. Sample chain-of-custody and other documentation requirements should be completed at this time.

The sampling tool and other sampling equipment should be decontaminated prior to reuse. All investigation-derived waste should be properly contained before leaving the area.

The sample hole should be backfilled to eliminate any surface hazard. The project sampling plan may indicate the requirements for backfilling of the sample hole.

4.4.4 Hand Auger Sampling

Select the sampling location and prepare the surface by removal of surface debris if present.

Decontaminate the sampling tool in accordance with established procedures prior to use.

A hand auger, or soil auger, can be used to extract shallow soil samples up to three (3) feet below the surface. Representative samples can be collected directly from the auger flight as it is withdrawn from the ground, or from the tube sampler attachment which can be advanced into the soil after augering to the desired depth.

When using the hand auger, the hole should be augered to the required depth by manually pushing and turning the auger. As the auger is turned, soils will be discharged to the ground surface, although some soil will be retained on the auger flight. Augering should be continued until the desired depth is achieved. If a composite or homogenized soil sample is the objective, those soils which have been discharged to the ground surface as well as those soils which cling to the auger flight should be homogenized within a soil collection pan prior to bottling. If a VOA sample is required, this fraction of the soil sample should be collected as soon as possible without compositing. It should be noted that soil augers cause considerable disturbance of the soil, therefore, some consideration should be given toward collection of VOA sample fractions using some other method (spoons, trowels, bucket augers may cause less disturbance).

Except for VOA sample fractions, the remainder of the soil sample should be thoroughly homogenized in the soil collection pan prior to bottling.

The appropriate sample containers should be filled with soil from the collection pan. A clean spoon or spatula may be needed to fill the sample bottles as necessary.

Once each sample container is filled, the rim and threads of the sample container will be cleaned of gross soil by wiping with a paper towel, then capped and labeled. Do not submerge the sample containers in water to clean them. Once labeled the sample containers should be placed into a cooler for protection. Sample chain-of-custody and other documentation requirements should be completed at this time.

All used sampling equipment should be decontaminated prior to reuse and investigation-derived waste should be properly contained before leaving the area.

The sample hole should be backfilled to eliminate any surface hazard. The project sampling plan may indicate the requirements for backfilling of the sample hole.

4.4.5 Bucket Auger Sampling

A bucket auger may be used to collect soil samples from depths ranging from one (1) to approximately five (5) feet. In some instances, soil samples may be collected from greater depths, but often with considerable more difficulty. Bucket augers allow for discrete depth interval sampling as the soil is retained within the hollow tube of the auger when it is extracted from the ground. It should be noted that if depth-discrete sampling is the objective, more than one auger may be necessary, with one auger used to provide access to the required sampling depth and the other (clean) auger used for sample collection.

Select the sampling location and prepare the surface by removal of surface debris, if present.

Decontaminate the sampling tool in accordance with established procedures prior to use.

When using the bucket auger, the auger should be pushed downward and rotated until the bucket becomes filled with soil. Usually a 6 to 12-inch core of soil is obtained each time the auger is inserted. Once filled, the auger should be removed from the ground and emptied into the soil collection pan. If a VOA sample is required, the sample should be taken directly from the auger using a teaspoon or spatula and/or directly filling the sample container from the auger. The augering process should be repeated until the desired sample interval has been augered and placed into the collection pan.

If the desired sample interval is located at a specific depth below the ground surface, the unwanted interval can be removed with one auger and the soil discarded. Sample collection can then proceed in normal fashion using a clean auger or following decontamination of the original auger.

Except for VOA sample fractions, the remainder of the soil sample should be thoroughly homogenized in the soil collection pan prior to bottling.

The appropriate sample containers should be filled with soil from the collection pan. Once each sample container is filled, the rim and threads of the sample container will be cleaned of gross soil by wiping with a paper towel, then capped and labeled. Do not submerge the sample containers in water to clean them. Once labeled the sample containers should be placed into a cooler for protection. Sample chain-of-custody and other documentation requirements should be completed at this time.

All used sampling equipment should be decontaminated prior to reuse and investigation-derived waste should be properly contained before leaving the area.

The sample hole should be backfilled to eliminate any surface hazard. The project sampling plan may indicate the requirements for backfilling of the sample hole.

5.0 QUALITY CONTROL

Quality control requirements for sample collection are dependent on project-specific sampling objectives. The Quality Assurance Project Plan (QAPP) will provide requirements for sample preservation and holding times, container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

6.0 DOCUMENTATION

Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms include:

- Field log books
- Sample collection records
- Chain-of-custody forms
- Shipping labels

The field book will be maintained as an overall log of all samples collected throughout the study. Sample collection records are generated for each sample collected and include specific information about the sample (Figure 1). Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes. Shipping labels are required if sample coolers are to be transported to the laboratory by a third party (courier service). Original and/or copies of these documents will be retained in the appropriate project files.

7.0 TRAINING/QUALIFICATIONS

Surface soil sampling is a relatively simple procedure requiring minimal training and a relatively small amount of equipment. It is, however, recommended that initial attempts be supervised by more experienced personnel. Sampling personnel should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous materials may be present.

8.0 REFERENCES

Not applicable.

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FIGURE 1 Surface Soil Sample Log

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SURFACE SOIL SAMPLE LOG

Project Number: ____________________ Project Location: ____

Sample Point No.: ____________________

Date: ____________________ Time:

Sample Point Description/Designation: ____

____

____

____

SAMPLE COLLECTION

Equipment Used: ____

No. of Samples Collected: Container Size: ____________________

Sample Number	Depth	Type of Material	Analyses Requested

Comments:

Lab Designation ____

Shipping ID Number: ______________________________

Collector's Name ______________________________

ENSR SOP Number 7115, Subsurface Soil Sampling

SOP NUMBER: 7115

Subsurface Soil Sampling by Split Spoon

Date:	3rd Qtr. 1994
Revision Number:	3
Author:	Charles Martin
Discipline:	Geosciencies

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This Standard Operating Procedure (SOP) describes the methods used in obtaining subsurface soil samples for physical and/or chemical analysis. Subsurface soil samples are obtained in conjunction with soil boring programs and provide information as to the physical and/or chemical makeup of the subsurface environment.

The purpose of this SOP is to provide a description of a specific method or procedure to be used in the collection of subsurface soil samples. Subsurface soil is defined as unconsolidated material which may consist of one or a mixture of the following materials: sand, gravel, silt, clay, peat (or other organic soils), and fill material. Subsurface soil sampling, conducted in accordance with this SOP will promote consistency in sampling and provide a basis for sample representativeness.

This SOP covers subsurface soil sampling by split-spoon only, as this is the means most often used for obtained samples of unconsolidated deposits. Other types of equipment are available for use in subsurface soil sampling, including thin-wall tube samplers (Shelby tubes), piston samplers, and continuous core barrel samplers. Information on the use of these other sampling devices may be found in several available drilling handbooks and respective state and/or federal agency technical guidance documents. The American Society for Testing and Materials (ASTM) also provides procedures for use of split-spoon and other sampling devices.

Deviations from this SOP to accommodate other regulatory requirements should be reviewed in advance of the field program, should be explained in the project work plan, and must be documented in the field project notebook when they occur.

1.2 General Principles

Split-spoon subsurface soil sampling generally requires use of a drilling rig and typically the hollow-stem auger or other common drilling method to generate a borehole in which to use the split-spoon sampler. The split-spoon sampler is inserted through the augers (or other type of drill casing) then is driven into the subsurface soil with a weighted hammer. The sampler is then retrieved and opened to reveal the recovered soil sample. Soil samples may be collected at a continuous interval or at pre-selected vertically spaced intervals within the borehole.

1.3 Quality Assurance Planning Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific Quality Assurance Project Plan (QAPP). Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements outlined in the QAPP typically suggest the collection of a sufficient quantity of field duplicate, field blank, and other samples.

1.4 Health and Safety Considerations

Subsurface soil sampling may involve chemical hazards associated with the types of contaminants potentially encountered and will always involve potential physical hazards associated with use of drilling equipment. When sampling is performed in materials which may contain hazardous constituents, or when the quality assurance objectives of the project require the use of hazardous solvents, adequate Health and Safety measures must be taken to protect sampling personnel. These measures must be addressed in the project Health and Safety Plan (HASP). This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

2.0 RESPONSIBILITIES

2.1 Drilling Subcontractor

It will be the responsibility of the drilling subcontractor to provide the necessary materials for obtaining subsurface soil samples. This generally includes one or more split-spoon samplers in good operating condition and sample containers used for stratigraphic characterization samples (sample containers for environmental samples should be provided by the designated analytical laboratory). It is the drilling subcontractor's responsibility to provide and maintain their own boring logs if desired. Equipment decontamination materials should also be supplied by the subcontractor and should meet project specifications.

2.2 Project Geologist/Sampling Engineer

It will be the responsibility of the project geologist/sampling engineer to conduct subsurface soil sampling in a manner which is consistent with this SOP. The project geologist/sampling engineer will observe all activities pertaining to subsurface soil sampling to ensure that the SOP is followed, and to record all pertinent data onto a boring log. It is also the project geologist/sampling engineer's responsibility to indicate the specific targeted sampling depth or sampling interval to the drilling subcontractor. The project geologist/sampling engineer is also responsible for the collection of representative environmental or stratigraphic characterization samples once the sampling device has been retrieved and opened. Additional sample collection responsibilities include labeling, handling, and storage of samples until further chain-of-custody procedures are implemented.

3.0 REQUIRED MATERIALS

In addition to those materials provided by the subcontractor, the project geologist/sampling engineer will require:

- Project Sampling Plan, QAPP, and HASP
- Boring logs
- Teaspoon or spatula (stainless steel is recommended)
- Sample kit (bottles, labels, custody records and tape, cooler)
- Sample collection pen
- Folding rule or tape measure
- Equipment decontamination materials
- Health and safety equipment (as required by HASP)
- Field project notebook/pen

4.0 METHOD

4.1 General Method Description

Split-spoon sampling devices are typically constructed of steel and are most commonly available in lengths of 18 and 24 inches and diameters of 1.5 to 3 inches. The split-spoon consists of a tubular body with two halves that split apart lengthwise, a drive head on the upper end with a ball-check valve for venting, and a hardened steel cutting shoe at the bottom. The soil sample enters the split-spoon through the cutting shoe as the device is driven into the ground. A replaceable plastic or metal basket is often inserted into the shoe to assist with retaining samples. Once the sampler is retrieved, the drive head and cutting shoes are removed and the split-spoon halves are then separated, revealing the sample.

Sample depth intervals are usually defined on a project-specific basis with these requirements specified in the project sampling plan. Sampling intervals typically range from one (1) sample per five (5) feet of drilling to continuous sampling where the entire drilled interval is sampled.

Subsurface soil sampling is usually accomplished as part of a drilling program where a soil boring is advanced with drilling equipment to the designated depth prior to collection of a representative sample. The general procedures outlined briefly in the following section provide requirements for advancing drill casing/augers in preparation for sampling.

4.2 General Procedures - Borehole Preparation

4.2.1 Advancing Casing/Augers

Soil borings that are completed for soil sampling purposes are typically advanced using hollow-stem augers and sometimes drive-and-wash or other casing methods. The casing/augers must be of sufficient diameter to allow for soil sampling at a minimum. The casing/augers will be advanced according to project requirements to the required depth for sampling. If hollow-stem augers are used, a temporary plug shall be used in the lead auger to prevent the auger from becoming filled with drill cuttings while drilling is in progress.

4.2.2 Obstructions

For those borings which encounter obstructions, the casing/augers will be advanced past or through the obstruction if possible. Caution should be exercised when obstructions are encountered and an effort made to identify the obstruction before drilling is continued. If the obstruction is not easily drilled through or removed, the boring should be relocated to an adjacent location.

4.2.3 Use of Added Water

The use of added or recirculated water during drilling is permitted when necessary. Use of extraneous water should be minimized or avoided if possible as it may impact sample quality. Water usage should be documented in the field notebook. Sampling and analysis of added or recirculated water may be required for quality assurance purposes (refer to QAPP). If a well is installed within the completed borehole, removal of the added water may be required.

4.3 Sampling Procedure

4.3.1 Equipment Decontamination

Each split-spoon must be decontaminated prior to its initial use and following collection of each soil sample. Site-specific requirements for equipment decontamination should be outlined within the Project Sampling Plan. Equipment decontamination procedures are also outlined within SOP 7600 - Decontamination of Equipment.

4.3.2 Standard Penetration Test

The drilling subcontractor will lower the split-spoon into the borehole. Samples are generally obtained using the Standard Penetration Test (SPT) in accordance with ASTM standards (ASTM D 1586-84). Following this method, the sampler will be driven using the 140-pound hammer with a vertical free drop of 30 inches using two turns of the rope on the cathead. The number of hammer blows required for every 6 inches of penetration will be recorded on the boring log. Blowcount information is used as an indicator of soil density for geotechnical as well as stratigraphic logging purposes. Once the split-spoon has been driven to its fullest extent, or to refusal, it will be removed from the borehole.

4.3.3 Sample Recovery

The split-spoon will be immediately opened upon removal from the casing/auger. The open sampler shall then be screened for volatile organics with a photoionization device (PID) if required by the Project Sampling Plan. If the Sampling Plan also requires individual soil sample headspace screening for volatile organic compounds, then a small portion of the split-spoon sample shall be removed and properly contained for that purpose.

Sample recovery will be determined by the project geologist/sampling engineer who will examine the soil core once the sampler is opened. The length of sample shall then be measured with a folding rule or tape measure. Any portion of the split-spoon contents which are not considered part of the true sample (i.e., heaved soils) will be discarded. If the sample recovery is considered inadequate for sample characterization or analytical testing purposes, another sample should be collected from the next vertical interval if possible before drilling is reinitiated.

Adequate sample recovery for stratigraphic logging purposes and/or headspace organic vapor testing purposes should be approximately 6 inches. Adequate sample recovery for analytical testing purposes should be a minimum of 12 inches and is somewhat dependent on the type of analytical testing required. In some cases, continuous sampling over a short interval, and compositing of the sample, may be required to satisfy analytical testing requirements. Larger diameter samplers may be used if large volumes of soil are required for analytical testing.

4.3.4 Sample Containment - General

Once retrieved, the sample will be removed from the split-spoon with a teaspoon or spatula and placed into the appropriate sample container. The sample will be split if necessary to meet sampling program requirements. Sample splitting may be necessary to provide individual samples for headspace testing, visual characterization, physical testing, analytical testing, or simply for archiving purposes. In general, most sampling programs are structured around environmental characterization needs; therefore, sample portions required for analytical testing should be collected first. The Project Sampling Plan and QAPP provides specific sample container requirements for each type of sample and should be referred to for guidance.

Once filled, the sample containers should be properly capped, cleaned, and labeled, and chain-of-custody and sample preservation procedures initiated. Sampling equipment should then be properly decontaminated.

4.3.5 Sample Containment - Volatile Organic Analyses

Collection of subsurface soil samples for volatile organic analysis (VOA) is slightly more complex than collection of samples for other routine chemical or physical testing primarily because of the concern for the potential loss of volatiles during the sample collection procedure. To limit the potential for loss of volatiles, the soil sample needs to be obtained as quickly and as directly as possible from the split-spoon. This generally means that the VOA sample is to be collected and placed into the appropriate sample container first. The VOA sample should also be obtained from a discrete portion of the entire sample interval and not composited or homogenized. The remainder of the recovered sample can then be composited, homogenized or split to meet the other testing requirements. The boring log and/or sample logbook should be filled out to indicate actual sample collection depths for both VOA samples and other portions of the sample which may have been composited over a larger vertical interval.

5.0 QUALITY CONTROL

Quality control requirements are dependent on project-specific sampling objectives. The QAPP will provide requirements for sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

6.0 DOCUMENTATION

Various forms are required to ensure that adequate documentation is made of sample collection activities. These forms include:

- Boring logs
- Field log books
- Sample collection records
- Chain-of-custody records
- Shipping labels

Boring logs (Figure 1) will provide visual and descriptive information for each sample collected and are often the most critical form of documentation generated during a sampling program. The field log book is kept as a general log of activities. Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes. Shipping labels are required if sample coolers are to be transported to the laboratory by a third party (courier service). Original copies of these records should be maintained in the appropriate project files.

7.0 REFERENCES

ASTM D 1586-84

ENSR

Figure 1

Sheet 1 of __

BORING LOG

Project No. ______ Date – Start ______ Finish ______ Boring ______

Project Name ______ Drilling Co. ______

Location ______ Drilling Method ______

Total Depth ______ Inspector ______ Reviewer ______

Remarks ______

Depth Feet	Sample				Graphic Log	Lithologic Description	Equipment Installed
	Type & No.	Blows per 6 in.	Depth Range	Rec.			

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ENSR SOP Number 7116, Subsurface Soil Sampling by Geoprobe Methods Operating Procedures

ENSR INTERNATIONAL

SOP NUMBER: 7116	
Subsurface Soil Sampling by Geoprobe™ Methods	**Date:** 2^{nd} Qtr. 1995 **Revision Number:** 0 **Author:** Charles Martin **Discipline:** Geoscience

1.0 INTRODUCTION

1.1 Purpose and Applicability

This Standard Operating Procedure (SOP) describes the methods available for collecting subsurface soil samples using commercially available Geoprobe™ Systems (or other similar vendor) soil probing equipment. Subsurface soil samples may be obtained using this system for purposes of determining subsurface soil conditions and for obtaining soil samples for physical and/or chemical evaluation.

The purpose of this SOP is to provide a description of a specific method or procedure to be used in the collection of subsurface soil samples using the Geoprobe™ system. Subsurface soil is defined as unconsolidated material which may consist of one or a mixture of the following materials: sand, gravel, silt, clay, peat (or other organic soils), and fill material. Subsurface soil sampling, conducted in accordance with this SOP will promote consistency in sampling and provide a basis for sample representativeness.

This SOP covers subsurface soil sampling using Geoprobe™ Systems equipment; specifically, the Macro-Core Soil Sampler, and the Large Bore Sampler. Use of this sampling equipment requires use of the Geoprobe™ hydraulically-powered percussion/probing machine. Geoprobe™ sampling is usually performed by subcontractors, although rental equipment is available for use by trained operators.

The Geoprobe™ sampling methods covered in this SOP are applicable to unconsolidated soil/fill materials and to a maximum recommended depth of approximately 30 feet. Sampling depths are greatly dependent upon soil density as the hydraulically-powered probing unit has power limitations. Sample recovery is also somewhat dependent on grain size as very coarse gravel, cobbles, and boulders will occasionally cause premature refusal of the sampler. It is generally preferable to have some prior knowledge of site soil conditions if sampling activities are proposed where equipment limitations may become a factor.

Other types of equipment and sampling methods are available for use in obtaining samples of unconsolidated materials; and include split-spoons, Shelby tubes, and continuous core barrel samplers. Information on these and other soil sampling devices may be found in other ENSR SOPs, ASTM procedures, drilling handbooks, and respective state and/or federal agency technical guidance documents.

1.2 General Principles

Soil sampling using the Geoprobe™ System requires use of the hydraulically-powered percussion/probing machine and either the Macro-Core Soil Sampler or the Large Bore Sampler soil sampling devices. The percussion/probing machine is typically mounted onto the bed of a pickup truck or van so that a stable working platform is established. The percussion/probing machine, through its hydraulic operation, pushes and hammers the soil sampling equipment vertically into the ground within the targeted sampling interval. The soil sampler is then extracted from the ground to recover the sample.

The Macro-Core Sampler (Figure 1) consists of a 45-inch long by 1.5-inch diameter open-ended steel sampling tool with liners made of clear plastic (cellulose acetate butyrate), stainless steel, or teflon. The tool is designed for use in a continuous sampling capacity in an open borehole up to depths of approximately 24 feet. The borehole walls are required to stay open in order to collect a sample from the next depth interval. Once the sampling tool is removed from the ground, the inserted liner containing the soil sample is removed from the tool. The soil sample is then cut from or extracted from the liner. This sampling tool is most often used for soil profiling and collection of larger volume soil samples (1,300 ml).

The Large Bore Sampler (Figure 2) consists of a 22-inch long by a slightly over 1-inch diameter steel sampling tool and may be used for sampling to depths of approximately 30 feet. Various liner types are available for use with this sampler, and include: plastic, brass, stainless steel, and teflon. The metal liners are available in segmented 6-inch lengths. The sampler is designed for discrete interval sampling and is not affected significantly by borehole wall collapse. This sampler is similar to a piston sampler where a retractable drive (piston) point is withdrawn when the targeted sampling interval is achieved and the soil sample enters the sampler. Once the sampler is removed from the ground, the inserted liner containing the soil sample is extracted from the sampler and the soil sample is then cut from or extracted from the liner. The segmented liner materials and discrete interval sampling capability gives this device greater suitability for collection of smaller volume soil samples (320 ml).

1.3 Quality Assurance Planning Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific Quality Assurance Project Plan (QAPP). Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements outlined in the QAPP typically suggest the collection of a sufficient quantity of field duplicate, field blank, and other samples.

1.4 Health and Safety Considerations

The health and safety considerations for the site, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (HASP). All field activities will be conducted in conformance to this HASP. In the absence of a site-specific HASP, work will be conducted according to the ENSR Health and Safety Policy and Procedures Manual and/or direction from the Regional Health and Safety Manager.

2.0 RESPONSIBILITIES

2.1 Project Geologist/Engineer

It will be the responsibility of the project geologist/sampling engineer to conduct subsurface soil sampling in a manner which is consistent with this SOP. The project geologist/sampling engineer will observe all activities pertaining to subsurface soil sampling to ensure that the SOP is followed, and to record all pertinent data onto a boring log. It is also the project geologist/sampling engineer's responsibility to indicate the specific targeted sampling depth or sampling interval to the drilling subcontractor. The project geologist/sampling engineer is also responsible for the collection of representative environmental or stratigraphic characterization samples once the sampling device has been retrieved and opened. Additional sample collection responsibilities include labeling, handling, and storage of samples until further chain-of-custody procedures are implemented.

2.2 Drilling Subcontractor

It will be the responsibility of the drilling subcontractor to provide the necessary Geoprobe™ equipment for obtaining subsurface soil samples. This generally includes the truck or ATV-mounted percussion/probing machine and one or more Macro-Core and Large Bore samplers in good operating condition, appropriate liners, and other necessary equipment for borehole preparation and sampling. It is the drilling subcontractor's responsibility to provide and maintain their own boring logs if desired. Equipment decontamination materials should also be provided by the subcontractor and should meet project specifications.

3.0 REQUIRED MATERIALS

In addition to those materials provided by the subcontractor, the project geologist/sampling engineer will require:

- Project Sampling Plan, QAPP, and HASP
- Boring Logs
- Teaspoon or spatula
- Sample kit (bottles, labels, custody records and tape, cooler)
- Sample collection pan
- Folding rule or tape measure
- Utility knife
- Equipment decontamination materials (as required by QAPP)
- Health and safety equipment (as required by HASP)
- Field project notebook/pen

Sampling equipment which comes in direct contact with environmental samples during the sample collection process should be constructed of stainless steel, teflon, or glass, unless specified otherwise in the Project Sampling Plan or QAPP.

4.0 METHOD

4.1 General Method Description

Geoprobe™ soil sampling methods generally involve collection of soil samples by driving the sampling tool directly into the ground using the percussion/probing machine and without the aid of hollow-stem augers or other casing-installed drilling methods. Both the Macro-Core and Large Bore soil samplers consist of metal tubes of seamless construction which can not be split apart like split-spoons. Liner/sleeve inserts are required in order to extract an intact soil core/sample from the sampling device.

Both sampling devices operate by being directly pushed/hammered into the ground by the percussion/probing machine. The borehole is created as the sampling device is advanced downward. The Macro-Core Sampler collects samples continuously and requires that an open borehole be maintained for efficient sample recovery. The Large Bore Sampler contains a piston tip/drive point which allows for advancing the sampler to a designated depth for discrete interval sampling. The piston tip is retracted when the desired sampling interval is reached.

When the soil sampling device is retrieved from the borehole, the drive head, cutting shoe and/or piston assembly is removed, and the liner insert with sample is removed from the sampling device. The project geologist/sampling engineer is then given access to the sample for whatever purpose is required.

Table 1 summarizes the construction characteristics and sampling attributes of each type of sampler. The appropriate type of sampler should be selected based on project-specific sampling requirements.

4.2 Equipment Decontamination

Each sampling device must be decontaminated prior to its initial use and following collection of each soil sample, especially if sampling for analytical testing purposes is conducted. If sampling for soil logging only is conducted, thorough sampler decontamination between samples may not be necessary although sufficient cleansing is necessary for the sampler to operate properly. Site-specific requirements for equipment decontamination should be outlined in the Project Sampling Plan. Equipment decontamination procedures are also outlined within SOP 7600 - Decontamination of Equipment.

4.3 Sampling Procedures - Macro-Core Sampler

(Note: These procedures are excerpted from Geoprobe™ Systems literature. This SOP assumes that the subcontractor will perform sampling; therefore, detailed procedures regarding sample aquisition are not provided.)

4.3.1 Sampler Preparation

- Decontaminate the sampler parts (cutting shoe, sample tube, liners) before assembly.
- Assemble the sampler by first placing the liner over the inside end of the cutting shoe, then inserting the liner/shoe assembly into the sample tube, and then finally threading the cutting shoe into the sample tube. Tighten the cutting shoe with the shoe wrench.
- Thread the sampler onto the drive head.

4.3.2 Sampling

- Using the percussion/probing machine, drive the sampler into the ground until the drive head reaches the ground surface.
- For deeper samples, the borehole walls must remain stable. The cutting shoe is designed with a tapered surface to limit sidewall scraping. Add additional probe rods until the sampler reaches the

targeted sample interval, then drive the sampler through the desired sample interval.

- Use the machine hydraulics to pull the sampler from the borehole.

4.3.3 Sample Recovery

- Once the sampler has been removed from the borehole, the sampler must be unthreaded from the drive head, the cutting shoe unthreaded from the sampler, and the liner/shoe assembly removed from the sample tube.

- Disconnect the cutting shoe from the liner which contains the soil sample. The recovered soil sample may now be viewed, logged, and extracted from the liner for analysis (refer to Section 4.5 for sample containment procedures).

4.4 Sampling Procedures - Large Bore Sampler

(Note: These procedures are excerpted from Geoprobe™ Systems literature. This SOP assumes that the subcontractor will perform sampling; therefore, detailed procedures regarding sample aquisition are not provided. Additional detailed sampling procedures for this specific item of equipment is presented in Geoprobe™ Technical Bulletin No.93-660, appended to this SOP.)

4.4.1 Sampler Preparation

- Decontaminate the sampler parts (cutting shoe, piston rod/tip, sample tube, liners) before assembly.

- Assemble the sampler by first placing the liner on the cutting shoe, then threading the liner/shoe assembly into the sample tube, then connecting the piston tip to the piston rod, and then finally inserting the piston tip/rod assembly into the sample tube. Tighten the cutting shoe with the shoe wrench.

- Thread the sampler onto the drive head. Thread the stop-pin onto the drive head (stop-pin holds the piston tip/rod in place while driving the sampler to the desired sample interval).

4.4.2 Sampling

- Using the percussion/probing machine, drive the sampler into the ground until the upper portion of the targeted sampling interval is achieved.

- Unthread and remove the stop-pin from the drive head using extension rods. This will activate the piston tip/rod.

- Drive the sampler through the targeted sampling interval to collect the sample. The piston tip/rod will retract as the sample enters the sample tube.
- Use the machine hydraulics to pull the sampler from the ground.

4.4.3 Sample Recovery

- Once the sampler has been removed from the ground, the sampler must be unthreaded from the drive head, then the cutting shoe unthreaded from the sample tube, and the liner/shoe assembly removed from the sample tube.
- Disconnect the cutting shoe from the liner which contains the soil sample. The recovered soil sample may now be viewed, logged, and extracted from the liner for analysis (refer to Section 4.5 for sample containment procedures).

4.5 Sample Containment

4.5.1 General

- The soil sample can be removed from the liner following viewing and/or logging. Non-segmented plastic or teflon liners should be cut with a utility knife into approximate 6-inch lengths to facilitate sample extraction or to isolate specific sample zones targeted for analysis. Segmented metal liners can be manually separated.
- Once the liner has been separated, the soil sample may be extracted from the individual liner segments with a spoon or spatula. Except for volatile organic samples (see below), the soil sample should be placed into a sample collection pan and homogenized. Place the sample directly into the required sample container.
- Once filled, the sample container should be properly capped, cleaned and labeled. Sample chain-of-custody and preservation procedures should then be initiated.
- Perform equipment decontamination following containment of the sample.

4.5.2 Volatile Organic Samples

- Use of teflon liners is preferred when sampling for analysis of volatile organic compounds (VOC) because these liners are more inert. In order to limit the potential for loss of volatiles, the soil sample should be removed from the liner as soon as possible after sample recovery. VOC soil samples should be selected from a central point within the liner unless another specific sample zone has been targeted. The liner should be cut with a knife and the sample immediately extracted and containerized. Clean and label the container and place it into a cooler immediately. Residual sample may then be used to fill other sample or logging requirements.

5.0 QUALITY CONTROL

Quality control requirements are dependent on project-specific sampling objectives. The QAPP will provide requirements for equipment decontamination (frequency and materials), sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

6.0 DOCUMENTATION

Various forms are required to ensure that adequate documentation is made of sample collection activities. These forms include:

- Boring logs
- Field log books
- Sample collection records
- Chain-of-custody records
- Shipping labels

Boring logs (Figure 3) will provide visual and descriptive information for each sample collected and are often the most critical form of documentation generated during a soil sampling program. The field log book is kept as a general log of activities and should not be used in place of the boring log. Occasionally, sample collection records are used to supplement boring logs, especially for environmental samples which have been collected for laboratory analysis. Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes. Shipping labels are required if sample coolers are to be transported to the laboratory by a third party (courier service). Original copies of these records should be maintained in the appropriate project files.

7.0 REFERENCES

Geoprobe™ Systems, August 1993, "1993-94 Equipment and Tools Catalog".

TABLE 1
Geoprobe Systems Soil Sampler Characteristics

Sampler Type	Length (in.)	Diameter (in.)	Volume (ml)	Sleeve Liner Type	Suitability[1] Soil Logging	Physical Testing	Chemical-Inorganics	Chemical-Organics
Macro-Core	45	1.5	1,300	Acetate Stainless Steel Teflon	A B A	A A A	A B A	B A A
Large Bore	22	1.06	320	Acetate Brass Stainless Steel Teflon	A B B A	A A A A	A B B A	B B A A

[1] **A - Preferred suitability**
B - Acceptable suitability

Figure 1 – Soil Sampling Tools – Macro-Core Sampler - Parts

SOIL SAMPLING TOOLS - Macro-Core Sampler - Parts

Macro-Core Sampler
AT-720 Series
The sampler features a nickel-plated sample tube that is 48" long x 2.0" in diameter, a hardened tool steel cutting shoe that has a 1.5" diameter opening, and a tapered drive head that fits standard Geoprobe probe rods. The overall length assembled is 51.25". Sample recovery is 45" long x 1.50" diameter (1302 ml) in a PETG liner.

PARTS	
AT-720	MC Cutting Shoe
AT-721	MC Drive Head
AT-722	MC Sample Tube
AT-725	MC PETG (clear plastic) Liner
AT-726	MC Vinyl End Cap
AT-727	MC Shoe Wrench

KITS

Assembled Macro-Core Sampler*
Part No. AT-720K
Includes the following parts:
(1) **AT-720** MC Cutting Shoe
(1) **AT-721** MC Drive Head
(1) **AT-722** MC Sample Tube
*kit does not include liners and end caps

LINERS	
AT-725K	MC PETG Liners (pre-flared, clear plastic) Box of 66 only
AT-726K	MC Vinyl End Caps (fit AT-725 liners) Box of 66 pairs (66 red/66 black)

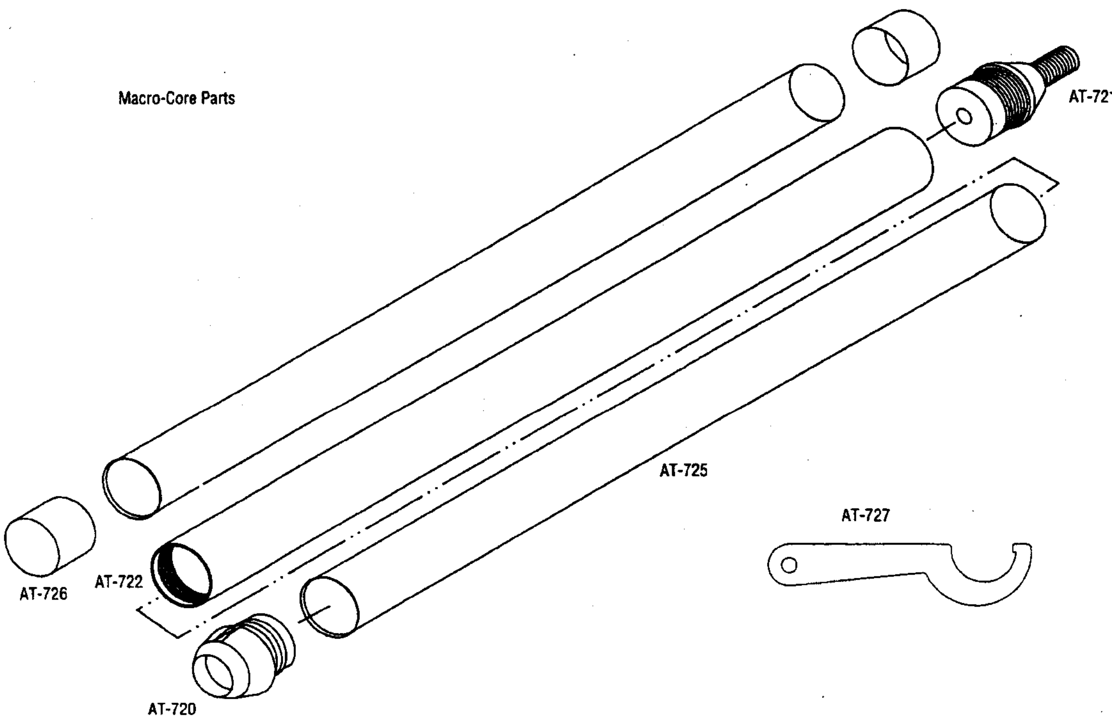
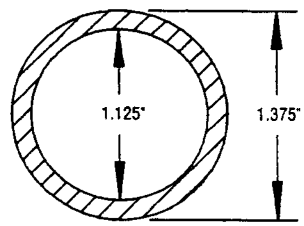


Figure 2 – Soil Sampling Tools – Probe Drive System/Large Bore

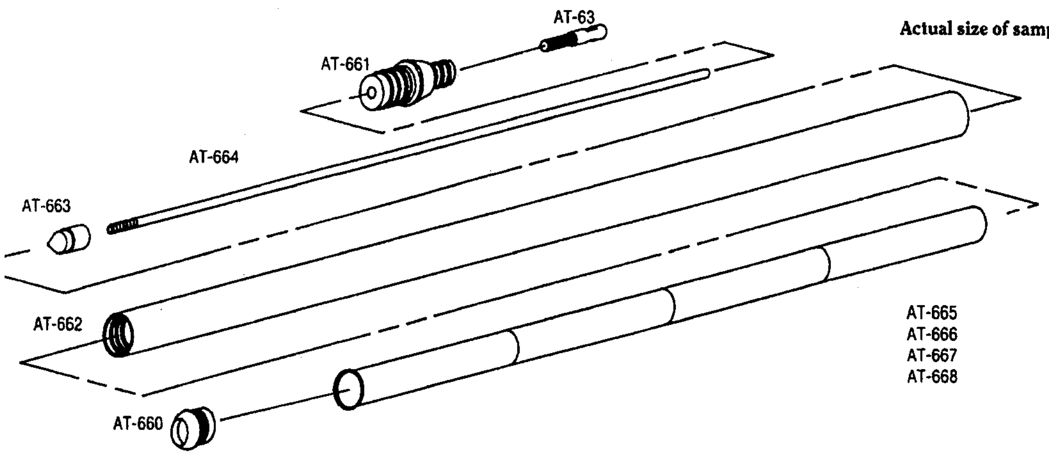
SOIL SAMPLING TOOLS - Probe Drive System/Large Bore

Large Bore Sampler
AT-660 Series
Features nickel plated sample tube, replaceable hardened tool steel cutting shoe and removable liner. Recovers core approximately 22" long x 1-1/16" diameter (320 ml). Uses STD Piston Stop-Pin. Recommended for sampling depths up to 30 feet. Liners available in brass, stainless steel, PTFE (Teflon), or PETG (clear plastic).



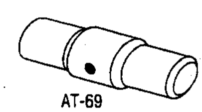
Actual size of sample tube

Large Bore Sampler Parts:



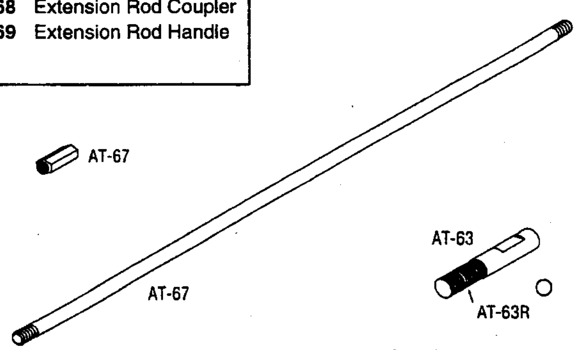
PARTS

Large Bore Sampler Parts		Liners		Also required:	
AT-660	LB Cutting Shoe	**AT-665**	LB PETG Liner	**AT-63**	STD Stop-Pin
AT-661	LB Drive Head	**AT-666**	LB Brass Liner	**AT-63R**	Stop-Pin O-rings
AT-662	LB Sample Tube	**AT-667**	LB Stainless Liner	**AT-67**	Extension Rod
AT-663	LB Piston Tip	**AT-668**	LB PTFE Liner	**AT-68**	Extension Rod Coupler
AT-664	LB Piston Rod			**AT-69**	Extension Rod Handle
AT-669	LB Shoe Wrench				



PARTS

Parts used with all Probe-Drive Samplers	
AT-63	STD Stop-Pin
AT-63R	Stop-Pin O-rings
AT-67	Extension Rod
AT-68	Extension Rod Coupler
AT-69	Extension Rod Handle



Extension Rod Parts **Stop-Pin Parts**

Geoprobe Systems

ENSR. INTERNATIONAL

Figure 3 – Boring Log

ENSR

BORING LOG

Sheet 1 of

Project No. ______ Date - Start ______ Finish ______ Boring ______

Project Name ______ Drilling Co. ______

Location ______ Drilling Method ______

Total Depth ______ Inspector ______ Reviewer ______

Remarks ______

Depth Feet	Sample				Graphic Log	Lithologic Description	Equipment Installed
	Type & No.	Blows per 6 In.	Depth Range	Rec.			

ENSR SOP Number 7510, Packaging and Shipment of Samples

ENSR

SOP NUMBER: 7510

Packaging and Shipment of Environmental Samples

Date:	4th Qtr. 1999
Revision Number:	4
Author:	Charles Martin
Discipline:	Geosciences

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This Standard Operating Procedure (SOP) describes the procedures associated with the packaging and shipment of environmental samples. Two general categories of samples exist: environmental samples consisting of water and soil submitted for routine environmental testing, and waste material samples which include non-hazardous solid wastes and/or hazardous wastes as defined by 40 CFR Part 261 submitted for environmental testing or bench/pilot-scale treatability testing. Packaging and shipping procedures will differ for the two sample categories.

This SOP is applicable to packaging and shipment of environmental samples submitted for routine environmental testing. Environmental samples are not considered a hazardous waste by definition; therefore, more stringent Department of Transportation (DOT) regulations regarding sample transportation do not apply. Environmental samples do, however, require fairly stringent packaging and shipping measures to ensure sample integrity as well as safety for those individuals handling and transporting the samples.

This SOP is designed to provide a high degree of certainty that environmental samples will arrive at their destination intact. This SOP assumes that samples will often require shipping overnight by a commercial carrier service, therefore, the procedures are more stringent than may be necessary if a laboratory courier is used or if samples are transported directly to their destination by a sampling team member. Should the latter occur, the procedures may be modified to reflect a lesser degree of packaging requirements.

Respective state or federal agency (regional offices) protocols may require or recommend specific types of equipment for use in sample packaging or a specific method of shipment that may vary from the indicated procedures. Deviations from this SOP to accommodate other regulatory requirements should be reviewed in advance of the field program, should be explained in the project work plan, and must be documented in the field project notebook when they occur.

1.2 General Principles

Sample packaging and shipment generally involves the placement of individual sample containers into a cooler or other similar shipping container and placement of packing materials and coolant in such a manner as to isolate the samples, maintain the required temperature, and to limit the potential for damage to sample containers when the cooler is transported.

1.3 Quality Assurance Planning Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific work plan or Quality Assurance Project Plan (QAPP). Proper quality assurance requirements should be provided which will specify sample packaging and shipment requirements if variations to the indicated procedures are necessary on a particular project.

1.4 Health and Safety Considerations

Sampling personnel should be aware that packaging and shipment of samples involves potential physical hazards primarily associated with handling of occasional broken sample containers and lifting of heavy objects. Adequate health and safety measures must be taken to protect sampling personnel from these potential hazards. The project Health and Safety Plan (HASP) generally addresses physical and other potential hazards. This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed. In the absence of a HASP, work will be conducted according to the ENSR Health and Safety Policy and Procedures Manual and/or direction from the Regional Health and Safety Manager.

2.0 RESPONSIBILITIES

2.1 Sampling Technician

It is the responsibility of the sampling technician to be familiar with the procedures outlined within this SOP and with specific sampling, quality assurance, and health and safety requirements outlined within the project-specific plans. The sampling technician is responsible for proper packaging and shipment of environmental samples and for proper documentation of sampling activities for the duration of the sampling program.

2.2 Sampling Coordinator

Large sampling programs may require additional support personnel such as a sampling coordinator. The sampling coordinator is responsible for providing management support such as maintaining an orderly sampling process, providing instructions to sampling technicians regarding sampling locations, and fulfilling sample documentation requirements, thereby allowing sampling technicians to collect samples in an efficient manner.

2.3 Project Manager

The project manager is responsible for ensuring that project-specific requirements are communicated to the project team and for providing the materials, resources, and guidance necessary to perform the activities in accordance with the project plan and this SOP. The project manager is also responsible for ensuring that proper arrangements have been made with the designated analytical laboratory. These arrangements include, but are not necessarily limited to, subcontractor agreements, analytical scheduling, and bottle/cooler orders. The project manager may delegate some of these responsibilities to other project staff.

3.0 REQUIRED MATERIALS

- Sample coolers
- Sample containers
- Shipping labels
- Chain-of-custody records, custody seals
- Bubble wrap
- Vermiculite (granular), or styrofoam pellets
- "Blue Ice" refreezable ice packs, or ice cubes
- Transparent tape, or rubber bands
- Fiber tape
- Duct tape
- Zipper-lock plastic bags

- Trash bags
- Health and Safety supplies
- Equipment decontamination materials
- Field project notebook/pen

4.0 METHOD

4.1 General Information

4.1.1 Regulatory Information

The extent and nature of sample containerization will be governed by the type of sample, and the most reasonable projection of the sample's hazardous nature and constituents. The EPA regulations (40 CFR Section 261.4(d)) specify that samples of solid waste, water, soil or air, collected for the sole purpose of testing, are exempt from regulation under the Resource Conservation and Recovery Act (RCRA) when any of the following conditions are applicable:

- Samples are being transported to a laboratory for analysis;
- Samples are being transported to the collector from the laboratory after analysis;
- Samples are being stored (1) by the collector prior to shipment for analyses, (2) by the analytical laboratory prior to analyses, (3) by the analytical laboratory after testing but prior to return of sample to the collector or pending the conclusion of a court case.

4.1.2 Sample Information:

The following information must accompany each shipment of samples on a chain-of-custody form (Figure 1) where each sample has an individual entry:

- Sample collector's name, mailing address and telephone number,
- Analytical laboratory's name, mailing address and telephone number,
- A unique identification of each sample,

- Sample description (matrix),
- Number and type of sample containers,
- Container size,
- Preservative,
- Type and method of analysis requested, and
- Date and time that the samples were collected and prepared for shipping,
- Special handling instructions, including notation of suspected high concentration samples.

4.1.3 Laboratory Notifications:

Prior to sample collection, the Project Manager, or designated alternative must notify the laboratory manager of the number, type and approximate collection and shipment dates for the samples. If the number, type or date of sample shipment changes due to program changes which may occur in the field, the Project Manager or alternate must notify the laboratory of the changes. Additional notification from the field is often necessary when shipments are scheduled for weekend delivery.

4.2 General Site Preparation

4.2.1 Small Projects

Small projects of one or two days duration may require packaging and shipment of samples using the field vehicle as the sample preparation area. If sample coolers will be sent via third party commercial carrier service, adequate sample packaging materials should be sent to the project location in advance of sampling or purchased from stores located near the site.

4.2.2 Large Projects

Multi-day or week sampling programs usually require rental of an office trailer or use of existing office/storage facilities for storage of equipment as well as for sample preparation. If possible, a designated area should be selected for storage of unused sample containers/coolers and another area for sample handling, packaging, and shipment. Handling of environmental samples should preferably be conducted in a clean area and away from unused sample containers to minimize the potential for cross contamination. Large quantities of packaging materials may require advance special ordering. Shipping forms/labels may be preprinted to facilitate shipping.

4.2.3 Cooler Inspection and Decontamination

Laboratories will often re-use coolers. Every cooler received at a project location should be inspected for condition and cleanliness. Any coolers that have cracked interior or exterior linings/panels or hinges should be discarded as their insulating properties are now compromised. Any coolers missing one or both handles should also be discarded if replacement handles (i.e., knotted rope handles) can not be fashioned in the field. Replacement coolers may be purchased in the field if necessary.

The interior and exterior of each cooler should be inspected for cleanliness before using it. Excess strapping tape and old shipping labels should be removed. If the cooler interior exhibits visible contamination or odors it should be decontaminated in accordance with ENSR SOP-7600 (Decontamination of Equipment) prior to use. Drain plugs should be sealed on the inside with duct tape.

4.2.4 Other Considerations

VOC Samples - Sample containers used for VOC analysis may be grouped into a single cooler, with separate chain-of-custody record, to limit the number of trip blanks required for transportation and analysis. Individual VOC samples may also be placed into Zipper-lock bags to further protect the samples.

Contaminated Samples - Sample containers with presumed high contaminant concentrations should be isolated within their own cooler with each sample container placed into a Zipper-lock bag.

4.3 Sample Packaging Method

Sample packaging should be conducted in the following manner:

4.3.1 Place plastic bubble wrap matting over the base of each cooler or shipping container as needed. A 2- to 3-inch thickness layer of vermiculite may be used as a substitute base material.

4.3.2 Insert a clean trash bag into the cooler to serve as a liner.

4.3.3 Check that each sample container is sealed, labelled legibly, and is externally clean. Re-label and/or wipe bottles clean if necessary. Clear tape should be placed over the labels to protect them. Wrap each sample bottle individually with bubble wrap secured with tape or rubber bands. Place bottles into the cooler in an upright single layer with approximately one inch of space between each bottle. Do not stack bottles or place them in the cooler lying on their side. If plastic and glass sample containers are used, alternate the placement of each type of container within the cooler so that glass bottles are not placed side by side.

4.3.4 Insert cooler temperature blanks if required.

4.3.5 Place additional vermiculite, bubble wrap, and/or styrofoam pellet packing material throughout the voids between sample containers within each cooler to a level which meets the approximate top of the sample containers. Packing material may require tamping by hand to reduce the potential for settling.

4.3.6 Place cubed ice or cold packs in heavy duty Zip-lock type plastic bags, close the bags, and distribute the packages in a layer over the top of the samples. Cubed ice should be double-bagged to prevent leakage. Loose ice should never be used. Cold packs should be used only if the samples are chilled before being placed in the cooler.

4.3.7 Add additional bubble wrap/styrofoam pellets or other packing materials to fill the balance of the cooler or container.

4.3.8 Obtain two pieces of chain of custody tape as shown in Figure 2 and enter the custody tape numbers in the appropriate place on the chain-of-custody form. Sign and date the chain-of-custody tape.

4.3.9 Complete the chain-of-custody form. If shipping the samples involves use of a third party commercial carrier service, sign the chain-of-custody record thereby relinquishing custody of the samples. Shippers should not be asked to sign chain of custody records. If a laboratory courier is used, or if samples are transported to the laboratory, the receiving party should accept custody and sign the chain-of-custody records. Remove the last copy from the form and retain it with other field notes. Place the original (with remaining copies) in a Zipper-lock type plastic bag and tape the bag to the inside lid of the cooler or shipping container.

4.3.10 Close the top or lid of the cooler or shipping container.

4.3.11 Place the chain of custody tape at two different locations (i.e., one tape on each side) on the cooler or container lid and overlap with transparent packaging tape.

4.3.12 Packaging tape should be placed entirely around the sample shipment containers. A minimum of two full wraps of packaging tape will be placed at least two places on the cooler.

4.3.13 Repeat the above steps for each cooler or shipping container.

4.4 Sample Shipping Method

Packaged sample coolers should be shipped using one of the following options:

4.4.1 Hand Delivery

When a project member is transporting samples by automobile to the laboratory, the cooler should only be sealed with tape. In these cases, chain-of-custody will be maintained by the person transporting the sample and chain-of-custody tape need not be used. Chain-of-custody records should be relinquished upon delivery and a copy of the record retained in the project file.

4.4.2 Laboratory Courier

Laboratory couriers are usually employees of the analytical laboratory receiving the samples. As such, they will accept custody of the samples and must be asked to sign the chain-of-custody records. Chain-of-custody records do not need to be sealed in the cooler although it is recommended that the coolers be sealed with tape. All other packaging requirements generally apply unless otherwise specified in the QAPP.

If the laboratory courier is not authorized to accept custody of the samples, or if the requirements of the project plan preclude transfer to the laboratory courier, samples will be handled as described below in Section 4.4.3.

4.4.3 Third Party Courier

If overnight shipment is required, a third party package delivery service should be used. Transport the cooler to the package delivery service office or arrange for package pick-up at the site. Fill out the appropriate shipping form or airbill and affix it to the cooler. Some courier services may use multi-package shipping forms where only one form needs to be filled out for all packages going to the same destination. If not, a separate shipping form should be used for each cooler. Keep the receipt for package tracking purposes should a package become lost. Please note that each cooler also requires a shipping label which indicates point of origin and destination. This will aid in recovery of a lost cooler if a shipping form gets misplaced. Never leave coolers unattended while waiting for package pick-up. Airbills or waybills will be maintained as part of the custody documentation.

4.5 Sample Receipt

Upon receipt of the samples, the analytical laboratory will open the cooler or shipping container and will sign "received by laboratory" on each chain-of-custody form. The laboratory will verify that the chain-of-custody tape has not been broken previously and that the tape number corresponds with the number on the chain-of-custody record. The laboratory will note the condition of the samples upon receipt and will identify any discrepancies between the contents of the cooler and chain-of-custody. The analytical laboratory will then forward the back copy of the chain-of-custody record to the project manager to indicate that sample transmittal is complete.

5.0 QUALITY CONTROL

The potential for samples to break during transport increases greatly if individual containers are not snugly packed into the cooler. Completed coolers may be lightly shake-tested to check for any loose bottles. The cooler should be repacked if loose bottles are detected.

Environmental samples are generally shipped so that the samples are maintained at a temperature of approximately 4°C. Temperature blanks may be required for some projects as a quality assurance check on shipping temperature conditions. These blanks usually are supplied by the laboratory and consist of a 40-ml vial or plastic bottle filled with tap water. Temperature blanks should be placed near the center of the cooler.

6.0 DOCUMENTATION

Documentation supporting sample packaging and shipment generally consists of chain-of-custody records and shipping records. In addition, a description of sample packaging procedures will be written in the field project notebook. All documentation will be retained in the project files following project completion.

7.0 TRAINING/QUALIFICATIONS

Sample packaging and shipment is a relatively simple procedure requiring minimal training and a minimal amount of equipment. It is, however, recommended that initial attempts be supervised by more experienced personnel. Sampling technicians should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous waste materials are considered to be present.

Figure 1. Chain of Custody Form

M901376

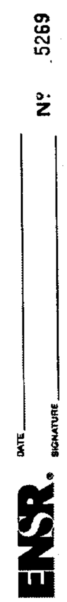
ENSR CHAIN OF CUSTODY RECORD Page ____ of ____

Client/Project Name:	Project Location:	Analysis Requested
Project Number:	Field Logbook No.:	
Sampler: (Print Name) /Affiliation: Signature:	Chain of Custody Tape No.: Send Results/Report to:	

Field Sample No./ Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered							Lab I.D.	Remarks

Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	Analytical Laboratory (Destination): ENSR 4303 W. LaPorte Ave. Fort Collins, CO 80521 (970) 416-0916
Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	
Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	Serial No.

Figure 2. Chain of Custody Tape



ENSR SOP Number 7315, Operation/Calibration of a Photoionization Detector (PID)

SOP NUMBER: 7315

Operation/Calibration of a Photoionization Detector (PID)

Date: 3rd Qtr. 2002
Revision Number: 2
Author: Debra McGrath
Discipline: Quality Assurance

1.0 INTRODUCTION

1.1 Purpose and Applicability

This document describes the procedures that will be followed by field staff for operation and calibration of a photoionization detector (PID). The PID is primarily used by ENSR personnel for safety and survey monitoring of ambient air, determining the presence of volatiles in soil and water, and detecting leakage of volatiles.

PIDs routinely used by ENSR personnel include the Photovac Microtip, Thermoelectron 580EZ, and MiniRAE 2000. Personnel responsible for using the PID should first read and thoroughly familiarize themselves with the instrument instruction manual.

1.2 Principle of Operation

The PID is a non-specific vapor/gas detector. The unit generally consists of a hand-held probe that houses a PID, consisting of an ultraviolet (UV) lamp, two electrodes, and a small fan which pulls ambient air into the probe inlet tube. The probe is connected to a readout/control box that consists of electronic control circuits, a readout display, and the system battery. Units are available with UV lamps having an energy from 9.5 electron volts (eV) to 11.7 eV.

The PID analyzer measures the concentration of trace gas present in the atmosphere by photoionization. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and become a positive ion. This will occur when the ionization potential of the molecule (in electron volts (eV)) is less than the energy of the photon. The source of photons is an ultraviolet lamp in the probe unit. Lamps are available with energies ranging from 9.5 eV to 11.7 eV. All organic and inorganic vapor/gas compounds having ionization potentials lower than the energy output of the UV lamp are ionized and the resulting potentiometric change is seen as a positive reading on the unit. The reading is proportional to the concentration of organics and/or inorganics in the vapor.

Sample gases enter the probe through the inlet tube and enter the ion chamber where they are exposed to the photons emanating from the UV lamp. Ionization occurs for those molecules having ionization potentials near to or less than that of the lamp. A positivebiased polarizing electrode causes these positive ions to travel to a collector electrode in the chamber. Thus the ions create an electrical current which is amplified and displayed on the meter. This current is proportional to the concentration of trace gas present in the ion chamber and to the sensitivity of that gas to photoionization.

In service, the analyzer is first calibrated with a gas of known composition equal to, close to, or representative of that to be measured. Gases with ionization potentials near to or less than the energy of the lamp will be ionized. These gases will thus be detected and measured by the analyzer. Gases with ionization potentials greater than the energy of the lamp will not be detected. The ionization potentials of the major components of air, i.e., oxygen, nitrogen, and carbon dioxide, range from about 12.0 eV to 15.6 eV and are not ionized by any of the lamps available. Gases with ionization potentials near to or slightly higher than the lamp are partially ionized, with low sensitivity.

1.3 Specifications

Refer to the manufacturer's instructions for the technical specifications of the instrument being used. The operating concentration range is typically 0.1 to 2,000 ppm isobutylene equivalent.

1.4 Quality Assurance Planning Considerations

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. These quality assurance requirements will be defined in the site-specific workplan or Quality Assurance Project Plan (QAPP), hereafter referred to as the project plan.

1.5 Health and Safety Considerations

The health and safety considerations for the site, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (HASP). In the absence of a site-specific HASP, work will be conducted according to the ENSR Health and Safety Policy and Procedures Manual and/or direction from the Regional Health and Safety Manager.

Only PIDs stamped Division I Class I may be used in explosive atmospheres. Refer to the project HASP for instructions pertaining to instrument use in explosive atmospheres.

2.0 RESPONSIBILITIES

2.1 The project manager is responsible for ensuring that project-specific requirements are communicated to the project team and for providing the materials, resources, and guidance necessary to perform the measurements in accordance with this SOP and the project plan.

2.2 The field operator is responsible for verifying that the PID is in proper operating condition prior to use and for implementing the calibration and measurement procedures in accordance with this SOP and the project plan.

3.0 REQUIRED MATERIALS

- Calibration Gas: Compressed gas cylinder of isobutylene in air or similar stable gas mixture of known concentration. The selected gas should have an ionization potential similar to that of the vapors to be monitored, if known. The concentration should be at 50-75% of the range in which the instrument is to be calibrated.
- Regulator for calibration gas cylinder
- Approximately 6 inches of Teflon® tubing
- Tedlar bag (optional)
- Commercially-supplied zero grade air (optional)
- "Magic Marker" or "Sharpie" or other waterproof marker
- Battery charger
- Moisture traps
- Spare lamps
- Manufacturer's instructions
- Field data sheets or logbook

4.0 METHOD

4.1 Preliminary Steps

4.1.1 Preliminary steps (battery charging, check-out, calibration, maintenance) should be conducted in a controlled or non-hazardous environment.

4.2 Calibration

4.2.1 The PID must be calibrated in order to display concentrations in units equivalent to ppm. First a supply of zero air (ambient air or from a supplied source), containing no ionizable gases or vapors is used to set the zero point. A span gas, containing a known concentration of a photoionizable gas or vapor, is then used to set the sensitivity.

4.2.2 Calibrate the instrument according to the manufacturer's instructions. Record the instrument model and identification number, the initial and adjusted meter readings, the calibration gas composition and concentration, and the date and the time in the field records.

4.2.3 If the calibration cannot be achieved or if the span setting resulting from calibration is 0.0, then the lamp must be cleaned (Section 4.4).

4.3 Operation

4.3.1 Turn on the unit and allow it to warm up (minimum of 5 minutes). Check to see if the intake fan is functioning; if so, the probe will vibrate slightly and a distinct sound will be audible when holding the probe casing next to the ear. Also, verify on the readout display that the UV lamp is lit.

4.3.2 Calibrate the instrument as described in Section 4.2, following the manufacturer's instructions. Record the calibration information in the field records.

4.3.3 The instrument is now operational. Readings should be recorded in the field records.

4.3.4 When the PID is not being used or between monitoring intervals, the unit may be switched off to conserve battery power and UV lamp life; however, a "bump" test should be performed each time the unit is turned on and prior to taking additional measurements. To perform a bump test, connect the outlet tubing from a Tedlar bag containing a small amount of span gas to the inlet tubing on the unit and record the reading. If the reading is not within the tolerance specified in the project plan, the unit must be recalibrated.

4.3.5 At the end of each day, recheck the calibration. The check will follow the same procedures as the initial calibration (Section 4.2) except that no adjustment will be made to the instrument. Record the information in the field records.

4.3.6 Recharge the battery after each use (Section 4.4).

4.3.7 When transporting, ensure that the instrument is packed in its stored condition in order to prevent damage.

4.4 Routine Maintenance

4.4.1 Routine maintenance associated with the use of the PID includes charging the battery, cleaning the lamp window, replacing the detector UV lamp, replacing the inlet filter, and replacing the sample pump. Refer to the manufacturer's instructions for procedures and frequency.

4.4.2 All routine maintenance should be performed in a non-hazardous environment.

4.5 Troubleshooting Tips

4.5.1 One convenient method for periodically confirming instrument response is to hold the sensor probe next to the tip of a magic marker. A significant reading should readily be observed.

4.5.2 Air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings.

4.5.3 A fogged or dirty lamp, due to operation in a humid or dusty environment, may cause erratic or fluctuating readings. The PID should never be operated without the moisture trap in place.

4.5.4 Moving the instrument from a cool or air-conditioned area to a warmer area may cause moisture to condense on the UV lamp and produce unstable readings.

4.5.5 A zero reading on the meter should not necessarily be interpreted as an absence of air contaminants. The detection capabilities of the PID are limited to those compounds that will be ionized by the particular probe used.

4.5.6 Many volatile compounds have a low odor threshold. A lack of meter response in the presence of odors does not necessarily indicate instrument failure.

4.5.7 When high vapor concentrations enter the ionization chamber in the PID the unit can become saturated or "flooded". Remove the unit to a fresh air environment to allow the vapors to be completely ionized and purged from the unit.

5.0 QUALITY CONTROL

Calibration of the PID will be conducted at the frequency specified in the project plan. In the absence of project-specific guidance, calibration will be performed at the beginning of each day of sampling and will be checked at the end of the sampling day or whenever instrument operation is suspect. The PID will sample a calibration gas of known concentration. The instrument must agree with the calibration gas within ±10%. If the instrument responds outside this tolerance, it must be recalibrated.

Checks of the instrument response (Section 4.5.1) should be conducted periodically and documented in the field records.

6.0 DOCUMENTATION

Safety and survey monitoring with the PID will be documented in a bound field logbook, or on standardized forms, and retained in the project files. The following information is to be recorded:

- Project name and number.
- Instrument manufacturer, model, and identification number.
- Operator's signature.
- Date and time of operation.
- Calibration gas used.
- Calibration check at beginning and end of day (meter readings before adjustment).
- Span setting after calibration adjustment.
- Meter readings (monitoring data obtained).
- Instances of erratic or questionable meter readings and corrective actions taken.
- Instrument checks and response verifications – e.g., battery check, magic marker response (Section 4.5.1) or similar test.

7.0 REFERENCES

United States Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM). USEPA, Region 4, SESD, Enforcement and Investigations Branch, Athens, GA. November 2001.

ENSR SOP Number 7220, Monitoring Well Construction and Installation

SOP NUMBER: 7220

Monitoring Well Construction and Installation

Date: 3rd Qtr., 1995

Revision Number: 4

Author: Charles Martin

Discipline: Geosciences

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This SOP provides guidance for installing groundwater monitoring wells. Monitoring wells are installed to monitor the depth to groundwater, to measure aquifer properties, and to obtain samples of groundwater for chemical analysis.

This SOP is applicable to installation of single monitoring wells within a borehole. The construction and installation of nested, multilevel or other special well designs is not covered within this SOP as these type of wells are not frequently constructed. This SOP applies to both overburden and bedrock monitoring wells.

Some states and EPA Regions have promulgated comprehensive guidelines for monitoring well construction and for subsurface investigation procedures. Deviations from this SOP to accommodate other regulatory requirements should be reviewed in advance of the field program, should be explained in the project work plan, and must be documented in the field project notebook when they occur.

1.2 General Principles

Monitoring well construction and installation generally involves drilling a borehole using conventional drilling equipment, installing commercially available well construction and filter/sealing materials, and development of the well prior to sampling. This SOP covers well construction and installation methods only. Borehole drilling and well development methods are covered under SOP-7115 (Subsurface Soil Sampling) and SOP-7221 (Monitoring Well Development), respectively.

1.3 Quality Assurance Planning Considerations

Field personnel should follow specific quality assurance guidelines as outlined in the site-specific QAPP.

The following aspects of monitoring well design and installation procedures depend on project-specific objectives which should be addressed in the QAPP and in the project work plan:

- Borehole drilling method and diameter,
- Type of construction materials for well screen, riser, filter pack and seals,
- Diameter of well materials,
- Length of well screen,
- Location, thickness, and composition of annular seals, and
- Well completion and surface protection requirements.

1.4 Health and Safety Considerations

Monitoring well installation may involve chemical hazards associated with materials in the soil or groundwater being investigated; and always involves physical hazards associated with drilling equipment and well construction methods. When wells are to be installed in locations where the aquifer and/or overlying materials may contain chemical hazards, a Health and Safety Plan (HASP) must be prepared and approved by the Health and Safety Officer before field work commences. This plan must be distributed to all field personnel and must be adhered to as field activities are performed.

2.0 RESPONSIBILITIES

2.1 Drilling Subcontractor

It is the responsibility of the drilling subcontractor to provide the necessary equipment for well construction and installation. Well construction materials should be consistent with project requirements.

2.2 Surveying Subcontractor

It is the responsibility of the surveying subcontractor to provide one or more of the following well measurements as specified in the project work plan: ground surface elevation, horizontal well coordinates, top of well casing elevation (i.e., top-of-casing, or measuring point elevation), and/or top of protective casing elevation.

2.3 Project Geologist/Engineer

It is the responsibility of the Project Geologist/Engineer to directly oversee the construction and installation of the monitoring well by the drilling subcontractor to ensure that the well-installation specifications defined in the project work plan are adhered to, and that all pertinent data are recorded on the appropriate forms.

2.4 Project Manager

It is the responsibility of the Project Manager to ensure that each project involving monitoring well installation is properly planned and executed.

3.0 REQUIRED MATERIAL

3.1 Well Construction Materials

Well construction materials are usually provided by the drilling subcontractor and most often consist of commercially available flush-threaded well screen and riser pipe constructed of PVC or stainless steel with a minimum 2-inch inside diameter. The length of the screen and the size of the screen slots should be specified in the project work plan.

3.2 Well Completion Materials

Well completion materials include silica sand, bentonite, cement, protective casings and locks. Completion materials are generally provided by the drilling subcontractor.

3.3 Other required materials include the following:

- Potable water supply
- Fiberglass or steel measuring tape
- Water level indicator
- Well construction diagrams (Figure 1)
- Waterproof marker or paint (to label wells)
- Health and Safety supplies

- Equipment decontamination materials
- Field project notebook/pen

4.0 METHOD

4.1 General Preparation

4.1.1 Borehole Preparation

Standard drilling methods should be used to achieve the desired drilling/well installation depths specified in the project work plan. Soil sampling, if conducted, should be conducted in accordance with ENSR SOP-7115 (Subsurface Soil Sampling).

The diameter of the borehole must be a minimum of 2 inches greater than the outside diameter of the well screen or riser pipe used to construct the well. This is necessary so that sufficient annular space is available to install filter packs, bentonite seals, and grout seals. Bedrock wells may require reaming after coring in order to provide a large enough borehole diameter for well installation.

Rotary drilling methods requiring bentonite-based drilling fluids, if selected, should be used with caution to drill boreholes that will be used for monitoring well installation. The bentonite mud builds up on the borehole walls as a filter cake and permeates the adjacent formation, potentially reducing the permeability of the material adjacent to the well screen.

If water or other drilling fluids have been introduced into the boring during drilling or well installation, samples of these fluids should be obtained and analyzed for chemical constituents that may be of interest at the site. In addition, an attempt should be made to recover the quantity of fluid or water that was introduced, either by flushing the borehole prior to well installation and/or by overpumping the well during development.

4.1.2 Well Material Decontamination

Although new well materials (well screen and riser pipe) generally arrive at the site boxed and sealed within plastic bags, it is sometimes necessary to decontaminate the materials prior to their use. Well materials should be inspected by the project geologist/engineer upon delivery to check cleanliness. If the well materials appear dirty, or if local or regional regulatory guidance requires decontamination, then well material decontamination should be performed by the drilling subcontractor in accordance with ENSR SOP-7600 (Decontamination of Equipment).

4.2 Well Construction Procedure

4.2.1 Depth Measurement

Once the target drilling depth has been reached, the drilling subcontractor will measure the total open depth of the borehole with a weighted, calibrated tape measure. Adjustments of borehole depth can be made at this time by drilling further or installing a small amount of sand filter material to achieve the desired depth. If drilling fluids were used during the drilling process, the borehole should be flushed at this time using potable water. The water table depth may also be checked with a water level indicator if this measurement cannot be obtained with the calibrated tape.

4.2.2 Centralizers

In order to install a well which is centered within the borehole, it is recommended that centralizers be used. Centralizers are especially helpful for deep well installations where it may be difficult to position the well by hand. Centralizers may not be necessary on shallow water table well installations where the well completion depth is within 25 feet of the ground surface.

4.2.3 Well Construction

The well screen and riser pipe generally are assembled by hand as they are lowered into the borehole. Before the well screen is inserted into the borehole, the full length of the slotted portion of the well screen as well as the unslotted portion of the bottom of the screen should be measured with the measuring tape. These measurements should be recorded on the well construction diagram.

After the above measurement has been taken, the drilling subcontractor may begin assembling the well. As the assembled well is lowered, care should be taken to ensure that it is centered in the hole if centralizers are not used. The well should be temporarily capped before filter sand and other annular materials are installed.

4.2.4 Filter Sand Installation

The drilling subcontractor should fill the annular space surrounding the screened section of the monitoring well to at least 1 foot above the top of the screen with an appropriately graded, clean sand or fine gravel. In general, the filter pack should not extend more than 3 feet above the top of the screen to limit the thickness of the monitoring zone. If coarse filter materials are used, an additional 1-foot thick layer of fine sand should be placed immediately above the filter pack to prevent the infiltration of sealing components (bentonite or grout) into the filter pack. As the filter pack is placed, a weighted tape should be lowered in the annular space to verify the depth to the top of the layer. Depending upon depth, some time may be required for these materials to settle. If necessary, to eliminate possible bridging or creation of voids, placement of the sand pack may require the use of a tremie pipe. Tremie pipe sandpack installations are generally suggested for deep water table wells and for wells which are screened some distance beneath the water table.

4.2.5 Bentonite Seal Installation

A minimum 2-foot thick layer of bentonite pellets or slurry seal will be installed by the drilling subcontractor immediately above the well screen filter pack in all monitoring wells. The purpose of the seal is to provide a barrier to vertical flow of water in the annular space between the borehole and the well casing. Bentonite is used because it swells significantly upon contact with water. Pellets generally can be installed in shallow boreholes by pouring them very slowly from the surface. If they are poured too quickly, they may bridge at some shallow, undesired depth. As an option, powdered bentonite may be mixed with water into a very thick slurry and a tremie pipe used to inject the seal to the desired depth.

4.2.6 Annular Grout Seal Installation

This grout seal should consist of a bentonite/cement mix with a ratio of bentonite to cement of between 1:5 and 1:20. The grout ratio should be chosen based on site conditions with a higher percentage of bentonite generally used for formations with higher porosity. A mud balance should be used if a specific mud density is required at a particular site. Grout slurry should be pumped into the annular space using a side-discharging tremie pipe located about 2 feet above the sand pack. Side discharge will help preserve the integrity of the sand pack.

In situations where the monitoring well screen straddles the water table, the seal will be in the unsaturated zone and pure bentonites (pellets or powder) will not work effectively as seals without hydration. Dry bentonite may be used if sufficient time to hydrate the seal is allowed. Seal hydration requires the periodic addition of clean water. Optionally, seals in this situation may be a cement/bentonite mixture containing up to 10 percent bentonite by weight. This type of mixture shall be tremied to the desired depth in the borehole.

The borehole annulus will be grouted with seal materials to within 3 feet of the ground surface. Drill cuttings, even those known not to be contaminated, will not be used as backfill material.

4.2.7 Well Completion

The drilling subcontractor will cut the top of the well to the desired height and install a vented (if possible), locking cap. The upper portion of the well casing can optionally be drilled to allow venting. Well casings are usually cut to be a certain height above ground surface (typically 2.5 to 3 feet) or are cut to be flush with the ground surface.

4.2.8 Protective Casing/Concrete Pad Installation

The drilling subcontractor will install a steel guard pipe on the well as a protective casing. The borehole around the guard pipe will be dug out to an approximate 2 to 3-foot radius to a minimum depth of 1 foot at the center and 6 inches at the edges. After installing the protective casing, the excavation will be filled with a concrete/sand mix. The surface of the concrete pad will be sloped so that drainage occurs away from the well. Flush-mount protective casings may not require an extensive concrete pad and should be completed such that they are slightly mounded above the surrounding surface to prevent surface water from running over or ponding on top of the casing. It should be noted, however, that in areas subject to snowfall, flush-mount casings may have to be installed so that they are entirely flush with the ground surface as they may be damaged by snow plows.

Above-ground protective casings should also be vented or should have non-air tight caps. Road box installations should not be vented. Installation of additional guard pipes may be necessary around above-ground well completions in traffic areas. Protective casings should be lockable to prevent unauthorized access.

4.2.9 Well Numbering

The project geologist/engineer will number each well casing with an indelible marker or paint to identify the well. This is particularly important with nested or paired wells to distinguish between shallow and deep wells. The well should be labeled on both the outside of the protective casing and inside beneath the protective casing lid.

4.2.10 Measuring Point Identification

The project geologist/engineer will mark the measuring point from which water level measurements will be made at a specific location along the upper edge of the well casing. PVC wells can easily be notched with a pocket knife or saw. Stainless steel wells (or PVC wells) can be marked with a waterproof marker on the outside of the well casing with an arrow pointing to the measuring point location. The measuring point is the point which will require surveying during the well elevation survey task.

4.2.11 Well Measurements

Upon completion, the following well measurements should be taken by the project geologist/engineer and recorded on the well construction diagram (Figure 1):

- Depth to static water level if water level has stabilized,
- Total length of well measured from top-of-well casing,
- Height of well casing above ground surface,
- Height of protective casing above ground surface,
- Depth of bottom of protective casing below ground surface (may be estimated).

Well screen filter pack, bentonite seal and annular seal thicknesses and depths should also be recorded on the well construction diagram.

4.2.12 Disposal of Drilling Wastes

Drill cuttings and other investigation-derived wastes such as drilling mud or well development/purge water must be properly contained and disposed of. Site-specific requirements for collection and removal of these waste materials should be outlined within the project work plan. Containment of these materials should be performed by the drilling subcontractor.

4.2.13 Well Development

At some point after installation of a well and prior to use of the well for water-level measurements or collection of water quality samples, development of the well shall be undertaken in accordance with ENSR SOP-7221 (Monitoring Well Development). Well development may be performed by the drilling subcontractor if contracted to do so, or by the project geologist/engineer or other project staff.

4.2.14 Well Elevation Survey

At the completion of the well installation program, all monitoring wells are usually surveyed to provide, at a minimum, the top-of-casing measuring point elevation for water level monitoring purposes. Other surveyed points which may be required by the project work plan include: ground surface elevation, top of protective casing elevation, and well coordinate position. Well elevation surveys are usually conducted by a surveying subcontractor.

5.0 QUALITY CONTROL

Certain quality control measures should be taken to ensure proper well completion.

5.1 The borehole will be checked for total open depth, and extended by further drilling or shortened by backfilling, if necessary, before any well construction materials are placed.

5.2 Water level and non-aqueous phase liquid (NAPL) presence will be checked during well installation to ensure that the positions of well screen, sand pack, and seal, relative to water level, conform to project requirements.

5.3 The depth to the top of each layer of packing (i.e., sand, bentonite, grout, etc.) will be verified and adjusted if necessary to conform to project requirements before the next layer is placed.

5.4 If water or other drilling fluids have been introduced into the boring during drilling or well installation, samples of these fluids may be required for analysis of chemical constituents of interest at the site.

6.0 DOCUMENTATION

All well construction data will be recorded on the Monitoring Well Construction Detail form (Figure 1). All wells will be referenced onto the appropriate site map. A field notebook and/or boring log will be used as additional means of recording data. In no case will the notebook or boring log take the place of the well construction diagram.

7.0 TRAINING/QUALIFICATIONS

Well construction and installation requires a moderate degree of training and experience as numerous drilling situations may occur which will require field decisions to be made. It is recommended that inexperienced personnel be supervised for several well installations before working on their own. Experienced drillers are also of great assistance with problem resolution in the field. Field personnel should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous waste materials are considered to be present.

8.0 REFERENCES

1. Standard References for Monitoring Wells, Massachusetts Department of Environmental Protection, WSC-310-91, 1991.

APPENDIX: DEFINITIONS

Annulus: The measured width between the borehole wall and the outside of the well screen or riser pipe.

Bentonite Seal: A granular, chip, or pellet-size bentonite material that is often used to provide an annular seal above the well screen filter pack. This seal is typically installed dry followed by in-place hydration with or without the addition of water. Hydrated bentonite is sometimes used as a grout seal.

Bottom Cap/Plug: Threaded or slip-on cap placed at the bottom of the well prior to installation. Often serves as a sump for accumulation of silt which settles within the well. The measured length from the lowermost well screen slot to the bottom of the bottom cap is known as the sump or tail pipe portion of the well.

Centralizers: Stainless steel expansion clamps which, when fitted to well screens or riser pipe, expand to contact the borehole walls positioning the well centrally within the open borehole. Centralizers assist with even positioning and distribution of filter pack and sealant materials and assist with maintaining well plumbness.

Expansion Cap/Well Cap: Cap used to cover the opening at the top of the well riser pipe. Expansion caps are equipped with a rubber gasket and threaded wing nut which, when turned, provides a watertight seal. Expansion caps may also be locked, and generally are recommended for use with flush-constructed wells where road box protective casings are also used. Other well caps may include slip-on or threaded caps made of the same material as the well casing.

Filter Pack: A well-graded, clean sand or gravel placed around the well screen to act as a filter in preventing the entry of very fine soil particles into the well.

Grout Seal: A cement/bentonite mixture used to seal a borehole that has been drilled to a depth greater than the final well installation depth or to seal the remaining borehole annulus once the well has been installed. Occasionally, pure cement or pure bentonite is used as a grout seal.

Measuring Point: A selected point at the top of the well casing (riser pipe) used for obtaining periodic water-level measurements. The measuring point should consist of either a notch or indelibly marked point on the upper surface of the casing. Typically, the highest point on the casing (if not level) is used as the measuring point. The measuring point is also the point that is surveyed when well elevation data is obtained.

Protective Casing: A locking metal casing, placed around that portion of the well riser pipe that extends above the ground surface. The protective casing is generally cemented in place when the concrete pad is constructed around the well.

Riser Pipe: The section of unperforated well casing material used to connect the well screen with the ground surface. Frequently, it is made of the same material and has the same diameter as the well screen. Riser pipe is typically available pre-cleaned and pre-threaded for immediate use.

Road Box: A protective casing that is flush-mounted with the ground around a well installation. Road boxes are used in areas where the monitoring well cannot extend above the ground surface for traffic or security reasons. Road boxes usually require a special key to open.

Tremie Pipe: A small diameter pipe which fits in the open borehole annulus and is used to inject filter sands or hydrated seal materials under pressure.

Well Screen: That portion of the well casing material that is perforated in some manner so as to provide a hydraulic connection to the aquifer. Typically a well screen is purchased pre-slotted, pre-cleaned, and pre-threaded for immediate use.

Vent Hole: Small diameter hole drilled in the upper portion of the well riser pipe which provides atmospheric venting of the well. Allows for constant equilibration of the water level with changing atmospheric conditions. In flood-prone areas, or with flush-mount wells, vent holes should not be used.

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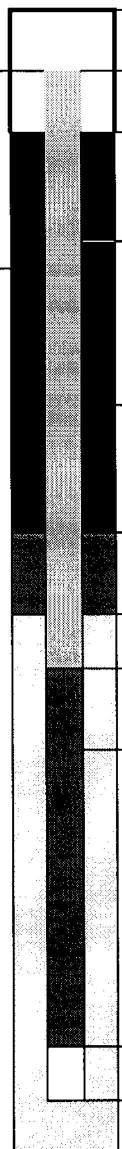
Figure 1 Monitoring Well Construction Detail

ENSR	Client:	WELL ID:
	Project Number:	
	Site Location:	Date installed:
	Well Location: Coords:	Inspector:
	Method:	Contractor:

MONITORING WELL CONSTRUCTION DETAIL



	Depth from G.S. (feet)	Elevation(feet) Datum ______
Top of Steel Guard Pipe	______	______
Top of Riser Pipe	______	______
Ground Surface (G.S.)	0.0	______
Top of Bentonite	______	______
Top of Sand	______	______
Top of Screen	______	______
▼ Stabilized Water Level	______	______
Bottom of Screen	______	______
Bottom of Tail Pipe:	______	______
Bottom of Borehole	______	______

Measuring Point for Surveying & Water Levels

Cement, Bentonite, Bentonite Slurry Grout, or Native Materials

______ % Cement

______ % Bentonite

______ % Native Materials

Riser Pipe:
- Length ______
- Inside Diameter (ID) ______
- Type of Material ______

Bottom of Steel Guard Pipe

Bentonite Seal Thickness ______

Screen:
- Length ______
- Inside Diameter (ID) ______
- Slot Size ______
- Type of Material ______

Type/Size of sand ______

Sand Pack Thickness ______

Bottom of Tail Pipe:
- Length ______

Borehole Diameter ______

Approved:

______ Signature ______ Date

Describe Measuring Point:

______

ENSR SOP Number 7221, Monitoring Well Development

SOP NUMBER: 7221

Monitoring Well Development

Date:	4th Qtr., 1994
Revision Number:	2
Author:	Charles Martin
Discipline:	Geosciences

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This SOP describes the methods used for developing newly installed monitoring wells and/or existing wells which may require redevelopment/rehabilitation. This SOP is applicable to monitoring wells and/or small diameter recovery wells and piezometers.

Monitoring well development and/or redevelopment is necessary for several reasons:

- To improve/restore hydraulic conductivity of the surrounding formations as they have likely been disturbed during the drilling process, or may have become partially plugged with silt,
- To remove drilling fluids (water, mud), when used, from the borehole and surrounding formations, and
- To remove residual fines from well filter materials and reduce turbidity of groundwater, therefore, reducing the chance of chemical alteration of groundwater samples caused by suspended sediments.

Respective state or federal agency (regional offices) regulations may require specific types of equipment for use or variations in the indicated method of well development. Deviations from this SOP to accommodate other regulatory requirements should be reviewed in advance of the field program, should be explained in the project work plan, and must be documented in the field project notebook when they occur.

1.2 General Principles

Well development generally involves withdrawal of an un-specified volume of water from a well using a pump, surge block or other suitable method such that, when completed effectively, the well is in good or restored hydraulic connection with the surrounding water bearing unit and is suitable for obtaining representative groundwater samples or for other testing purposes.

1.3 Quality Assurance Planning Considerations

Field project personnel should follow specific quality assurance guidelines as outlined in the site-specific Quality Assurance Project Plan (QAPP) and/or Sampling Plan. The plan should indicate the preferred method of well development at a particular site based on project objectives, aquifer conditions, and agency requirements. Specific well performance criteria such as low turbidity values to be achieved following well development should also be specified as well as any requirements for collection/containerization and disposal of well development water.

1.4 Health and Safety Considerations

Monitoring well development may involve chemical hazards associated with materials in the soil or aquifer being characterized and may involve physical hazards associated with use of well development equipment. When wells are to be installed and developed on hazardous waste investigation sites, a Health and Safety Plan must be prepared and approved by the Health and Safety Officer before field work commences. This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all field project personnel, and must be adhered to as field activities are performed.

2.0 RESPONSIBILITIES

2.1 Project Geologist/Engineer

Development or oversight of development of new monitoring wells is the responsibility of the project geologist/engineer involved in the original installation of the well. Records of well development methods and results will be retained in the project file.

2.2 Project Manager

The project manager is responsible for ensuring that the appropriate method of well development has been chosen which best meets project objectives, site hydrogeologic conditions, and/or relevant regulatory requirements.

3.0 REQUIRED MATERIALS

Well development can be performed using a variety of methods and equipment. The specific method chosen for development of any given well is governed by the purpose of the well, well diameter and materials, depth, accessibility, geologic conditions, static water level in the well, and type of contaminants present, if any.

The following list of equipment, each with their own particular application, may be used to develop and/or purge monitoring wells.

3.1 Bailer Purging

A bailer is used to purge silt-laden water from wells after using other devices such as a surge block. In some situations, the bailer can be used to develop a well by bailing and surging, often accompanied with pumping. A bailer should be used for purging in situations where the depth to static water is greater than 25 feet and/or where insufficient hydraulic head is available for use of other development methods.

3.2 Surge Block Development

Surge blocks are commercially available for use with Waterra™-type pumping systems or may be manufactured using a rubber or teflon "plunger" attached to a rod or pipe of sufficient length to reach the bottom of the well. Well drillers usually can provide surge blocks if requested. A recommended design is shown in Figure 1.

3.3 Pump Development

A pump is often necessary to remove large quantities of silt-laden ground water from a well after using the surge block. In some situations, the pump alone can be used to develop the well and remove the fines by overpumping. Since the purpose of well development is to remove suspended solids from a well and surrounding filter pack, the pump must be capable of moving some solids without damage. The preferred pump is a submersible pump which can be used in both shallow and deep ground water situations. A centrifugal pump may be used in shallow wells but will work only where the depth to static ground water is less than approximately 25 feet. Pumping may not be successful in low-yielding aquifer materials or in wells with insufficient hydraulic head.

3.4 Compressed Gas Development

Compressed gas, generally nitrogen from a tank or compressed air through a compressor, can be used to both surge and develop a monitoring well. The method works by injection of compressed gas at the bottom of the water column, driving sediment-laden water to the surface. Compressed gas can also be used for "jetting" - a process by which the gas is directed at the slots in the well screen to cause turbulence (thereby disturbing fine materials in the adjacent filter pack). Compressed gas is not limited by any depth range.

Since the compressed gas will be used to "lift" water from the monitoring well, provisions must be made for controlling the discharge from contaminated wells. This is generally accomplished by attaching a "tee" discharge to the top of the casing and providing drums to contain the discharged water. Gas-lifting should never be done in contaminated wells without providing a means to control discharge.

3.5 Other Required Materials:

- Well development records (Figure 2)
- Health and Safety equipment
- Equipment decontamination materials
- Water quality instrumentation: nephelometer, pH, temperature, specific conductance meters, as required
- Field project notebook/pen

4.0 METHOD

4.1 General Preparation

4.1.1 Well Records Review: Well completion diagrams should be reviewed to determine well construction characteristics. Formation characteristics should also be determined from review of available boring logs.

4.1.2 Site Preparation: Well development, similar to groundwater sampling, should be conducted in as clean an environment as possible. This usually requires, at a minimum, placing sheet plastic on the ground to provide a clean working area for development equipment.

4.1.3 IDW Containment: Provisions should be in place for collection and management of investigation-derived wastes (IDW), specifically well development water and miscellaneous expendable materials generated during the development process. The collection of IDW in drums or tanks may be required depending on project-specific requirements. The QAPP should specify the requirements for IDW containment.

4.1.4 Water Level/Well Depth Measurement: The water level and well depth should be measured with a water level indicator and written on the well development record. This information is used to calculate the volume of standing water (i.e., the well volume) within the well.

4.1.5 Equipment Decontamination: All down-well equipment should be decontaminated prior to use in accordance with ENSR SOP-7600 (Decontamination of Equipment).

4.1.6 Removal of Drilling Fluids: Drilling fluids such as mud or water, if used during the drilling and well installation process, should be removed during the well development procedure. It is recommended that a minimum of 1.5 times the volume of added fluid be removed from the well during development. Drilling muds should initially have been flushed from the drilling casing during the well installation procedure with water added during the flushing process. If the quantity of added fluid is not known or could not be reasonably estimated, removal of a minimum of 10 well volumes of water is recommended during the development procedure.

4.2 Development Procedures

4.2.1 Development Method Selection

The construction details of each well shall be used to define the most suitable method of well development. Some consideration should be given to the potential degree of contamination in each well as this will impact IDW containment requirements.

The criteria for selecting a well development method include well diameter, total well depth, static water depth, screen length, the likelihood and level of contamination, and characteristics of the geologic formation adjacent to the screened interval.

The limitations, if any, of a specific procedure are discussed within each of the following procedures.

4.2.2 General Water Quality Measurements

Measure and record water temperature, pH, specific conductance, and turbidity periodically during development using the available water quality instruments. These measurements will aid in determining whether well development is proceeding efficiently, will assist in identifying when well development is complete, will determine whether the development process is effective or not with any given well and, potentially, may identify well construction irregularities (i.e., grout in well, poor well screen slot-size selection). Water quality parameters should be checked a minimum of 3 to 5 times during the development process.

4.2.3 Bailer Procedure

- As stated previously, bailers shall preferably not be used for well development but may be used in combination with a surge block to remove silt-laden water from the well.

- When using a bailer to purge well water; select the appropriate bailer, then tie a length of bailer cord onto the end of it.

- Lower the bailer into the screened interval of the monitoring well. Silt, if present, will generally accumulate within the lower portions of the well screen.

- The bailer may be raised and lowered repeatedly in the screened interval to further simulate the action of a surge block and pull silt through the well screen.

- Remove the bailer from the well and empty it into the appropriate storage container.

- Continue surging/bailing the well until sediment-free water is obtained. If moderate to heavy siltation is still present, the surge block procedure should be repeated and followed again with bailing.

- Check water quality parameters periodically.

4.2.4 Surge Block Procedure

- A surge block effectively develops most monitoring wells. This device first forces water within the well through the well screen and out into the formation, and then pulls water back through the screen into the well along with fine soil particles. Surge blocks may be manufactured to meet the design criteria shown in the example (Figure 1) or may be purchased as an adaptor to fit commercially available well purging systems such as the Waterra system.

- Insert the surge block into the well and lower it slowly to the level of static water. Start the surge action slowly and gently above the well screen using the water column to transmit the surge action to the screened interval. A slow initial surging, using plunger strokes of approximately 3 feet, will allow material which is blocking the screen to separate and become suspended.

- After 5 to 10 plunger strokes, remove the surge block and purge the well using a pump or bailer. The returned water should be heavily laden with suspended silt and clay particles. Discharge the purged water into the appropriate storage container.

- Repeat the process. As development continues, slowly increase the depth of surging to the bottom of the well screen. For monitoring wells with long screens (greater than 10 feet) surging should be undertaken along the entire screen length in short intervals (2 to 3 feet) at a time. Continue this cycle of surging and purging until the water yielded by the well is free of visible suspended material.

- Check water quality parameters periodically.

4.2.5 Pump Procedure

- Well development using only a pump is most effective in monitoring wells that will yield water continuously. Theoretically, pumping will increase the hydraulic gradient and velocity of groundwater near the well by drawing the water level down. The increased velocity will move residual fine soil particles into the well and clear the well screen of this material. Effective development cannot be accomplished if the pump has to be shut off to allow the well to recharge.

- When using a submersible pump or surface pump, set the intake of the pump or intake line in the center of the screened interval of the monitoring well.

- Pump a minimum of three well volumes of water from the well and raise and lower the pump line through the screened interval to remove any silt/laden water.

- Continue pumping water from the well until sediment-free water is obtained. This method may be combined with the manual surge block method if well yield is not rapid enough to extract silt from the surrounding formations.

- Check water quality parameters periodically.

4.2.6 Compressed Gas Procedure

- Although the equipment used to develop a well using this method is more difficult to obtain and use, well development using compressed gas is considered to be a very effective method. This method is also not limited by well depth, well diameter, or depth to static water. Caution must be exercised, however, in highly permeable formations not to inject gas into the formation. Drilling subcontractors will often provide the necessary materials as well as perform this method , if requested. When using a compressor, an oil-less compressor should be used, or an oil trap/filter should be placed on the air discharge line which enters the well.

- Lower the gas line into the well, setting it near the bottom of the screened interval. Install the discharge control equipment (i.e., tee fitting) at the well head.

- Set the gas flow rate to allow continuous discharge of water from the well.

- At intervals during gas-lifting, especially when the discharge begins to contain less suspended material , shut off the air flow and allow the water in the well to backflush through the screened interval to disturb any bridging that may have occurred. Re-establish the gas flow when the water level in the well has returned to the pre-development level.

- Continue gas-lifting and/or jetting until the discharged water is free from suspended material.

- Check water quality parameters periodically.

5.0 QUALITY CONTROL

A well has been successfully developed when one or more of the following criteria are met:

- The sediment load in the well has been eliminated or greatly reduced. Regulatory requirements may be in place which state that water turbidity values ranging from 5 to 50 NTU must be achieved at the end of the development procedure. Use of a nephelometer is required during the well development procedure to measure water turbidity if meeting a specific turbidity value is required by the regulations. Attaining low turbidity values in fine-grained formations may be difficult to achieve.

- Permeability tests conducted in accordance with ENSR SOP-7720 (Hydraulic Conductivity Testing) yield repeatable hydraulic conductivity values.

6.0 DOCUMENTATION

The Monitoring Well Development Record (Figure 2) will be completed by the geologist or hydrogeologist conducting the development. In addition, a field project notebook should be maintained detailing any problems or unusual conditions which may have occurred during the development process.

7.0 TRAINING/QUALIFICATIONS

Well development procedures vary in complexity. It is recommended that initial development attempts be supervised by more experienced personnel. Field personnel should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous waste materials are considered to be present.

8.0 REFERENCES

Standard References for Monitoring Wells, Massachusetts Department of Environmental Protection, WSC-310-91, 1991.

APPENDIX: DEFINITIONS

Bridging: A condition within the filter pack outside the well screen whereby the smaller particles are wedged together in a manner that causes blockage of pore spaces.

Hydraulic Conductivity: a characteristic property of aquifer materials which describes the permeability of the material with respect to flow of water.

Hydraulic Connection: A properly installed and developed monitoring well should have good hydraulic connection with the aquifer. The well screen and filter material should not provide any restriction to the flow of water from the aquifer into the well.

Permeability Test: Used to determine the hydraulic conductivity of the aquifer formation near a well screen. Generally conducted by displacing the water level in a well and monitoring the rate of recovery of the water level as it returns to equilibrium. Various methods of analysis are available to calculate the hydraulic conductivity from these data.

Static Water Level: The water level in a well that represents an equilibrium or stabilized condition, usually with respect to atmospheric conditions in the case of monitoring wells.

Well Surging: That process of moving water in and out of a well screen to remove fine sand, silt and clay size particles from the adjacent formation.

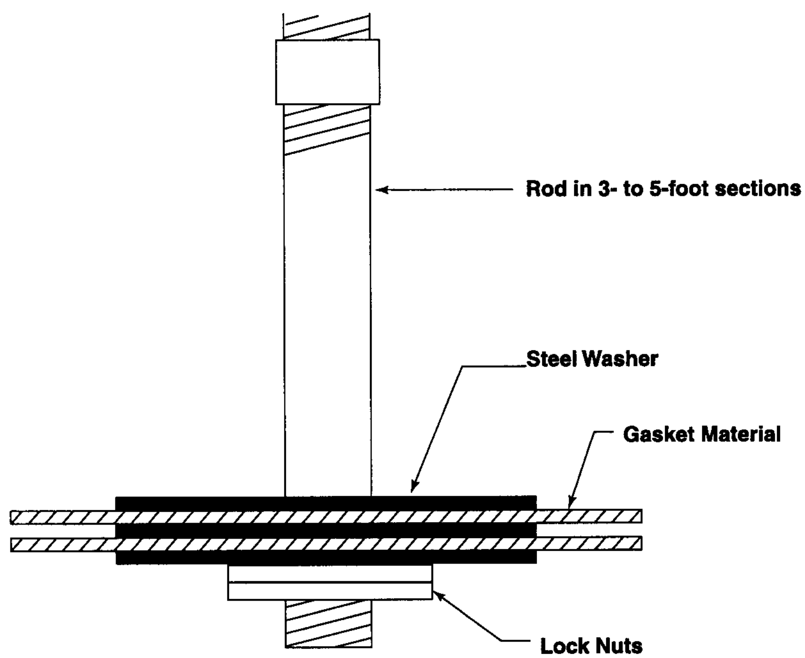
Well Purging: The process of removing standing water from a well to allow surrounding formation water to enter the well.

Well Screen: That portion of the well casing material that is perforated in some manner so as to provide a hydraulic connection to the aquifer. The perforated, or slotted, portion of a well is also known as the screened interval.

Figure 1
Recommended Surge Block Design

SURGE BLOCK DESIGN
(Not to Scale)

Steel washers should be 1/2" to 3/4" smaller in diameter than the well ID. Gasket can be rubber or leather and should be the same diameter or 1/8" smaller than the well ID to compensate for swelling of the leather/ Rod can be steel, fiberglass, or plastic but must be strong and lightweight.



ENSR

Figure 2
Well Development Record

ENSR

MONITORING WELL DEVELOPMENT RECORD

DATE: ____________ WELL I.D.: ____________

PROJECT NAME: ____________ LOCATION: ____________

PROJECT NUMBER: ____________ DEVELOPER: ____________

☐ ORIGINAL DEVELOPMENT ☐ REDEVELOPMENT ORIGINAL DEVELOPMENT DATE: ____________

WELL DATA	
Well Diameter: ____	Geology at Screened Interval:
Total Well Depth: ____	Likely Contaminants:
Depth to Top of Screen: ____	
Depth to Bottom of Screen: ____	Purge Water & Sediment Disposal Method:
Depth to Static Water Level: ____	

DEVELOPMENT METHOD	PURGE METHOD	PERMEABILITY TEST RESULTS

ACCEPTANCE CRITERIA

Signature: ____________ Date: ____________

US EPA Region I, “Low Stress Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells”, Revision 2, July 1996

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

July 30, 1996
Revision 2

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

I. SCOPE & APPLICATION

This standard operating procedure (SOP) provides a general framework for collecting ground water samples that are indicative of mobile organic and inorganic loads at ambient flow conditions (both the dissolved fraction and the fraction associated with mobile particulates). The SOP emphasizes the need to minimize stress by low water-level drawdowns, and low pumping rates (usually less than 1 liter/min) in order to collect samples with minimal alterations to water chemistry. This SOP is aimed primarily at sampling monitoring wells that can accept a submersible pump and have a screen, or open interval length of 10 feet or less (this is the most common situation). However, this procedure is flexible and can be used in a variety of well construction and ground-water yield situations. Samples thus obtained are suitable for analyses of ground water contaminants (volatile and semi-volatile organic analytes, pesticides, PCBs, metals and other inorganics), or other naturally occurring analytes.

This procedure does not address the collection of samples from wells containing light or dense non-aqueous phase liquids (LNAPLs and DNAPLs). For this the reader may wish to check: Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation; C.K. Smoley (CRC Press), Boca Raton, Florida and U.S. Environmental Protection Agency, 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance; Washington, DC (EPA/530-R-93-001).

The screen, or open interval of the monitoring well should be optimally located (both laterally and vertically) to intercept existing contaminant plume(s) or along flowpaths of potential contaminant releases. It is presumed that the analytes of interest move (or potentially move) primarily through the more permeable zones within the screen, or open interval.

Proper well construction and development cannot be overemphasized, since the use of installation techniques that are appropriate to the hydrogeologic setting often prevents "problem well" situations from occurring. It is also recommended that as part of development or redevelopment the well should be tested to determine the appropriate pumping rate to obtain stabilization of field indicator parameters with minimal drawdown in shortest amount of time. With this information field crews can then conduct purging and sampling in a more expeditious manner.

The mid-point of the saturated screen length (which should not exceed 10 feet) is used by convention as the location of the pump intake. However, significant chemical or permeability contrast(s) within the screen may require additional field work to determine the optimum vertical location(s) for the intake, and appropriate pumping rate(s) for purging and sampling more localized target zone(s). Primary flow zones (high(er) permealability and/or high(er) chemical concentrations) should be identified in wells with screen lengths longer than 10 feet, or in wells with open boreholes in bedrock. Targeting these zones for water sampling will help insure that the low stress procedure will not underestimate contaminant concentrations. The Sampling and Analysis Plan must provide clear instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met. If after 4 hours of purging indicator field parameters have not stabilized, one of 3 optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization) c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may not meet the sampling objectives).

Changes to this SOP should be proposed and discussed when the site Sampling and Analysis Plan is submitted for approval. Subsequent requests for modifications of an approved plan must include adequate technical justification for proposed changes. All changes and modifications must be approved before implementation in field.

II. EQUIPMENT

A. Extraction device

Adjustable rate, submersible pumps are preferred (for example, centrifugal or bladder pump constructed of stainless steel or

Teflon).

Adjustable rate, peristaltic pumps (suction) may be used with caution. Note that EPA guidance states: "Suction pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" (EPA/540/P-87/001, 1987, page 8.5-11).

The use of inertial pumps is discouraged. These devices frequently cause greater disturbance during purging and sampling and are less easily controlled than the pumps listed above. This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

B. Tubing

Teflon or Teflon lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for inorganics analyses. However, these materials should be used with caution when sampling for organics. If these materials are used, the equipment blank (which includes the tubing) data must show that these materials do not add contaminants to the sample.

Stainless steel tubing may be used when sampling for VOCs, SVOCs, pesticides, and PCBs. However, it should be used with caution when sampling for metals.

The use of 1/4 inch or 3/8 inch (inner diameter) tubing is preferred. This will help ensure the tubing remains liquid filled when operating at very low pumping rates.

Pharmaceutical grade (Pharmed) tubing should be used for the section around the rotor head of a peristaltic pump, to minimize gaseous diffusion.

C. Water level measuring device(s), capable of measuring to 0.01 foot accuracy (electronic "tape", pressure transducer). Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level "tape" at the start and end of each record.

D. Flow measurement supplies (e.g., graduated cylinder and stop watch).

E. Interface probe, if needed.

F. Power source (generator, nitrogen tank, etc.). If a gasoline generator is used, it must be located downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate the samples.

G. Indicator field parameter monitoring instruments - pH, Eh, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Use of a flow-through-cell is required when measuring all listed parameters, except turbidity. Standards to perform field calibration of instruments. Analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846. For Eh measurements, follow manufacturer's instructions.

H. Decontamination supplies (for example, non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.).

I. Logbook(s), and other forms (for example, well purging forms).

J. Sample Bottles.

K. Sample preservation supplies (as required by the analytical methods).

L. Sample tags or labels.

M. Well construction data, location map, field data from last sampling event.

N. Well keys.

O. Site specific Sample and Analysis Plan/Quality Assurance Project Plan.

P. PID or FID instrument (if appropriate) to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

III. PRELIMINARY SITE ACTIVITIES

Check well for security damage or evidence of tampering, record pertinent observations.

Lay out sheet of clean polyethylene for monitoring and sampling equipment.

Remove well cap and immediately measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook.

A synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin. It is recommended that water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) be measured the day before, in order to allow for re-settlement of any particulates in the water column. If measurement of total well depth is not made the day before, it should not be measured until after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe are usually not needed unless analytical data or field head space information signal a worsening situation. Note: procedures for collection of LNAPL and DNAPL samples are not addressed in this SOP.

IV. PURGING AND SAMPLING PROCEDURE

Sampling wells in order of increasing chemical concentrations (known or anticipated) is preferred.

1. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the midpoint of the zone to be sampled. The Sampling and Analysis Plan should specify the sampling depth, or provide criteria for selection of intake depth for each well (see Section I). If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well. Collection of turbid free water samples may be especially difficult if there is two feet or less of standing water in the well.

2. Measure Water Level

Before starting pump, measure water level. If recording pressure transducer is used-initialize starting condition.

3. Purge Well

3a. Initial Low Stress Sampling Event

Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.

Monitor and record water level and pumping rate every three to five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (for example, 0.1 - 0.4 l/min) to ensure stabilization of indicator parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen). The final purge volume must be greater than the stabilized drawdown volume plus the extraction tubing volume.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment. If the recharge rate of the well is lower than extraction rate capabilities of currently manufactured pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized.

3b. Subsequent Low Stress Sampling Events

After synoptic water level measurement round, check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). Perform purging operations as above.

4. Monitor Indicator Field Parameters

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, Eh, DO) every three to five minutes (or less frequently, if appropriate). Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at three (3) to five (5) minute intervals, are within the following limits:

turbidity (10% for values greater than 1 NTU), Nephlometric turbidity unit
DO (10%),
specific conductance (3%),
temperature (3%),
pH (± 0.1 unit),
ORP/Eh (± 10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell and may also cause an underestimation of turbidity values measured after the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities.

The flow-through-cell must be designed in a way that prevents air bubble entrapment in the cell. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must be submerged in water at all times. If two flow-through-cells are used in series, the one containing the dissolved oxygen probe should come first (this parameter is most susceptible to error if air leaks into the system).

5. Collect Water Samples

Water samples for laboratory analyses must be collected before water has passed through the flow-through-cell (use a by-pass assembly or disconnect cell to obtain sample).

VOC samples should be collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

During purging and sampling, the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use one of the following procedures to collect samples: (1) add clamp, connector (Teflon or stainless steel) or valve to constrict sampling end of tubing; (2) insert small diameter Teflon tubing into water filled portion of pump tubing allowing the end to protrude beyond the end of the pump tubing, collect sample from small diameter tubing; (3) collect non-VOC samples first, then increase flow rate slightly until the water completely fills the tubing, collect sample and record new drawdown, flow rate and new indicator field parameter values.

Add preservative, as required by analytical methods, to samples immediately after they are collected if the sample containers are not pre-preserved. Check analytical methods (e.g. EPA SW-846, water supply, etc.) for additional information on preservation. Check pH for all samples requiring pH adjustment to assure proper pH value. For VOC samples, this will require that a test sample be collected during purging to determine the amount of preservative that needs to be added to the sample containers prior to sampling.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter is required, and the filter size (0.45 um is commonly used) should be based on the sampling objective. Pre-rinse the filter with approximately 25 - 50 ml of ground water prior to sample collection. Preserve filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in ground water for human health risk calculations.

Label each sample as collected. Samples requiring cooling (volatile organics, cyanide, etc.) will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

6. Post Sampling Activities

If recording pressure transducer is used, remeasure water level with tape.

After collection of the samples, the pump tubing may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth is optional after the initial low stress sampling event. However, it is recommended if the well has a "silting" problem or if confirmation of well identity is needed.

Secure the well.

V. DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed between purging and sampling operations. The pump and tubing (including support cable and electrical wires which are in contact with the well) will be decontaminated by one of the procedures listed below.

Procedure 1

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then this step may be skipped.

Flush with distilled/deionized water. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

VI. FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed 20 samples). Trip blanks are required for the VOC samples at a frequency of one set per VOC sample cooler.

Field duplicate.

Matrix spike.

Matrix spike duplicate.

Equipment blank.

Trip blank (VOCs).

Temperature blank (one per sample cooler).

Equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank will only include the pump in subsequent sampling rounds.

Collect samples in order from wells with lowest contaminant concentration to highest concentration. Collect equipment blanks after sampling from contaminated wells and not after background wells.

Field duplicates are collected to determine precision of sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

If split samples are to be collected, collect split for each analyte group in consecutive order (VOC original, VOC split, etc.). Split sample should be as identical as possible to original sample.

All monitoring instrumentation shall be operated in accordance with EPA analytical methods and manufacturer's operating instructions. EPA analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846 with exception of Eh, for which the manufacturer's instructions are to be followed. Instruments shall be calibrated at the beginning of each day. If a measurement falls outside the calibration range, the instrument should be re-calibrated so that all measurements fall within the calibration range. At the end of each day, check calibration to verify that instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, need not be calibrated to the above frequency. They should be checked for accuracy prior to field use according to EPA Methods and the manufacturer's instructions.

VII. FIELD LOGBOOK

A field log shall be kept to document all ground water field monitoring activities (see attached example matrix), and record all of the following:

Well identification.

Well depth, and measurement technique.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.

Well sampling sequence and time of each sample collection.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analysis.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling equipment used, including trade names, model number, diameters, material composition, etc.

VIII. DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, and whatever field logbook information is needed to allow for a full evaluation of data useability.

Page____of____

EXAMPLE (Minimum Requirements)
Well PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)______________________________
Well Number____________________Date________________________
Field Personnel____
Sampling Organization______________________________________
Identify MP____

Depth to (below MP) ________/________ of screen
top bottom
Pump Intake at (ft. below MP)________________
Purging Device; (pump type)__________________

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. °C	Spec. Cond.[2] µS/cm	pH	ORP/ Eh[3] mv	DO mg/L	Turb- idity NTU	Comments

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25°C.
3. Oxidation reduction potential (stand in for Eh).

FACT SHEET 12/96

NEW MONITORING WELL PURGING AND SAMPLING PROCEDURE

WHY:

The new monitoring well purging and sampling procedure, EPA Region I Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells, July 30, 1996, was written to standardize the collection of ground water samples from monitoring wells, and to improve resultant data quality.

Historically, total (unfiltered) metals samples have been collected and analyzed to determine the potential human health risk associated with ground water ingestion. However, conventional ground water sampling methods often overestimated metals concentrations due to artificially elevated particulate loading. To circumvent the problem of elevated particulate loading, field filtration of water samples was often performed. In doing so, contaminant loads and, therefore, the potential human health risk, could be drastically underestimated for filtered water samples.

Recent technical literature and regional sampling experience indicate that use of this low stress purging and sampling procedure improves data quality for all inorganic and organic ground water sample results. The major benefit is that the water quality data generated using this new procedure will be more reproducible and representative of actual ground water conditions. Reasons for this include:

- Purging and sampling operations are more controlled,
- Pumping stresses are minimized,
- Objective measurement criteria are used to determine when sampling should begin, and
- Operational variability between sampling events is minimized.

WHAT:

This procedure provides a general framework for collecting ground water samples that are indicative of mobile organic and inorganic loads at ambient flow conditions (both the dissolved fraction and the fraction associated with the mobile particulates). The procedure is directed primarily at monitoring wells that can accept a submersible pump and have a screen, or open interval, of ten feet or less. This procedure, however, is flexible and can be used in a variety of well construction situations. Samples obtained utilizing this procedure are suitable for the analysis of ground water contaminants (volatile and semivolatile organics, pesticides, PCBs, metals and other inorganics) and naturally occurring analytes. This procedure is not designed to collect ground water samples from wells that contain LNAPLs or DNAPLs.

WHO:

This new procedure is intended for use by numerous stakeholders, including EPA and its contractors, States, Tribes, other Federal Agencies, PRPs, industry and the public. It serves to standardize ground water sampling procedures for programs that generate or use water quality data from monitoring wells to make environmental decisions. This procedure is especially pertinent to ground water sampling performed at Superfund and RCRA sites.

ENSR SOP Number 7600, Decontamination of Equipment

SOP NUMBER: 7600

Decontamination of Field Equipment

Date:	4th Qtr. 1994
Revision Number:	4
Author:	Charles Martin
Discipline:	Geosciences

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This SOP describes the methods to be used for the decontamination of field equipment used in the collection of environmental samples. The list of field equipment may include a variety of items used in the collection of soil and/or water samples, such as split-spoon samplers, trowels, scoops, spoons, bailers and pumps. Heavy equipment such as drill rigs and backhoes also require decontamination, usually in a specially constructed temporary decontamination area.

Decontamination is performed as a quality assurance measure and a safety precaution. Improperly decontaminated sampling equipment can lead to misinterpretation of environmental data due to interference caused by cross-contamination. Decontamination protects field personnel from potential exposure to hazardous materials. Decontamination also protects the community by preventing transportation of contaminants from a site.

This SOP emphasizes decontamination procedures to be used for decontamination of reusable field equipment. Occasionally, dedicated field equipment such as well construction materials (well screen and riser pipe) or disposable field equipment (bailers or other general sampling implements) may also require decontamination prior to use. The project-specific work plan should indicate the specific decontamination requirements for a particular project.

Respective state or federal agency (regional offices) regulations may require specific types of equipment or procedures for use in decontamination of field equipment. The project manager should review the applicable regulatory requirements, if any, prior to the start of the field investigation program.

1.2 General Principles

Decontamination is accomplished by manually scrubbing, washing, or spraying equipment with detergent solutions, tap water, distilled/deionized water, steam and/or high pressure water, or solvents. The decontamination method and agents are generally determined on a project-specific basis and must be stated in the Quality Assurance Project Plan (QAPP).

Generally, decontamination of equipment is accomplished at each sampling site between collection points. Waste decontamination materials such as spent liquids and solids will be collected and managed as investigation-derived waste for later disposal. All decontamination materials, including wastes, should be stored in a central location so as to maintain control over the quantity of materials used or produced throughout the investigation program.

1.3 Quality Assurance Planning Considerations

1.3.1 General Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific QAPP. The QAPP guidelines typically require collection of equipment blank samples in order to determine the effectiveness of the decontamination procedure.

The decontamination method, solvent, frequency, location on site and the method of containment and disposal of decontamination wash solids and solutions are dependent on site logistics, site-specific chemistry, and nature of the contaminated media to be studied and the objectives of the study. Each topic must be considered and addressed during development of a decontamination strategy and should be outlined in the Quality Assurance Project Plan (QAPP).

1.3.2 Solvent Selection

There are several factors which need to be considered when deciding upon a decontamination solvent. The solvent should not be an analyte of interest. The sampling equipment must be resistant to the solvent. The solvent must be evaporative or water soluble or preferably both. The applicable regulatory agency may have specific requirements regarding decontamination solvents. The QAPP should specify the type of solvent to be used for a particular project.

The analytical objectives of the study must also be considered when deciding upon a decontamination solvent. Pesticide-grade methanol is the solvent of choice for general organic analyses. It is relatively safe and effective. Hexane, acetone, and isopropanol are sometimes used as well. A 10% nitric acid in deionized water solution is the solvent of choice for general metals analyses. Nitric acid can be used only on Teflon, plastics and glass. If used on metal equipment, nitric acid will eventually corrode the metal and lead to the introduction of metals to the collected samples. Dilute hydrochloric acid is usually preferred over nitric acid when cleaning metal sampling equipment.

Equipment decontamination should be performed a safe distance away from the sampling area so as not to interfere with sampling activities but close enough to the sampling area to maintain an efficient working environment. If heavy equipment such as drill rigs or backhoes are to be decontaminated, then a central decontamination station should be constructed with access to a power source and water supply.

1.4 Health and Safety Considerations

Decontamination procedures may involve chemical exposure hazards associated with the type of contaminants encountered or solvents employed and may involve physical hazards associated with decontamination equipment. When decontamination is performed on equipment which has been in contact with hazardous materials or when the quality assurance objectives of the project require decontamination with chemical solvents, the measures necessary to protect personnel must be addressed in the project Health and Safety Plan (HASP). This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing equipment decontamination, and must be adhered to as field activities are performed.

2.0 RESPONSIBILITIES

2.1 Sampling Technician

It is the responsibility of the sampling technician to be familiar with the decontamination procedures outlined within this SOP and with specific quality assurance, and health and safety requirements outlined within project-specific work plans (HASP, QAPP). The sampling technician is responsible for decontamination of field equipment and for proper documentation of decontamination activities. The sampling technician is also responsible for ensuring that decontamination procedures are followed by subcontractors when heavy equipment requires decontamination.

2.2 Field Project Manager

The field project manager is responsible for ensuring that the required decontamination procedures are followed at all times. The project manager is also responsible for ensuring that subcontractors construct and operate their decontamination facilities according to project specifications. The project manager is responsible for collection and control of IDW in accordance with project specifications.

3.0 REQUIRED MATERIALS

- Decontamination agents (per work plan requirements):
  - LIQUI-NOX, ALCONOX, or other phosphate-free biodegradable detergent,
  - Tap water,
  - Distilled/deionized water,
  - Nitric acid and/or hydrochloric acid,
  - Methanol and/or hexane, acetone, isopropanol.
- Health and Safety equipment
- Chemical-free paper towels
- Waste storage containers: drums, 5-gallon pails w/covers, plastic bags
- Cleaning containers: plastic buckets or tubs, galvanized steel pans, pump cleaning cylinder
- Cleaning brushes
- Pressure sprayers
- Squeeze bottles
- Plastic sheeting
- Aluminum foil
- Field project notebook/pen

4.0 METHODS

4.1 General Preparation

4.1.1 It should be assumed that all sampling equipment, even new items, are contaminated until the proper decontamination procedures have been performed on them or unless a certificate of analysis is available which demonstrates the items cleanliness.

Field equipment that is not frequently used should be wrapped in aluminum foil, shiny side out, and stored in a designated "clean" area. Small field equipment can also be stored in plastic bags to eliminate the potential for contamination. Field equipment should be inspected and decontaminated prior to use if the equipment appears contaminated and/or has been stored for long periods of time. Unless customized procedures are stated in the QAPP for decontamination of equipment, the standard procedures specified in this SOP shall be followed.

4.1.2 Establish the decontamination station within an area that is convenient to the sampling location. If single samples will be collected from multiple locations, then a centralized decontamination station, or a portable decontamination station should be established.

4.1.3 An investigation-derived waste (IDW) containment station should be established at this time also. The project-specific work plan should specify the requirements for IDW containment. In general, decontamination solutions are discarded as IDW between sampling locations. Solid waste is disposed of as it is generated.

4.2 Decontamination for Organic Analyses

4.2.1 This procedure applies to soil sampling and groundwater sampling equipment used in the collection of environmental samples submitted for organic constituents analysis. Examples of relevant items of equipment include split-spoons, trowels, scoops/spoons, bailers, and other small items. Submersible pump decontamination procedures are outlined in Section 4.4.

4.2.2 Decontamination is to be performed before sampling events and between sampling points.

4.2.3 After a sample has been collected, remove all gross contamination from the equipment or material by brushing and then rinsing with available tap water.

This initial step may be completed using a 5-gallon pail filled with tap water. Steam or a high-pressure water rinse may also be conducted to remove solids and/or other contamination.

4.2.4 Wash the equipment with a phosphate-free detergent and tap water solution. This solution should be kept in a 5-gallon pail with its own brush.

4.2.5 Rinse with tap water or distilled/deionized water until all detergent and other residue is washed away. This step can be performed over an empty bucket using a squeeze bottle or pressure sprayer.

4.2.6 Rinse with methanol or other appropriate solvent using a squeeze bottle or pressure sprayer. Rinsate should be collected in a waste bucket.

4.2.7 Rerinse with deionized water to remove any residual solvent. Rinsate should be collected in the solvent waste bucket.

4.2.8 Allow the equipment to air-dry in a clean area or blot with chemical-free paper towels before reuse. Wrap the equipment in tin foil and/or seal it in a plastic bag if it will not be reused for a while.

4.2.9 Dispose of soiled materials and spent solutions in the designated IDW disposal containers.

4.3 Decontamination for Inorganic (Metals) Analyses

4.3.1 This procedure applies to soil sampling equipment used primarily in the collection of environmental samples submitted for inorganic constituents analysis. Examples of relevant items of equipment include split-spoons, trowels, scoops/spoons, bailers, and other small items.

4.3.2 For plastic and glass sampling equipment, follow the steps outlined in 4.2 above, however, use a 10% nitric acid solution (acid in water) in place of the solvent rinse in Section 4.2.6.

4.3.3 For metal sampling equipment, follow the steps outlined in 4.2 above, however, use a 10% hydrochloric acid solution (acid in water) in place of the solvent rinse in Section 4.2.6.

4.4 Decontamination of Submersible Pumps

4.4.1 This procedure will be used to decontaminate submersible pumps before and between ground-water sample collection points. This procedure applies to both electric submersible and bladder pumps. This procedure also applies to discharge tubing if it will be reused between sampling points.

4.4.2 Prepare the decontamination area if pump decontamination will be conducted next to the sampling point. If decontamination will occur at another location, the pump and tubing may be removed from the well and placed into a clean trash bag for transport to the decontamination area. Pump decontamination is easier with the use of 3-foot tall pump cleaning cylinders (i.e., Nalgene cylinder) for the various cleaning solutions, although the standard bucket rinse equipment may be used.

4.4.3 Once the decontamination station is established, the pump should be removed from the well and the discharge tubing and power cord coiled by hand as the equipment is removed. If any of the equipment needs to be put down temporarily, place it on a plastic sheet (around well) or in a clean trash bag. If a disposable discharge line is used it should be removed and discarded at this time.

4.4.4 As a first step in the decontamination procedure, use a pressure sprayer with tap water to rinse the exterior of the pump, discharge line, and power cord as necessary. Collect the rinsate and handle as IDW.

4.4.5 Place the pump into a pump cleaning cylinder or bucket containing a detergent solution (detergent in tap water). Holding the tubing/power cord, pump solution through the pump system. A minimum of one gallon of detergent solution should be pumped through the system. Collect the rinsate and handle as IDW.

4.4.6 Place the pump into another cylinder/bucket containing a 10% solution of solvent (methanol, or other designated solvent) in distilled/deionized water. Pump until the detergent solution is removed. Collect the rinsate and handle as IDW.

4.4.7 Place the pump into another cylinder/bucket containing distilled/deionized water. Pump a minimum of 3 to 5 pump system volumes (pump and tubing) of water through the system. Collect the rinsate and handle as IDW.

4.4.8 Remove the pump from the cylinder/bucket and if the pump is reversible, place the pump in the reverse mode to discharge all removable water from the system. If the pump is not reversible the pump and discharge line should be drained by hand as much as possible. Collect the rinsate and handle as IDW.

4.4.9 Using a pressure sprayer with distilled/deionized water, rinse the exterior of the pump, discharge line, and power cord thoroughly, shake all excess water, then place the pump system into a clean trash bag for storage. If the pump system will not be used again right away, the pump itself should also be wrapped with aluminum foil before placing it into the bag.

4.5 Decontamination of Large Equipment

4.5.1 Consult the QAPP for instruction on the location of the decontamination station and the method of containment of the wash solutions. On large projects usually a temporary decontamination facility (decontamination pad) is required which may include a membrane-lined and bermed area large enough to drive heavy equipment (drill rig, backhoe) onto with enough space to spread other equipment and to contain overspray. Usually a small sump with pump is necessary to collect and contain rinsate. A water supply and power source is also necessary to run steam cleaning and/or pressure washing equipment.

4.5.2 Upon arrival and prior to leaving a sampling site, all heavy equipment such as drill rigs, trucks, and backhoes should be thoroughly cleaned and then the parts of the equipment which come in contact or in close proximity to sampling activity should be decontaminated. This can be accomplished in two ways, steam cleaning or high pressure water wash and manual scrubbing. Following this initial cleaning, only those parts of the equipment which come in close proximity to the sampling activities (i.e., auger stems, rods, backhoe bucket) must be decontaminated in between sampling events.

Occasionally, well construction materials such as well screen and riser pipe may require decontamination before the well materials are used. These materials may be washed in the decontamination pad, preferably on a raised surface above the pad (i.e., on sawhorses), with clean plastic draped over the work surfaces. Well materials usually do not require a multistep cleaning process as they generally arrive clean from the manufacturer. Usually, a thorough steam-cleaning of the interior/exterior of the well materials will be sufficient. The QAPP should provide specific guidance regarding decontamination of well materials.

5.0 QUALITY CONTROL

5.1 Field Blank Sample Collection

General guidelines for quality control check of field equipment decontamination usually require the collection of one field blank from the decontaminated equipment per day. The QAPP should specify the type and frequency of collection of each type of quality assurance sample.

Field blanks are generally made by pouring laboratory-supplied deionized water into, over, or through the freshly decontaminated sampling equipment and then transferring this water into a sample container. Field blanks should then be labeled as a sample and submitted to the laboratory to be analyzed for the same parameters as the associated sample. Field blank sample numbers, as well as collection method, time and location should be recorded in the field notebook.

6.0 DOCUMENTATION

Specific information regarding decontamination procedures should be documented in the project-specific field notebook. Documentation within the notebook should thoroughly describe the construction of each decontamination facility and the decontamination steps implemented in order to show compliance with the project work plan. Decontamination events should be logged when they occur with the following information documented:

- Date, time and location of each decontamination event
- Equipment decontaminated
- Method
- Solvents
- Noteable circumstances
- Identification of field blanks and decontamination rinsates
- Method of blank and rinsate collection
- Date, time and location of blank and rinsate collection
- Disposition of IDW

Repetitive decontamination of small items of equipment does not need to be logged each time the item is cleaned.

7.0 TRAINING/QUALIFICATIONS

All sampling technicians performing decontamination must be properly trained in the decontamination procedures employed, the project data quality objectives, health and safety procedures and the project QA procedures. Specific training or orientation will be provided for each project to ensure that personnel understand the special circumstances and requirements of that project. Field personnel should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous materials may be present.

8.0 REFERENCES

Not applicable.

US EPA SOP Number 2042, Soil Gas Sampling **(June 1, 1996)**

SOIL GAS SAMPLING

SOP#: 2042
DATE: 06/01/96
REV. #: 0.0

1.0 SCOPE AND APPLICATION

Soil gas monitoring provides a quick means of waste site evaluation. Using this method, underground contamination can be identified, and the source, extent, and movement of the pollutants can be traced.

This standard operating procedure (SOP) outlines the methods used by U.S. EPA/ERT in installing soil gas wells; measuring organic vapor levels in the soil gas using a Photoionization Detector (PID), Flame Ionization Detector (FID) and/or other air monitoring devices; and sampling the soil gas using Tedlar bags, Tenax sorbent tubes, and/or Summa canisters.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

A 3/8" diameter hole is driven into the ground to a depth of four to five feet using a commercially available slam bar. Soil gas can also be sampled at other depths by the use of a longer bar or bar attachments. A 1/4" O.D. stainless steel probe is inserted into the hole. The hole is then sealed around the top of the probe using modeling clay. The gas contained in the interstitial spaces of the soil is sampled by pulling the sample through the probe using an air sampling pump. The sample may be stored in Tedlar bags, drawn through sorbent cartridges, or analyzed directly using a direct reading instrument. The air sampling pump is not used for Summa canister sampling of soil gas. Sampling is achieved by soil gas equilibration with the evacuated Summa canister.

Other field air monitoring devices, such as the combustible gas indicator (MSA CGI/02 Meter, Model 260) and the Organic Vapor Analyzer (Foxboro OVA, Model 128), can also be used dependent on specific site conditions. Measurement of soil temperature using a temperature probe may also be desirable. Bagged samples are usually analyzed in a field laboratory using a portable Photovac GC.

Power driven sampling probes may be utilized when soil conditions make sampling by hand unfeasible (i.e., frozen ground, very dense clays, pavement, etc.). Commercially available soil gas sampling probes (hollow, 1/2 = O.D. steel probes) can be driven to the desired depth using a power hammer (e.g., Bosch Demolition Hammer or Geoprobe™). Samples can be drawn through the probe itself, or through Teflon tubing inserted through the probe and attached to the probe point. Samples are collected and analyzed as described above.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

3.1 Tedlar Bags

Soil gas samples are generally contained in 1.0-L Tedlar bags. Bagged samples are best stored in dark plastic bags placed in coolers to protect the bags from any damage that may occur in the field or in transit. In addition, coolers insure the integrity of the samples by keeping them at a cool temperature and out of direct sunlight. Samples should be analyzed as soon as possible, preferably within 24 - 48 hours.

3.2 Tenax Tubes

Bagged samples can also be drawn onto Tenax or other sorbent tubes to undergo lab GC/MS analysis. If Tenax tubes are to be utilized, special care must be taken to avoid contamination. Handling of the tubes should be kept to a minimum and only while wearing nylon or other lint-free gloves. After sampling, each tube should be stored in a clean, sealed culture tube; the ends packed with clean glass wool to protect the sorbent tube from breakage. The culture tubes should be kept cool and wrapped in aluminum foil to prevent any photodegradation of samples (see Section 7.4.).

3.3 Summa Canisters

The Summa canisters used for soil gas sampling have a 6 liter sample capacity and are certified clean by GC/MS analysis before being utilized in the field. After sampling is completed, they are stored and shipped in travel cases.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

4.1 PID Measurements

A number of factors can affect the response of a PID (such as the HNu PI 101). High humidity can cause lamp fogging and decreased sensitivity. This can be significant when soil moisture levels are high, or when a soil gas well is actually in groundwater. High concentrations of methane can cause a downscale deflection of the meter. High and low temperature, electrical fields, FM radio transmission, and naturally occurring compounds, such as terpenes in wooded areas, will also affect instrument response.

Other field screening instruments can be affected by interferences. Consult the manufacturers manuals.

4.2 FID Measurements

A number of factors can affect the response of an FID (such as the OVA model 128). High humidity can cause the FID to flame out or not ignite at all. This can be significant when soil moisture levels are high, or when a soil gas well is actually in groundwater. The FID can only read organic based compounds (they must contain carbon in the molecular structure). The FID also responds poorly to hydrocarbons and halogenated hydrocarbons (such as gasoline, propane fuel). High and low temperature, electrical fields and FM radio transmission will also affect instrument response.

4.3 Factors Affecting Organic Concentrations in Soil Gas

Concentrations in soil gas are affected by dissolution, adsorption, and partitioning. Partitioning refers to the ratio of component found in a saturated vapor above an aqueous solution to the amount in the solution; this can, in theory, be calculated using the Henry's Law constants. Contaminants can also be adsorbed onto inorganic soil components or "dissolved" in organic components. These factors can result in a lowering of the partitioning coefficient.

Soil "tightness" or amount of void space in the soil matrix, will affect the rate of recharging of gas into the soil gas well.

Existence of a high, or perched, water table, or of an impermeable underlying layer (such as a clay lens or layer of buried slag) may interfere with sampling of the soil gas. Knowledge of site geology is useful in such situations, and can prevent inaccurate sampling.

4.4 Soil Probe Clogging

A common problem with this sampling method is soil probe clogging. A clogged probe can be identified by using an in-line vacuum gauge or by listening for the sound of the pump laboring. This problem can usually be eliminated by using a wire cable to clear probe (see Section 7.1.3.).

4.5 Underground Utilities

Prior to selecting sample locations, an underground utility search is recommended. The local utility companies can be contacted and requested to mark the locations of their underground lines. Sampling plans can then be drawn up accordingly. Each sample location should also be screened with a metal detector or magnetometer to verify that no underground pipes or drums exist.

5.0 EQUIPMENT/APPARATUS

5.1 Slam Bar Method

- Slam Bar (1 per sampling team).
- Soil gas probes, stainless steel tubing, 1/4" O.D., 5 ft length.
- Flexible wire or cable used for clearing the

tubing during insertion into the well.

- C "Quick Connect" fittings to connect sampling probe tubing, monitoring instruments, and Gilian pumps to appropriate fittings on vacuum box.
- C Modeling clay.
- C Vacuum box for drawing a vacuum around Tedlar bag for sample collection (1 per sampling team).
- C Gilian pump Model HFS113A adjusted to approximately 3.0 L/min (1 to 2 per sample team).
- C 1/4" Teflon tubing, 2 ft to 3 ft lengths, for replacement of contaminated sample line.
- C 1/4" Tygon tubing, to connect Teflon tubing to probes and quick connect fittings.
- C Tedlar bags, 1.0 L, at least 1 bag per sample point.
- C Soil Gas Sampling labels, field data sheets, logbook, etc.
- C PID/FID, or other field air monitoring devices, (1 per sampling team).
- C Ice chest, for carrying equipment and for protection of samples (2 per sampling team).
- C Metal detector or magnetometer, for detecting underground utilities/pipes/drums (1 per sampling team).
- C Photovac GC, for field-lab analysis of bagged samples.
- C Summa canisters (plus their shipping cases) for sample, storage and transportation.
- C Large dark plastic garbage bags

5.2 Power Hammer Method

- C Bosch demolition hammer.
- C 1/2" O.D. steel probes, extensions, and points.
- C Dedicated aluminum sampling points.
- C Teflon tubing, 1/4".
- C "Quick Connect" fittings to connect sampling probe tubing, monitoring instruments, and Gilian pumps to appropriate fittings on vacuum box.
- C Modeling clay.
- C Vacuum box for drawing a vacuum around Tedlar bag for sample collection (1 per sampling team).
- C Gilian pump Model HFS113A adjusted to approximately 3.0 L/min (1 to 2 per sample team).
- C 1/4" Teflon tubing, 2 ft to 3 ft lengths, for replacement of contaminated sample line.
- C 1/4" Tygon tubing, to connect Teflon tubing to probes and quick connect fittings.
- C Tedlar bags, 1.0 L, at least 1 bag per sample point.
- C Soil Gas Sampling labels, field data sheets, logbook, etc.
- C HNu Model P1101, or other field air monitoring devices, (1 per sampling team).
- C Ice chest, for carrying equipment and for protection of samples (2 per sampling team).
- C Metal detector or magnetometer, for detecting underground utilities/pipes/drums (1 per sampling team).
- C Photovac GC, for field-lab analysis of bagged samples.
- C Summa canisters (plus their shipping cases) for sample, storage and transportation.
- C Generator w/extension cords.
- C High lift jack assembly for removing probes.

5.3 Geoprobe™ Method

The Geoprobe is a hydraulically-operated sampling device mounted in a customized four-wheel drive vehicle. The sampling device can be deployed from the truck and positioned over a sample location. The base of the sampling device is positioned on the ground. The weight of the vehicle is hydraulically raised on the base. As the weight of the vehicle is transferred to the probe, the probe is pushed into the ground. A built-in hammer mechanism allows the probe to be driven past some dense stratigraphic horizons. When the probe reaches the sample depth, up to 50 feet under favorable geologic situations, samples can be collected.

Soil gas can be collected from specific depths in two general ways. One method involves withdrawing a sample directly from the probe rods, after evacuating a sufficient volume of air from the probe rods. The other method involves collecting a sample through tubing attached by an adaptor to the bottom probe rod section. Correctly used, this method provides more reliable results. Manufacturer's instructions and the SOP for the Model 5400 Geoprobe™ Operation should be followed when using this method.

6.0 REAGENTS

- C PID/FID or calibration gases for field air monitoring devices (such as methane and isobutylene).

- C Deionized organic-free water, for decontamination.
- C Methanol, HPLC grade, for decontamination.
- C Ultra-zero grade compressed air, for field blanks.
- C Standard gas preparations for Photovac GC calibration and Tedlar bag spikes.
- C Propane Torch (for decontamination of steel probes)

7.0 PROCEDURES

7.1 Soil Gas Well Installation

1. Initially a hole slightly deeper than the desired depth is made. For sampling up to 5 feet, a 5-ft single piston slam bar is used. For deeper depths, a piston slam bar with threaded 4-foot-long extensions can be used. Other techniques can be used, so long as holes are of narrow diameter and no contamination is introduced.

2. After the hole is made, the slam bar is carefully withdrawn to prevent collapse of the walls of the hole. The soil gas probe is then inserted.

3. It is necessary to prevent plugging of the probe, especially for deeper holes. A metal wire or cable, slightly longer than the probe, is placed in the probe prior to inserting into the hole. The probe is inserted to full depth, then pulled up three to six inches, then cleared by moving the cable up and down. The cable is removed before sampling.

4. The top of the sample hole is sealed at the surface against ambient air infiltration by using modeling clay molded around the probe at the surface of the hole.

5. If conditions preclude hand installation of the soil gas wells, the power driven system may be employed. The generator powered demolition hammer is used to drive the probe to the desired depth (up to 12 Ft may be attained with extensions). The probe is pulled up 1-3 inches if the retractable point is used. No clay is needed to seal the hole. After sampling, the probe is retrieved using the high lift jack assembly.

6. If semi-permanent soil gas wells are required, the dedicated aluminum probe points are used. These points are inserted into the bottom of the power driven probe and attached to the Teflon tubing. The probe is inserted as in step 5. When the probe is removed, the point and Teflon tube remain in the hole, which may be sealed by backfilling with clean sand, soil, or bentonite.

7.2 Screening with Field Instruments

1. The well volume <u>must</u> be evacuated prior to sampling. Connect the Gilian pump, adjusted to 3.0 L/min, to the sample probe using a section of Teflon tubing as a connector. The pump is turned on, and a vacuum is pulled through the probe for approximately 15 seconds. Longer time is required for sample wells of greater depths.

2. After evacuation, the monitoring instrument(s) (i.e. HNu or OVA) is connected to the probe using a Teflon connector. When the reading is stable, or peaks, the reading is recorded on soil gas data sheets.

3. Of course, readings may be above or below the range set on the field instruments. The range may be reset, or the response recorded as a greater than or less than figure. Recharge rate of the well with soil gas must be considered when resampling at a different range setting.

7.3 Tedlar Bag Sampling

1. Follow step 7.2.1 to evacuate well volume. If air monitoring instrument screening was performed prior to sample taking, evacuation is not necessary.

2. Use the vacuum box and sampling train (Figure 1) to take the sample. The sampling train is designed to minimize the introduction of contaminants and losses due to adsorption. All wetted parts are either Teflon or stainless steel. The vacuum is drawn indirectly to avoid contamination from sample pumps.

3. The Tedlar bag is placed inside the vacuum box, and attached to the sampling port. The sample probe is attached to the sampling port via Teflon tubing and a "Quick Connect" fitting.

4. A vacuum is drawn around the outside of the bag, using a Gilian pump connected to the vacuum box evacuation port, via Tygon tubing and a "Quick Connect" fitting. The vacuum causes the bag to inflate, drawing the sample.

5. Break the vacuum by removing the Tygon line from the pump. Remove the bagged sample from the box and close valve. Record data on data sheets or in logbooks. Record the date, time, sample location ID, and the PID/FID instrument reading(s) on sample bag label.

CAUTION: Labels should not be pasted directly onto the bags, nor should bags be labeled directly using a marker or pen. Inks and adhesive may diffuse through the bag material, contaminating the sample. Place labels on the edge of the bags, or tie the labels to the metal eyelets provided on the bags. Markers with inks containing volatile organics (i.e., permanent ink markers) should not be used.

Chain of Custody Sheets must accompany all samples submitted to the field laboratory for analysis.

7.4 Tenax Tube Sampling

Samples collected in Tedlar bags may be adsorbed onto Tenax tubes for further analysis by GC/MS.

7.4.1 Additional Apparatus

A. Syringe with a luer-lock tip capable of drawing a soil gas or air sample from a Tedlar bag onto a Tenax/CMS sorbent tube. The syringe capacity is dependent upon the volume of sample begin drawn onto the sorbent tube.

B. Adapters for fitting the sorbent tube between the Tedlar bag and the sampling syringe. The adapter attaching the Tedlar bag to the sorbent tube consists of a reducing union (1/4" to 1/16" O.D. -- Swagelok cat. # SS-400-6-ILV or equivalent) with a length of 1/4" O.D. Teflon tubing replacing the nut on the 1/6" (Tedlar bag) side. A 1/4" I.D. silicone O-ring replaces the ferrules in the nut on the 1/4" (sorbent tube) side of the union.

The adapter attaching the sampling syringe to the sorbent tube consists of a reducing union (1/4" to 1/16" O.D. -- Swagelok Cat. # SS-400-6-ILV or equivalent) with a 1/4" I.D. silicone O-ring replacing the ferrules in the nut on the 1/4" (sorbent tube) side and the needle of a luer-lock syringe needle inserted into the 1/16" side. (Held in place with a 1/16" ferrule.) The luer-lock end of the needle can be attached to the sampling syringe. It is useful to have a luer-lock on/off valve situated between the syringe and the needle.

C. Two-stage glass sampling cartridge (1/4" O.D. x 1/8" I.D. x 5 1/8") contained in a flame-sealed tube (Manufacturer: Supelco Custom Tenax/Spherocarb Tubes) containing two sorbent sections retained by glass wool:

Front section: 150 mg of Tenax-GC
Back section: 150 mg of CMS (Carbonized Molecular Sieve)

These tubes are prepared and cleaned in accordance with EPA Method EMSL/RTP-SOP-EMD-013 by the vendor. The vendor sends ten tubes per lot made to the REAC GC/MS Laboratory and they are tested for cleanliness, precision, and reproductability.

D. Teflon-capped culture tubes or stainless steel tube containers for sorbent tube storage and shipping. These containers should be conditioned by baking at 120 degrees C for at least two hours. The culture tubes should contain a glass wool plug to prevent sorbent tube breakage during transport. Reconditioning of the containers should occur between uses or after extended periods of disuse (i.e., two weeks or more).

E. Nylon gloves or lint-free cloth. (Hewlett Packard Part # 8650-0030 or equivalent.)

7.4.2 Sample Collection

Handle sorbent tubes with care, using nylon gloves (or other lint-free material) to avoid contamination.

Immediately before sampling, break one end of the sealed tube and remove the Tenax cartridge.

Connect the valve on the Tedlar bag to the sorbent tube adapter. Connect the sorbent tube to the sorbent tube adapter with the Tenax (white granular) side of the tube facing the Tedlar bag. Connect the sampling syringe assembly to the CMS (black) side of the sorbent tube. Fittings on the adapters should be finer-tight. Open the valve on the Tedlar bag. Open the on/off valve of the sampling syringe. Depending on work plan stipulations, at least 10% of the soil gas samples analyzed by this GC method must be submitted for confirmational GC/MS analysis (according to modified methods TO-1 [Tenax absorbent] and TO-2 [Carbon Molecular Sieve (CMS) absorbent]). Each soil gas sample must be absorbed on replicate Tenax/CMS tubes. The volume absorbed on a Tenax/CMS tube is dependent on the total concentration of the compounds measured by the photovac/GC or other applicable GC:

Total Concentration (ppm)	Sample Volume (mL)
>10	Use Serial Dilution
10	10 - 50
5	20-100
1	100-250

After sampling, remove the tube from the sampling train with gloves or a clean cloth. DO NOT LABEL OR WRITE ON THE TENAX/CMS TUBE.

Place the sorbent tube in a conditioned stainless steel tube holder or culture tube. Culture tube caps should be sealed with Teflon tape.

7.4.3 Sample Labeling

Each sample tube container (not tube) must be labeled with the site name, sample station number, date sampled, and volume sampled.

Chain of custody sheets must accompany all samples to the laboratory.

7.4.4 Quality Assurance (QA)

Before field use, a QA check should be performed on each batch of sorbent tubes by analyzing a tube by thermal desorption/cryogenic trapping GC/MS.

At least one blank sample must be submitted with each set of samples collected at a site. This trip blank must be treated the same as the sample tubes except no sample will be drawn through the tube.

Sample tubes should be stored out of UV light (i.e., sunlight) and kept on ice until analysis. Samples should be taken in duplicate, when possible.

7.5 Summa Canister Sampling

1. Follow step 7.2.1 to evacuate well volume. If PID/FID readings were taken prior to taking a sample, evacuation is not necessary.
2. Attach a certified clean, evacuated 6-liter Summa canister via the 1/4" Teflon tubing.
3. Open valve on Summa canister. The soil gas sample is drawn into the canister by pressure equilibration. The approximate sampling time for a 6 liter canister is 20 minutes.
4. Site name, sample location, number, and date must be recorded on a chain of custody form and on a blank tag attached to the canister.

8.0 CALCULATIONS

8.1 Field Screening Instruments

Instrument readings are usually read directly from the meter. In some cases, the background level at the soil gas station may be subtracted:

Final Reading = Sample Reading - Background

8.2 Photovac GC Analysis

Calculations used to determine concentrations of individual components by Photovac GC analysis are beyond the scope of this SOP and are covered in ERT SOP #2109, *Photovac GC Analysis for Soil Water and Air/Soil Gas*.

9.0 CALIBRATION

9.1 Field Instruments

It is recommended that the manufacturers' manuals be consulted for correct use and calibration of all instrumentation.

9.2 Gilian Model HFS113A Air Sampling Pumps

Flow should be set at approximately 3.0 L/min; accurate flow adjustment is not necessary. Pumps should be calibrated prior to bringing into the field.

10.0 QUALITY ASSURANCE/ QUALITY CONTROL

10.1 Sample Probe Contamination

Sample probe contamination is checked between each sample by drawing ambient air through the probe via a Gilian pump and checking the response of the FID/PID. If readings are higher than background, replacement or decontamination is necessary.

Sample probes may be decontaminated simply by drawing ambient air through the probe until the HNu reading is at background. More persistent contamination can be washed out using methanol and water, then air drying. For persistent volatile contamination, use of a portable propane torch may be needed. Using a pair of pliers to hold the probe, run the torch up and down the length of the sample probe for approximately 1-2 minutes. Let the probe cool before handling. When using this method, make sure to wear gloves to prevent burns. Having more than one probe per sample team will reduce lag times between sample stations while probes are decontaminated.

10.2 Sample Train Contamination

The Teflon line forming the sample train from the probe to the Tedlar bag should be changed on a daily basis. If visible contamination (soil or water) is drawn into the sampling train, it should be changed immediately. When sampling in highly contaminated areas, the sampling train should be purged with ambient air, via a Gilian pump, for approximately 30 seconds between each sample. After purging, the sampling train can be checked using an FID or PID, or other field monitoring device, to establish the cleanliness of the Teflon line.

10.3 FID/PID Calibration

The FID and PIDs should be calibrated at least once a day using the appropriate calibration gases.

10.4 Field Blanks

Each cooler containing samples should also contain one Tedlar bag of ultra-zero grade air, acting as a field blank. The field blank should accompany the samples in the field (while being collected) and when they are delivered for analysis. A fresh blank must be provided to be placed in the empty cooler pending additional sample collection. One new field blank per cooler of samples is required. A chain of custody sheet must accompany each cooler of samples and should include the blank that is dedicated to that group of samples.

10.5 Trip Standards

Each cooler containing samples should contain a Tedlar bag of standard gas to calibrate the analytical instruments (Photovac GC, etc.). This trip standard will be used to determine any changes in concentrations of the target compounds during the course of the sampling day (e.g., migration through the sample bag, degradation, or adsorption). A fresh trip standard must be provided and placed in each cooler pending additional sample collection. A chain of custody sheet should accompany each cooler of samples and should include the trip standard that is dedicated to that group of samples.

10.6 Tedlar Bag Check

Prior to use, one bag should be removed from each lot (case of 100) of Tedlar bags to be used for sampling and checked for possible contamination as follows: the test bag should be filled with ultra-zero grade air; a sample should be drawn from the bag and analyzed via Photovac GC or whatever method is to be used for sample analysis. This procedure will ensure sample container cleanliness prior to the start of the sampling effort.

10.7 Summa Canister Check

From each lot of four cleaned Summa canisters, one is to be removed for a GC/MS certification check. If the canister passes certification, then it is re-evacuated and all four canisters from that lot are available for sampling.

If the chosen canister is contaminated, then the entire lot of four Summas must be recleaned, and a single canister is re-analyzed by GC/MS for certification.

10.8 Options

10.8.1 Duplicate Samples

A minimum of 5% of all samples should be collected in duplicate (i.e., if a total of 100 samples are to be collected, five samples should be duplicated.) In choosing which samples to duplicate, the following criteria applies: if, after filling the first Tedlar bag, and, evacuating the well for 15 seconds, the second HN (or other field monitoring device being used) reading matches or is close to (within 50%) the first reading, a duplicate sample may be taken.

10.8.2 Spikes

A Tedlar bag spike and Tenax tube spike may be desirable in situations where high concentrations of contaminants other than the target compounds are found to exist (landfills, etc.). The additional level of QA/QC attained by this practice can be useful in determining the effects of interferences caused by these non-target compounds. Summa canisters containing samples are not spiked.

11.0 DATA VALIDATION

11.1 Blanks (Field and Tedlar Bag Check)

For each target compound, the level of concentration found in the sample must be greater than three times the level (for that compound) found in the field blank which accompanied that sample to be considered valid. The same criteria apply to target compounds detected in the Tedlar bag pre-sampling contamination check.

12.0 HEALTH AND SAFETY CONSIDERATIONS

Due to the remote nature of sampling soil gas, special considerations can be taken with regard to health and safety. Because the sample is being drawn from underground, and no contamination is introduced into the breathing zone, soil gas sampling usually occurs in Level D. Ambient air is constantly monitored using the HNu PI101 to obtain background readings during the sampling procedure. As long as the levels in ambient air do not rise above background, no upgrade of the level of protection is needed.

When conducting soil gas sampling, leather gloves should be worn, and proper slam bar techniques should be implemented (bend knees). Also, an underground utility search should be performed prior to sampling. (See Section 4.5).

13.0 REFERENCES

Gilian Instrument Corp., Instruction Manual for Hi Flow Sampler: HFS113, HFS 113 T, HFS 113U, HFS 113 UT, 1983.

HNu Systems, Inc., Instruction Manual for Model PI 101 Photoionization Analyzer, 1975.

N.J.D.E.P., Field Sampling Procedures Manual, Hazardous Waste Programs, February, 1988.

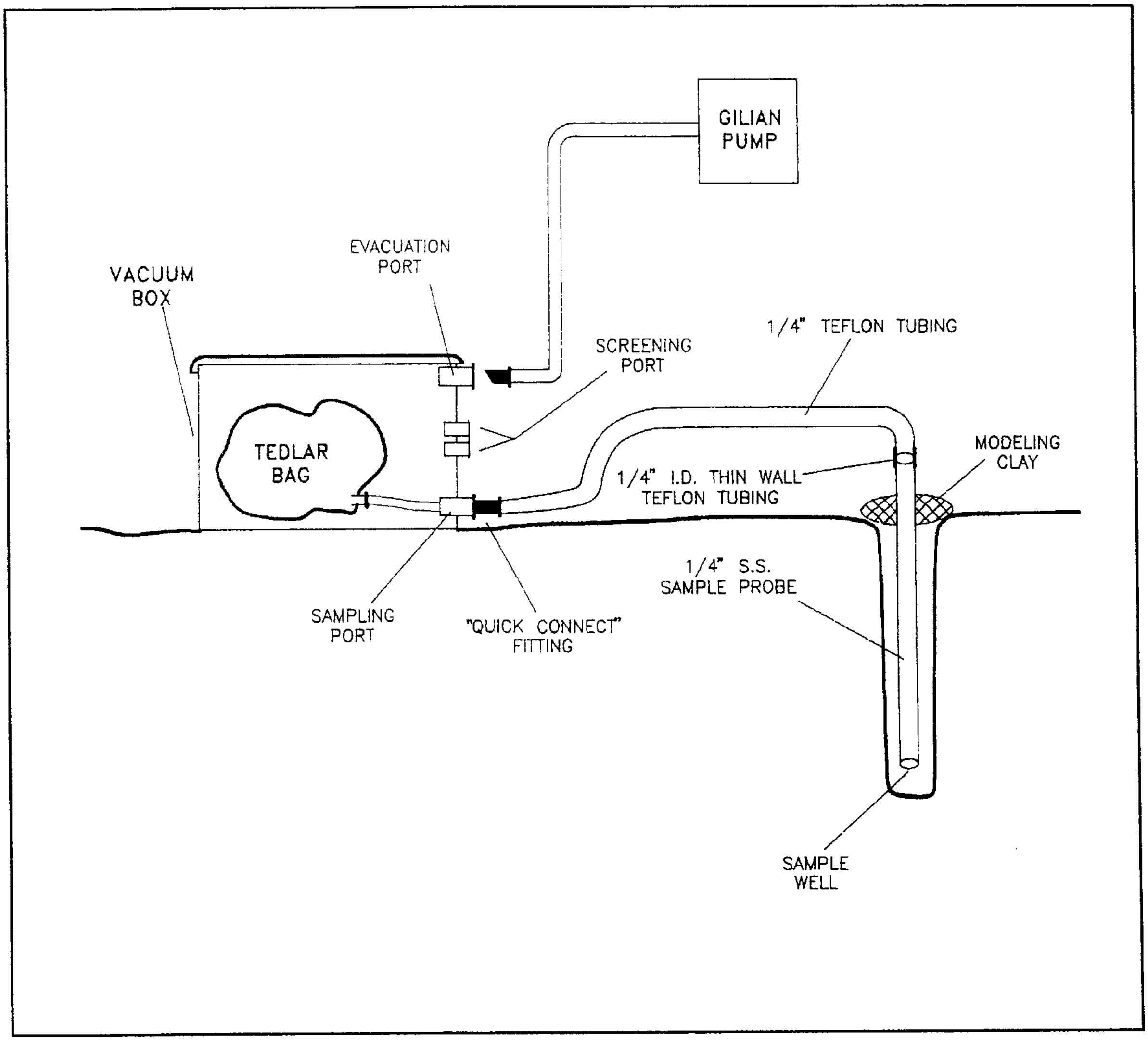
Roy F. Weston, Inc., Weston Instrumentation Manual, Volume I, 1987.

U.S.E.P.A., Characterization of Hazardous Waste Sites - A Methods Manual: Volume II, Available Sampling Methods, 2nd Edition, EPA-600/4-84-076, December, 1984.

APPENDIX A

Figure

FIGURE 1. Sampling Train Schematic



APPENDIX B

HNu Field Protocol

Field Procedure

The following sections detail the procedures that are to be followed when using the HNu in the field.

Startup Procedure

a. Before attaching the probe, check the function switch on the control panel to ensure that it is in the off position. Attach the probe by plugging it into the interface on the top of the readout module. Use care in aligning the prongs in the probe cord with the plug in; don't force.

b. Turn the function switch to the battery check position. The needle on the meter should read within or above the green battery are on the scale. If not, recharge the battery. If the red indicator light comes on, the battery needs recharging.

c. Turn the function switch to any range setting. Look into the end of the probe for no more than two to three seconds to see if the lamp is on. If it is on, it will give a purple glow. Do not stare into the probe any longer than three seconds. Long term exposure to UV light can damage eyes. Also, listen for the hum of the fan motor.

d. To ZERO the instrument, turn the function switch to the standby position and rotate the zero adjustment until the meter reads zero. A calibration gas is not needed since this is an electronic zero adjustment. If the span adjustment setting is changed after the zero is set, the zero should be rechecked and adjusted, if necessary. Wait 15 to 20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero.

Operational Check

a. Follow the startup procedure.

b. With the instrument set on the 0-20 range, hold a solvent-based major market near the probe tip. If the meter deflects upscale, the instrument is working.

Field Calibration Procedure

a. Follow the startup procedure and the operational check.

b. Set the function switch to the range setting for the concentration of the calibration gas.

c. Attach a regulator (HNu 101-351) to a disposable cylinder of isobutylene gas (HNu 101-351). Connect the regulator to the probe of the HNu with a piece of clean Tygon tubing. Turn on the value on the regulator.

d. After fifteen seconds, adjust the span dial until the meter reading equals the concentration of the calibration gas used. Be careful to unlock the span dial before adjusting it. If the span has to be set below 3.0, calibration internally or return to equipment maintenance for repair.

e. Record in the field logbook: the instrument ID no. (EPA decal or serial number if the instrument is a rental); the initial and final span settings; the date and time; concentration and type of calibration has used; and the name of the person who calibrated the instrument.

Operation

a. Follow the startup procedure, operational check, and calibration check.

b. Set the function switch to the appropriate range. If the concentration of gases or vapors is unknown, set the function switch to the 0-20 ppm range. Adjust it if necessary.

c. While taking care not to permit the HNu to be exposed to excessive moisture, dirt, or contamination, monitor the work activity as specified in the Site Health and Safety Plan.

d. When the activity is completed or at the end of the day, carefully clean the outside of the HNu with a damp disposable towel to remove any visible dirt. Return the HNu to a secure area and place on charge.

e. With the exception of the probe's inlet and exhaust, the HNu can be wrapped in clear plastic to prevent it form becoming contaminated and to prevent water from getting inside in the event of precipitation.

New York State Department of Health
Division of Environmental Health Assessment
Bureau of Toxic Substance Assessment

Indoor Air Sampling & Analysis Guidance

August 8, 2001

NEW YORK STATE DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH ASSESSMENT
BUREAU OF TOXIC SUBSTANCE ASSESSMENT

INDOOR AIR SAMPLING & ANALYSIS GUIDANCE
August 8, 2001

SCOPE:

Air testing for specific chemical compounds can be performed to determine whether petroleum spills or other contaminant sources affect indoor air quality. This document provides guidance for preparing sites and collecting samples for laboratory analysis to ensure the integrity of the test results and allow for meaningful interpretation of the data.

Forms (attached)
- Indoor Air Quality Questionnaire and Building Inventory Form
- Product Inventory Form

OBJECTIVE:

The purpose of this document is to outline the recommended procedure for testing indoor air for volatile organic chemicals (VOCs). The procedure includes pre-sampling inspection and preparation of homes, product inventories, collection of samples, analytical method selection.

1. Pre-sampling inspection and preparation of homes:

A pre-sampling inspection should be performed 2 or 3 days prior to testing (if possible) to evaluate the type of structure, floor layout and physical conditions of the building(s) being studied and to identify and minimize conditions that may affect or interfere with the proposed testing. This information along with information on sources of potential indoor contamination should be identified on the building inventory form. Portable organic vapor monitoring equipment (i.e. photoionization detectors (PIDs)) can be used to help evaluate potential interferences. Items to be included in the building inventory include use or storage of petroleum products including gasoline operated equipment, unvented kerosene heaters, recent use of petroleum based finishes or products containing petroleum distillates. Potential interferences should be corrected during the pre-sampling inspection. Removing the source from the indoor environment prior to testing is the most effective means of reducing the interference. Ensuring that containers are tightly sealed may be acceptable, but should be tested with a PID to demonstrate that the seal is tight. The inability to eliminate potential interference may be justification for not testing. Once these interfering conditions are corrected, aggressive ventilation may be needed prior to testing to eliminate residual contamination.

Any ventilation should be done twenty-four hours or more prior to the scheduled sampling time. If ventilation is deemed necessary, ventilate the house by opening windows and doors for at least 10 to 15 minutes. House ventilation should be avoided 24 hours prior to and during testing. During colder months, heating systems should be operating for at least twenty-four hours prior to the scheduled sampling time to maintain normal indoor temperatures above 65^0 F before and during sampling.

FOR 24 HOURS PRIOR TO SAMPLING, DO NOT

- open any windows, fireplace dampers, openings or vents,
- operate ventilation fans unless special arrangements are made,
- smoke in the house,
- paint,

- use wood stove, fireplace or other auxiliary heating equipment, (eg. kerosene heater),
- operate or store automobile in attached garage,
- allow containers of gasoline or oil to remain within the house or garage area, except for fuel oil tanks,
- clean, wax or polish furniture or floors with petroleum or oil-based products,
- use air fresheners or odor eliminators,
- engage in any hobbies which use materials containing volatile organic chemicals,
- use cosmetics: including hairspray, nail polish, nail polish removers, perfume/cologne, etc.
- apply pesticides.

2 . Product Inventories:

Some household products contain volatile organic chemicals (VOCs) which can contribute to levels of VOCs in air. Products in buildings should be inventoried every time air is tested to provide an accurate assessment of the potential contribution of VOCs. Each room in the building should be inspected and products that contain VOCs should be listed on the Products Inventory Form along with PID readings obtained near the container. If available, the volatile ingredients should be recorded for each product. If the ingredients are not listed on the label, record the manufacturer's name and address or phone number if available.

3. Collection of Samples

To characterize contaminant concentration trends and potential exposures, air samples should be collected from the basement, first floor living space, and from outdoors. In settings with diurnal occupancy patterns such as schools and office buildings, samples should be collected during normally occupied periods to be representative of typical exposure. Sample collection intakes should be approximately three feet above the floor level to represent breathing zones. To ensure that air is representative of the locations sampled and to avoid undue influence from sampling personnel, samples should be collected for 2 to 8 hours, but at least a one-hour period and personnel should avoid lingering in the immediate area of the sampling device while samples are being collected. Sample collection techniques vary depending on the analytical method(s) being used and sample flow rates must conform to the specifications in the sample collection method. Some methods require collecting samples in duplicate. Sampling personnel should be completely familiar with the sampling protocol for the particular method being used.

a. Quality Assurance/Quality Control

Extreme care should be taken during all aspects of sample collection to ensure that high quality data are obtained. The laboratory should use only certified clean sample collection devices. The sampling team members should avoid actions which cause sample interference such as pumping gas prior to testing or using permanent marking pens in the field. Once samples are collected, they should be stored according to the method protocol and delivered to the analytical laboratory as soon as possible. Samples should not exceed recommended holding times prior to being processed by the laboratory. Blanks should be submitted and analyzed with the samples to provide a quality check. Laboratory procedures for sample accession and chain of custody should be followed.

b. Sampling Information

Detailed information must be gathered at the time of sampling to document conditions during sampling to aid in interpretation of the test results. The information should be recorded on the building inventory form. Floor plan sketches should be drawn for each floor and should include the floor layout with sample locations, any chemical storage areas, garages, doorways, stairways, location of basement sumps and any other pertinent information including compass orientation (north). Outdoor plot sketches should include the building site, area streets, outdoor sample location, the location of potential interferences (such as gas stations, factories, lawn mowers), wind direction and magnetic orientation (north). In addition, any pertinent observations such as odors and PID readings should be recorded on the building inventory form and on associated sample accession forms.

The products inventory shall include those items discussed in Section 2.

c. <u>Sample Analysis</u>

New York State Law requires laboratories analyzing environmental samples from New York State to have current Environmental Laboratory Approval Program (ELAP) certification for certain contaminant categories and media (air, water, solid waste).

The goal of indoor air sampling is to evaluate exposure to VOCs by measuring levels low enough to compare to background indoor air levels. Therefore, the samples must be analyzed by methods that can achieve minimum detection limits of at least one part per billion (ppb) (1 to 7 micrograms per cubic meter (mcg/m^3) depending on the molecular weight for each compound). Several analytical methods for VOCs in air are capable of achieving these detection limits including Environmental Protection Agency (EPA) Method TO-14A/TO-15 and EPA Method TO-1/TO-2. Prior to choosing an analytical method, the laboratory should verify they are capable of detecting target compounds.

Petroleum is a mixture of many individual compounds. Various petroleum products (i.e. gasoline, diesel, fuel oil) have different chemical constituents and specific aromatic and aliphatic compounds can be good indicators for individual petroleum products. Analytical methods using a mass spectrometer detector allow for the identification of aromatic and aliphatic hydrocarbons, and oxygenated compounds such as ethanol, acetone and methyl tertiary butyl ether (MTBE).

Target compounds for gasoline may include the aromatics: benzene, toluene, ethylbenzene and xylenes; C-4 to C-8 straight and branched aliphatics; and the oxygenate additive MTBE.

Target compounds for fuel oil may include the aromatics: benzene, toluene, ethylbenzene, xylenes, naphthalene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, n-butylbenzene, sec-butylbenzene and tert-butylbenzene; and C-9 to C-12 straight and branched aliphatic hydrocarbons.

Sampling for other potential contaminants may involve different target compound(s) and different analytical methodology.

For additional information contact Mr. Gerry McDonald or Mr. Michael Hughes of the Bureau of Toxic Substance Assessment (518) 402-7810.

OSR - 3

NEW YORK STATE DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH ASSESSMENT
BUREAU OF TOXIC SUBSTANCE ASSESSMENT

INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY

This form must be completed for each residence involved in indoor air testing.

Preparer's Name ______________________ Date Prepared __________

Preparer's Affiliation ______________________ Phone No. __________

1. **OCCUPANT**

Name: ______________________

Address: ______________________

____

County: ______________________

Home Phone No. __________ Office Phone No __________

2. **OWNER OR LANDLORD**: (If different than occupant)

Name: ______________________

Address: ______________________

____

Phone No. ______________________

A. Building Construction Characteristics

Type (circle appropriate responses): Single Family Multiple Dwelling Commercial

Ranch	2-Family
Raised Ranch	Duplex
Split Level	Apartment House ______ Units
Colonial	Number of floors ______
Mobile Home	Other specify __________

Residence Age ______ General Description of Building Construction Materials __________

____

Is the building insulated? Yes / No How air tight is the building ______________________

B. Basement construction characteristics (circle all that apply):

1. Full basement, crawlspace, slab on grade, other ________
2. Basement floor: concrete, dirt, other __________
3. Concrete floor: unsealed, painted, covered; with _________
4. Foundation walls: poured concrete, block, laid up stone, other _________
5. The basement is: wet, damp, dry _______Sump present? y / n _____Water in sump? y / n ____
6. The basement is: finished, unfinished _______________
7. Identify potential soil vapor entry points (e.g., cracks, utility ports etc.)
   ____
8. Describe how air tight the basement is ____
   ____

C. HVAC (circle all that apply):

1. The type of heating system(s) used in this residence is/are:

Hot Air Circulation	Heat Pump
Hot Water Radiation	Unvented Kerosene Heater
Steam Radiation	Wood stove
Electric Baseboard	Other (specify) ______________________________

2. The type(s) of fuel(s) used is/are: Natural Gas, Fuel Oil, Electric, Wood Coal Solar

   Other (specify) ____________________________.
3. Is the heating system's power plant located in the basement or another area: _______________.
4. Is there air-conditioning? Yes / No Central Air or Window Units?

   Specify the location _____________________________
5. Are there air distribution ducts present? Yes / No
6. Describe the supply and cold air return duct work in the basement including whether there is a cold air return, the tightness of duct joints

   ____

   ____

OSR-3 (continued)

D. Potential Indoor Sources of Pollution

1. Has the house ever had a fire? Yes / No
2. Is there an attached garage? Yes / No
3. Is a vehicle normally parked in the garage? Yes / No
4. Is there a kerosene heater present? Yes / No
5. Is there a workshop, hobby or craft area in the residence? Yes / No
6. An inventory of all products used or stored in the home should be performed. Any products that contain volatile organic compounds or chemicals similar to the target compounds should be listed. The attached product inventory form should be used for this purpose.
7. Is there a kitchen exhaust fan? Yes / No   Where is it vented? ________________
8. Has the house ever been fumigated? If yes describe date, type and location of treatment.

____

E. Water and Sewage (Circle the appropriate response)

Source of Water

Public Water   Drilled Well   Driven Well   Dug Well   Other (Specify) ____________

Water Well Specifications:

Well Diameter ____________________   Grouted or Ungrouted ____________

Well Depth ____________________   Type of Storage Tank ____________

Depth to Bedrock ____________________   Size of Storage Tank ____________

Feet of Casing ____________________   Describe type(s) of Treatment ______

____

Water Quality:

Taste and/or odor problems? y / n   If so, describe ________________________

How long has the taste and/or odor been present? ________________________

Sewage Disposal: Public Sewer   Septic Tank   Leach Field   Other (Specify) ______________

Distance from well to septic system ________ Type of septic tank additive ____________

OSR-3 (continued)

F. Plan View

Draw a plan view sketch for each floor of the residence and if applicable, indicate air sampling locations, possible indoor air pollution sources and PID meter readings.

OSR-3 (continued)

G. Potential Outdoor Sources of Pollution

Draw a sketch of the area surrounding the residence being sampled. If applicable, provide information on the spill location (if known), potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system if applicable, and a qualifying statement to help locate the site on a topographical map.

Household Products Inventory

Occupant / residence ____

Investigator: ______________________________ Date: __________________

Product description (dispenser, size, manufacturer …)	VOC Ingredients	PID Reading

ENSR SOP

Emission Isolation Flux Chamber Air Sampling for Building Floors

Site Specific Method #13

Emission Isolation Flux Chamber Air Sampling for Building Floors

Introduction

The emission isolation flux chamber air sampling method provides for direct measurement of volatile species emission rates. The technique uses a surface enclosure (flux chamber) to isolate a known surface area for emission rate flux (rate per area) measurement. The emission isolation flux chamber sampling system is shown in the attached Figure 13-1.

Volatile emissions from the exposed surface enter the open bottom of the chamber. Clean, dry sweep air is added to the chamber at a known rate. Within the chamber, the sweep air is mixed with the vapors emitted from the floor surface by the physical design of the sweep air inlet dispersion tube. The sweep air creates a slight air velocity at the emitting surface, preventing a build up of the emission concentration in the boundary layer directly above the surface.

The exit port is used for collection of samples of the mixture within the chamber including sweep air and emitted vapors once a steady state mixture is achieved. The exit port can be connected to direct reading analyzers or to sampling devices such as Summa® canisters. The flux chamber is vented to the ambient air through the exit port thus preventing pressure build up within the chamber which might affect the emission event.

Sampling Approach

The surface for which volatile emission rates are to be determined should be selected or prepared prior to sampling to ensure that the flux chamber surface contact can be effectively sealed. In the case of a building floor, level floor surfaces should be selected and steam-cleaned prior to testing to remove surface deposits or materials that might influence the testing results. Where floor surfaces of different types, age, or condition are present, sampling locations should be selected to characterize a range of different floor types. The surface areas represented by the different floor types sampled should be measured so that the testing results can be weighted appropriately.

The flux chamber consists of a non-reactive plexiglas dome with a square base covering a surface area of 0.25 square meters (m^2), with an internal volume of approximately 0.125 cubic meters (m^3). The flux chamber dimensions are shown in Figure 13-2. The chamber includes a stainless steel inlet dispersion tube and exit port. The placement of the inlet dispersion tube and exit port are such that mixing occurs passively without the use of a mechanical mixing device.

The inlet dispersion tube is connected with stainless steel or teflon tubing to a sweep air supply consisting of ultra-high purity air that is certified to be hydrocarbon-free. A calibrated flow meter is used to control the flow rate of the sweep air into the flux chamber. The optimal flow rate for sweep air is 100 to 200 cubic centimeters per minute (cc/min).

The flux chamber exit port is connected with stainless steel or teflon tubing under atmospheric pressure to an Andersen Volatile Organic Compound Canister Sampling System (VOCCS). The system is designed to collect an air sample at a pre-determined flow rate over a designated period up to 24 hours. The sample air slip stream is drawn from the greater exhaust flow into the VOCCS sampler by a specially modified inert vacuum pump in conjunction with a mass flow controller. Initial sample collection in the Summa canister is achieved by vacuum until the evacuated canister reaches atmospheric pressure. After that time the canister is filled by the action of the flow controlled pump to a pressure of up to 30 pounds per square inch (psi). Exact start and stop times are controlled using a digital timer-programmer. Care is taken in the collection of the Summa canister sample that the sample air slip stream flow rate is less than the total chamber exhaust flow rate (which should be essentially the same as the sweep air inlet flow rate) so as not to pull ambient air into the sample through the vent to the atmosphere.

Sampling parameters are documented to support the validity of the sample collection and analysis effort. Field documentation includes:

- Field Log Sheets
- Field Data Sheets
- Sample Labeling
- Chain-of-Custody Tape
- Chain-of-Custody Records
- Sampling Location Diagrams/Photographs

In addition to field samples collected, a Summa canister that is not opened but is carried to the field will be labeled and submitted for analysis with the field samples as a field/trip blank.

Field Log Books – Details of all field activities are recorded in the filed on field log books. The field log sheets are sued to chronologically document all field activities during sample collection and sample recovery. Data recorded in the field log books includes:

- Project name/location
- Date and time of each log entry
- Description and location of activities conducted
- Relevant field observations
- Initial/ID of field team member

Field Data Sheets – Field data sheets specific to the emissions isolation flux chamber field sampling program are used to document the specific data for each field sample collected. The field data sheets include the following information (see attached example sheets):

- Project no.
- Project name
- Client name
- Sample location
- Sample set-up date, time, temperature, barometric pressure
- Sample start time and date
- Sample stop time and date
- Sample recovery date, time, temperature, barometric pressure
- Sample location diagram
- Sample type
- Sample ID
- Sampler ID
- Initial Summa canister vacuum
- Final Summa canister pressure
- Sampler initial elapsed timer reading
- Sampler final elapsed timer reading
- Total elapsed time
- Sampler flowrate
- Sweep gas cylinder ID
- Sweep gas flowmeter ID
- Initial sweep gas flowmeter reading
- Final sweep gas flowmeter reading

* Average sweep gas flowmeter reading
* Average sweep gas flowrate
* Comments

Sample Labeling – Each Summa canister used is identified with a unique permanent fixed sample ID number. For each sample, this number is recorded on both the Field Data Sheet and Chain-of-Custody Record.

Chain-of-Custody Tape – Chain-of-Custody (COC) Tape is used at each field sample location to document sample integrity if samplers are left unattended. After the flux chambers are installed and sampling is initiated, COC tape is placed at ht junction of the floor and the flux chamber base, on the door of the VOCCS sampler, and on the sweep air flowmeter adjustment knob. The COC tape numbers are recorded on the Field Data Sheets and, upon recovery, the condition of the COC tapes are recorded.

Chain-of-Custody Records – Chain-of-Custody (COC) Records are completed at the time of sample recovery. The COC records include:

* Project name and no.
* Project location
* Sampler name and affiliation
* Sample ID, type, container, and requested analysis
* Name, date, time samples were relinquished
* Name, date, time samples were received

The time entered on the COC record for sample collection indicates the time that the sampler took physical custody of the sample in the field. The actual start and stop times for sample collection are recorded on the Field Data Sheet.

Sampling Location Diagrams and Photographs – The location of each sampling site is described on the field data sheets. In addition, each sample location is photographed and diagrammed as necessary to document the location and sampling system set-up. Sample location diagrams will also include the estimated surface area represented by the type, age and condition of the floor area sampled, and the estimated total building floor surface area.

Sample Preservation and Holding Time

The Summa canisters require no sample preservation. However, it is recommended that they be kept cool and out of the direct sunlight. Summa canisters have been shown to have a holding time of between 14 and 30 days between sample collection and analysis by the laboratory.

Analytical Method

Summa canister samples will be analyzed for volatile organic compounds according to U.S. EPA Method TO-14A. A target analytes list for Method TO-14A is attached to this Site Specific Method.

Equipment List

Flux chamber equipped with inlet dispersion tube and exit port
Stainless steel or teflon tubing and fittings
Certified hydrocarbon-free sweep air gas cylinder
Calibrated flow meter
Thermometer
Barometer
Clock or wristwatch

Summa canisters
Andersen VOCCS sampling system
Data sheets
COC tape and records

Calculations

Calculations to be done are listed below:

Emission flux rate for compound i, E_i, is calculated as follows:

$$E_i = (C_{i\text{-}chamber}\ Q_{sweep}) \ / \ A_{chamber}$$

Where: E_i = emission flux of compound i (ug/m^2-min)
$C_{i\text{-}chamber}$ = concentration of compound i in chamber exhaust (ug/m^3)
Q_{sweep} = sweep air flow rate into chamber (m^3/min)
$A_{chamber}$ = surface area enclosed by chamber (m^2)

Indoor air concentration of compound i, $C_{i\text{-}air}$, is calculated as follows:

$$C_{i\text{-}air} = (C_{i\text{-}chamber}\ Q_{sweep}\ A_{bldg}) \ / \ (Q_{bldg}\ A_{chamber})$$

Where: $C_{i\text{-}air}$ = concentration of compound i in building air (ug/m^3)
$C_{i\text{-}chamber}$ = concentration of compound i in chamber exhaust (ug/m^3)
Q_{sweep} = sweep air flow rate into chamber (m^3/min) 200 cm^3/min
A_{bldg} = total surface area of building floor (m^2)
Q_{bldg} = building ventilation rate (m^3/min)
$A_{chamber}$ = surface area enclosed by chamber (m^2)

Average indoor air concentration of compound i, $C_{i\text{-}average}$, is calculated as follows:

$$C_{i\text{-}air\text{-}average} = \frac{(C_{i\text{-}air\text{-}x}\ A_{floor\text{-}x})}{A_{bldg}} + \frac{(C_{i\text{-}air\text{-}y}\ A_{floor\text{-}y})}{A_{bldg}} + \frac{(C_{i\text{-}air\text{-}z}\ A_{floor\text{-}z})}{A_{bldg}} \ \ldots$$

Where: $C_{i\text{-}air\text{-}average}$ = average indoor air concentration of compound i (ug/m^3)
$C_{i\text{-}air\text{-}x}$ = indoor air concentration of compound i for sample x (ug/m^3)
$A_{floor\text{-}x}$ = surface area of building floor represented by sample x (m^2)
$C_{i\text{-}air\text{-}y}$ = indoor air concentration of compound i for sample y (ug/m^3)
$A_{floor\text{-}y}$ = surface area of building floor represented by sample y (m^2)
$C_{i\text{-}air\text{-}z}$ = indoor air concentration of compound i for sample z (ug/m^3)
$A_{floor\text{-}z}$ = surface area of building floor represented by sample z (m^2)
A_{bldg} = total surface area of building floor (m^2)

References

Air/Superfund National Technical Guidance Study Series. Volume 2 Estimation of Baseline Air Emissions at Superfund Sites (Revised), Radian Corporation, Austin, TX, Prepared for Environmental Protection Agency, Research Triangle Park, NC, August 1990, PB90-270588.

Compendium Method TO-15, "Determination of Volatile Organic Compounds in Ambient Air using Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry", US EPA, January, 1997.

Figure 13-1
Schematic of Isolation Flux Chamber Sampling System

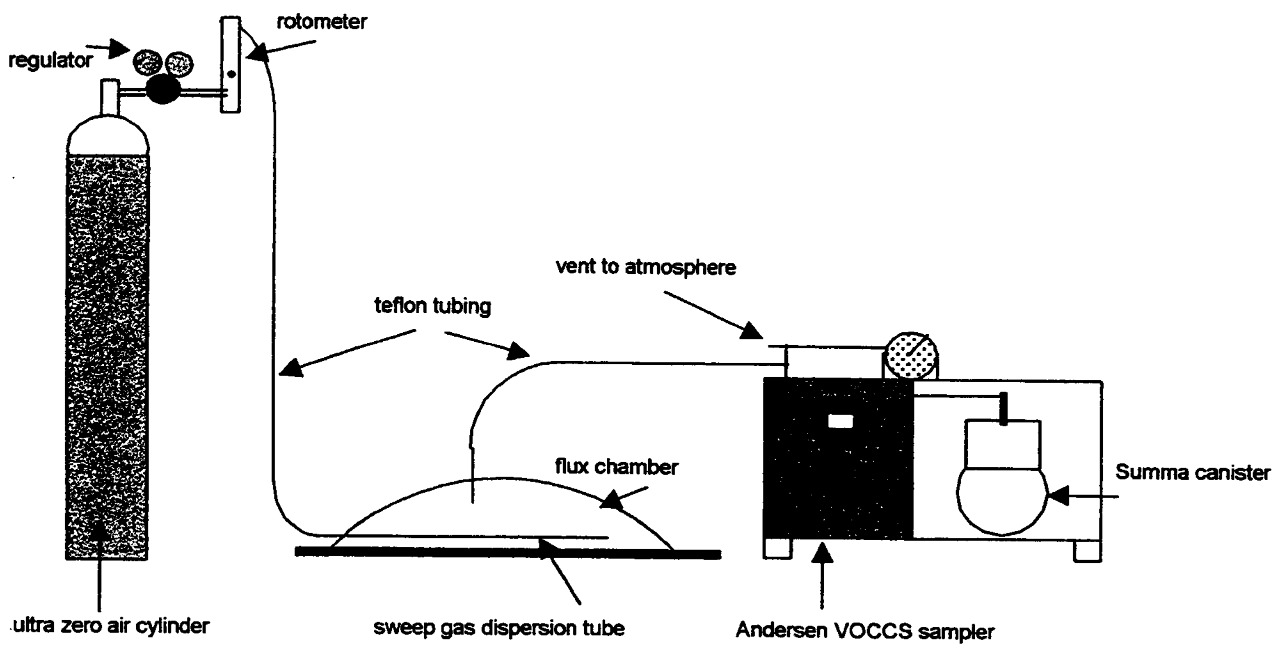


Figure 13-2

Isolation Flux Chamber Specification

Flux Chamber Specifications

dimensions

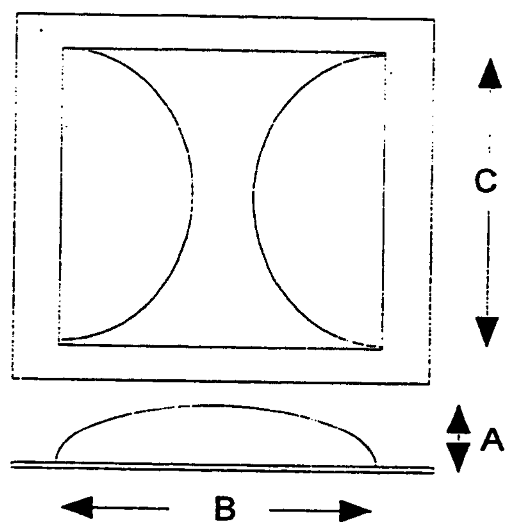
	inches	meters
A - height	3.9	0.1000
B - width	19.7	0.5000
C - length	19.7	0.5000

surface area

sq inches	sq feet	sq meters
387.5	2.69	0.250

volume

cu inches	cu feet	cu meters
762.6	0.8826	0.0125



EPA Method TO-14A Target Analyte List

1. Freon-114
2. Dichlorodifluoromethane
3. Chloromethane
4. Vinyl Chloride
5. 1,3-Butadiene
6. Bromomethane
7. Chloroethane
8. Trichlorofluoromethane
9. 1,2-Dichloroethene
10. Methylene Chloride
11. Freon-113
12. 1,1-Dichloroethane
13. trans-1,2-Dichloroethene
14. cis-1,2-Dichloroethene
15. Chloroform
16. 1,2-Dichloroethane
17. Trichloroethene
18. 1,1,1-Trimethylbenzene
19. Benzene
20. Carbon Tetrachloride
21. 1,2-Dichloropropane
22. cis-1,3-Dichloropropane
23. trans-1,3-Dichloropropane
24. 1,1,2-Trichloroethane
25. Toluene
26. 1,2-Dibromomethane
27. Tetrachloroethane
28. Chlorobenzene
29. Ethylbenzene
30. m&p-Xylenes
31. Styrene
32. 1,1,2,2-Tetrachloroethane
33. o-Xylene
34. 1,3,5-Trimethylbenzene
35. 4-Ethyltoluene
36. Benzyl Chloride
37. 1,2,4-Trimethylbenzene
38. 1,3-Dichlorobenzene
39. 1,4-Dichlorobenzene
40. 1,2-Dichlorobenzene
41. 1,2,4-Trimethylbenzene
42. Hexachlorobutadiene

Flux Chamber Sampling Data Sheet

Project No: ______________________________ Location: ______________________________________

Client: ____________________ Setup Date/Time: ___________ Recov. Date/Time: _________

Setup Temp: ______________ deg F Setup Pres: __________ in Hg

Recov. Temp: _____________ deg F Recov. Pres: __________ in Hg

Sampling Location Schematic (if applicable)

Sample Collection Data

Sample Type: ______________ Sampler ID: ____________ Start Time: ________ End Time: ______

Initial Canister Vaccuum: ____________________ Final Canister Pressure: _____________

Initial Elapsed Timer Reading: ____________ Final Elapsed Timer Reading: _______________

Sample ID: _____________ Elapsed Time: _____________ Sampler Flow: _____________ cc/min

Flux Chamber Data

Audit Gas Cylinder ID: ______________ Rotometer ID: ______ Initial Rotometer Reading: __________

Final Rotometer Reading: _______________ Avg Rotometer Reading: ___________

Flux Chamber ID: ______________ Avg Sweep Gas Flowrate: _____________ cc/min

Comments: ____

____

____

____

____

____

____

SAMPLE COLLECTION DATA SHEET

Date: ____________________ Run Number: ____________________

Client: ____________________ Location: ____________________

Project Number: ____________________ Ambient Temperature (F^o): ____________________

Operator: ____________________ Barometric Pressure (inches Hg): ____________________

Sample ID	Collection Media	Sample Location	Pump Number	Start Time	End Time	Elapsed Time	Avg. Std. Flowrate (cc/min)	Static Volume	Analytical Result

ENSR SOP

Instructions for Canister (SUMMA) Sampling with Soil Gas 2 Micron Filters

ENSR INTERNATIONAL
ENSR Consulting and Engineering
Air Toxics Specialty Laboratory
325 Ayer Road
Harvard, MA 01451

Phone: 978-772-2345

Instructions for Canister Sampling with Soil Gas 2 Micron Filters

1. Make sure green valve on canister is closed. (Either turned completely clockwise or for the toggle valves, the toggle should be flipped to a 90º angle to the canister.) The canisters are equipped with a stainless steel cap attached to a wired lanyard. The cap helps to maintain proper vacuum. Pressure of canister should be between –25" and –30" of Hg.

2. The soil gas adapters have a blue or yellow capped end (with an O-ring seal) as well as a ¼" female end. Remove the blue or yellow cap. Unscrew the canister cap and attach O-ring end of soil gas adapter to the top fitting on the canister. Make sure the O-ring does not fall off, as it ensures a tight seal. Tighten fittings with two adjustable wrenches.

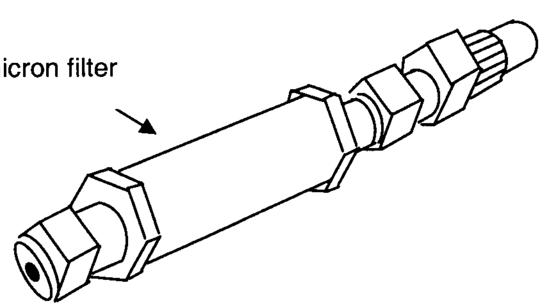
3. Attach ¼" nut to ¼" Teflon (or other appropriate) tubing. This tubing may be maneuvered down wells, probes or other specific sampling areas.

4. Attach the tubing with the ¼" nut to the soil gas adapter. Position the tubing to the appropriate sampling area and open the valve on the canister. The canister is under ~30"Hg vacuum, so you will hear the air rushing into the canister. When you no longer hear the air flowing into the canister, sampling is complete (process takes less than 1 minute). Close the valve on the canister (DO NOT OVERTIGHTEN VALVES) and remove the tubing/filter from the canister. **REATTACH THE CANISTER CAP.**

5. Please return all filters, fittings, tubing and caps provided by ENSR.

Capped end with O-ring attaches to canister

2 micron filter

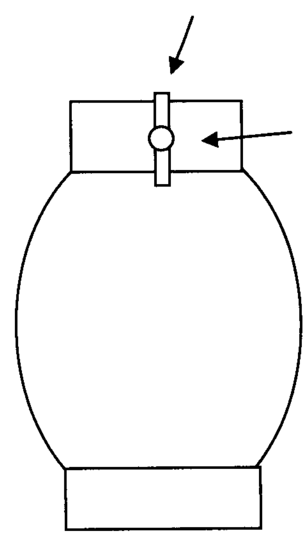


¼" female end

2 micron Filter

Attach filter here

On/Off valve



Canister

ENSR SOP

Instructions for Regulator and Canister (SUMMA) Use

ENSR INTERNATIONAL
ENSR Consulting and Engineering
Air Toxics Specialty Laboratory
325 Ayer Road
Harvard, MA 01451

Phone: 978-772-2345

Instructions for Regulator and Canister Use

1. Make sure green valve on canister is closed. (Either turned completely clockwise or for the toggle valves, the toggle should be flipped to a 90º angle to the canister.) The canisters are equipped with a stainless steel cap attached to a wired lanyard. The cap helps to maintain proper vacuum. Pressure of canister should be between –25" and –30" of Hg.

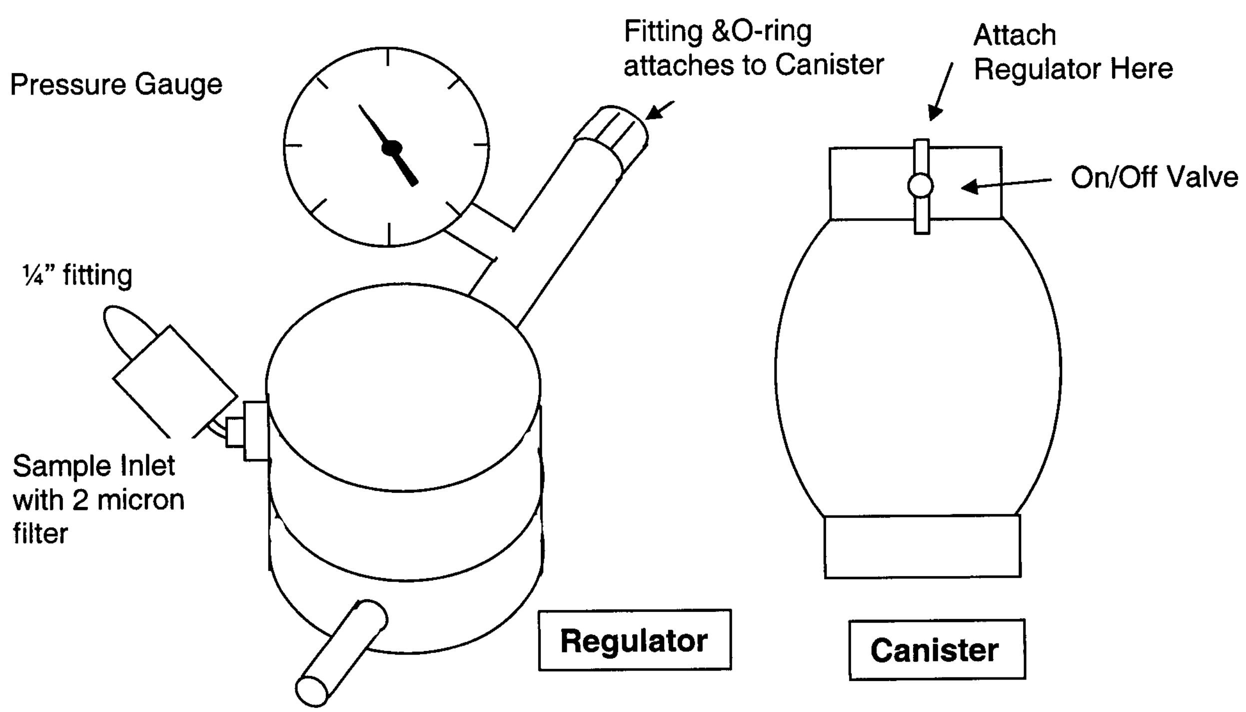
2. The regulator dial should read around zero (Some gauges may be slightly off of zero). One end of the regulator should have a ¼" opening at the end of a 2 micron filter. This is the sample inlet. The other exposed end (behind the pressure dial) of the regulator should have a blue or yellow plastic cap covering a male fitting with a black O-ring on the end. This is the fitting that attaches to the top of the canister. Make sure the O-ring does not fall off, as it ensures a tight seal.

3. Remove the canister cap and attach the regulator to the canister until it is finger tight. Then, using a 11/16" wrench, tighten the fitting until snug while the nut on the regulator is held using a 5/8" wrench (two adjustable wrenches are often more convenient to bring into the field).

4. Open the valve on the canister to begin sampling. The dial on the regulator should move down to around 25-30" Hg vacuum. As sampling progresses, the needle on the dial should move back closer to zero (ambient) pressure. Please note that some pressure gauges may not read exactly 30" Hg or zero. All regulators have been calibrated to your client specific flow rate before use in the field and have been certified acceptable by the ENSR laboratory. Do not leave canister sampling longer that the requested time. Sampling for an extended length of time may affect sample integrity.

5. When sampling is complete, close the valve on the canister (DO NOT OVERTIGHTEN VALVES), remove the regulator from the canister, and replace the blue/yellow cap over the fitting (check for O-ring). **REATTACH THE CANISTER CAP.**

6. Please return all caps along with the regulators and O-rings to the laboratory.



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Revision 1 01/16/04

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Appendix C

QUALITY ASSURANCE PROJECT PLAN

Former Ozone Industries, Inc. Site

NYSDEC Site # 2-41-033

Order on Consent Index # W2-0922-02-05 (with Endzone, Inc.)

Queens, New York

ENSR Corporation
May 14, 2004
Project No. 08734765

CONTENTS

TABLES

FIGURES

APPENDICES

1.0 PROJECT ORGANIZATION

This Quality Assurance Project Plan (QAPP) is an attachment (Appendix C) to a revised Remedial Investigation and Feasibility Study (RI/FS) Work Plan that has been prepared by ENSR Corporation for an area located within a city block in Ozone Park, Queens, New York that is bounded by 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south (Site) in accordance with the Order on Consent between the New York State Department of Environmental Conservation (NYSDEC) and Endzone, Inc., with an effective date of February 15, 2003. This RI/FS also pertains to areas in the vicinity of the Site, referred to as Site vicinity. The investigation is intended to further evaluate the presence of volatile organic compounds (VOCs) in soil, soil gas and groundwater at the Site and Site vicinity.

The original RI/FS Work Plan has been revised following written comments from the NYSDEC in a letter dated December 22, 2003 and subsequent telephone conversations. The original RI/FS Work Plan was submitted to the NYSDEC on April 15, 2003. A copy of the NYSDEC review comment letter is attached in Appendix A of the Work Plan. The comments have been addressed and included in the revised RI/FS Work Plan as applicable. Also attached in Appendix A of the Work Plan, is a copy of the review comments by the NYSDEC with notes following each indicating how and where the comments are addressed in the revised RI/FS Work Plan if applicable.

This QAPP presents specific protocols for sample collection, handling, and storage, chain-of-custody, and laboratory and field analyses. The QAPP is intended to complement the Field Sampling Plan (FSP), creating a comprehensive Sampling and Analysis Plan (SAP) for the RI. Other portions of the RI/FS Work Plan, including the FSP are incorporated into the QAPP by reference. All QA/QC procedures will be structured in accordance with applicable technical standards and United States Environmental Protection Agency (USEPA) requirements, regulations, guidance, and technical standards. This QAPP has been prepared using the following documents:

- USEPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, March 2001.
- NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (DER-10 Guidance), December 2002.
- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846. Third Edition. May 1986, revised June 1997.
- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. EPA540/R-99/008. October 1999.

- USEPA Region 2, SOP HW-24, Standard Operating Procedure for the Validation of Organic Data Acquired Using SW-846 EPA Method 8260B. Rev. 2. December 1996.

1.1 Key Personnel

The **NYSDEC Project Manager** will be the point of contact at NYSDEC and will have overall responsibility for all phases of the project under NYSDEC's oversight.

The New York State Department of Health (**NYSDOH) Project Manager** will be the point of contact at NYSDOH and have overall responsibility for all phases of the project under NYSDOH oversight.

The **Endzone Inc. Project Manager** will be responsible for overall project direction and decisions concerning technical issues and strategies, procurement and oversight of contractors, and final review of project plans and reports.

The **Consultant Project Manager** will be responsible for technical, financial, and scheduling matters. Responsibilities will include subcontractor procurement, assignment of project staff, review and approval of project deliverables, maintenance of project records, and communication with the client and field personnel. The Consultant Project Manager will also be the primary point of contact with NYSDEC and NYSDOH.

The **Consultant Field Team Leader** will have overall responsibility and authority for the various field activities. The Field Team Leader will be responsible for coordinating and managing the field sampling team and subcontractors. The Field Team Leader will report directly to the Project Manager.

A **Field Team** consisting of at least two people will be used (when necessary) during the RI field activities. The team will coordinate directly with the Field Team Leader and Project Manager.

The **Site Safety Officer** will be responsible for training and monitoring site conditions. The SSO will report directly to the Project Manager and work closely with the Field Team Leader. Depending upon the field work, the SSO may be the Field Team Leader.

The **Consultant Project Quality Assurance (QA) Officer** will be responsible for ensuring that all field work performed by the consultant or their subcontractors is being conducted in accordance with the FSP. The Project QA Officer will be responsible for conducting on-site and laboratory audit(s), if necessary, and reporting of deficiencies. The Project QA Officer will also be responsible for validating the analytical data. The Project QA Officer will report directly to the Project Manager. The resume of the proposed Project QA Officer is attached in Appendix A.

The **Consultant Data Manager** will be responsible for developing and implementing project-specific procedures to track, store, verify, and load the data collected during the field and analytical programs. The Data Manager will report directly to the Project Manager.

The **Laboratory Manager** will be responsible for the data produced by the laboratory. Specific responsibilities will include implementing and adhering to the laboratory's QA policies and procedures, maintaining adequate staffing and facility resources, and ensuring that corrective actions are implemented as needed.

The **Laboratory QA Manager** will be responsible for issuing and approving laboratory QA documents, assessing QA implementation within the laboratory, assisting in maintaining regulatory compliance, and performing QA assessments.

The **Laboratory Project Manager** will be the primary point of contact between the laboratory and Project Consultant. The Laboratory Project Manager will be responsible for monitoring project-specific analytical and QA requirements, keeping the laboratory and client informed of project status, and reviewing data packages for completeness and compliance to project requirements.

1.2 Special Training

This investigation includes no non-routine field sampling techniques, field analyses, or data validation.

Specialized training for field sampling, field analysis, and data validation is not required. However, prior to starting work, personnel will be given instruction specific to the project, covering the following areas:

- Organization and lines of communication and authority,
- Overview of the Work Plan,
- QA/QC requirements,
- Documentation requirements, and
- Health and safety requirements.

Instructions will be provided by the Consultant Project Manager, Consultant Field Team Leader, and Consultant Project QA Officer.

2.0 PROJECT BACKGROUND

2.1 Site Description and History

The Site is located between a block that is bounded by 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south, and is beneath an abandoned elevated Long Island Railroad. Ozone Industries, Inc. rented/operated for storage purposes a portion of the Site for a period prior to 1998, possibly starting as early as 1961. During that period, a portion of the Site was used to store solvents, hydraulic fluids, and scrap metal chips in roll-off containers that resulted from Ozone Industries, Inc. manufacturing activities. The portion of the Site utilized by Ozone Industries, Inc. was constructed of cinder block walls, and contained a dirt floor. During that period it is believed that releases of solvents, oil and/or fluids which coated the metal chips may have occurred at the Site. The nature and extent of those releases is not presently known. At the property across 100th Street from the Site, Ozone Industries, Inc. manufactured aircraft parts including landing gears, hydraulic assemblies, aircraft steering wheel assemblies, flight controls, etc.

2.2 Conceptual Site Model

The Site vicinity is characterized by the presence of certain VOCs (primarily trichloroethene [TCE]) above potentially relevant regulatory criteria in groundwater. Based on the site characterization information obtained to date, a preliminary conceptual site model (CSM) has been developed that presents potential sources of contamination, pathways and receptors.

The primary potential source of constituents to environmental media and potential receptors at the Site includes historical handling and storage at the Site of solvents, hydraulic fluids, and scrap metal chips in roll-off containers that resulted from former Ozone Industries, Inc. manufacturing activities.

Based upon the groundwater flow direction (south across the Site vicinity) and distribution of TCE in groundwater, the most TCE-impacted area is located in the vicinity of the Site, potentially a result of the storage and handling practices at the Site. The highest TCE level in groundwater was detected at GP-11 near the Site (22,000 ug/l). Many of the higher levels detected in the Site vicinity were between 1,000 ug/l and 3,000 ug/l, detected in samples from near the Site and south of the Site. It is not clear if other sources of TCE and/or chlorinated VOCs are present south of the Site.

Data are being collected as part of this RI in part to further assess what pathways are complete, and if so, what potential there is for impacts to receptors. The CSM will be further refined in the RI with a focus towards these potentially complete pathways and receptors, as follows.

Human receptors/pathways to be evaluated during the RI/FS include:

- Potential migration of vapors from impacted groundwater to indoor air; and

- Exposure to potentially contaminated soil at the Site.

Currently, no ecological receptors/pathways will require evaluation during the RI/FS.

2.4.1 Data Gaps

Data gaps to be further investigated as part of the RI/FS include:

- Soil conditions (i.e. contaminant concentrations) at the Site;

- Subsurface soil gas conditions to evaluate the potential migration of vapors from impacted groundwater and soil to indoor air;

- Groundwater and soil conditions, shallow and deep near the Site and location GP-11;

- Refinement of the groundwater monitoring well network to supplement previously estimated groundwater flow directions and to provide additional information on groundwater contaminant levels; and

- Identify other potential source areas that may be contributing to groundwater contamination (with installation of cross-gradient and upgradient monitoring wells, as discussed below, and possible collection of additional history and use information for other properties in the Site vicinity and/or bays at the Site).

3.0 PROJECT DESCRIPTION

3.1 Task Description

The tasks that will be implemented during the RI/FS are summarized below. Additional details regarding the field sampling activities are provided in the FSP. Sampling locations are shown on Figures 3 and 4 attached to the RI/FS Work Plan.

The RI/FS will consist of the following activities:

- Surface (if applicable) and Subsurface Soil Investigation;
- Subsurface Soil Vapor Investigation;
- Groundwater Investigation;
- In-Situ Hydraulic Conductivity Testing;
- Site Survey;
- Progress Reports;
- Phase Reports/Additional FFI Work Plan(s) (as appropriate); and
- RI/FS Report.

In accordance with the Consent Order, the RI Report will include the data generated and other information obtained during the RI, a listing of any additional data that must be collected, and certification that the RI activities were completed in accordance with the NYSDEC-approved RI/FS Work Plan, FSP, and QAPP.

4.0 DATA QUALITY OBJECTIVES

4.1 Project Quality Objectives

The project objectives are to address data gaps and to complete characterization of soil and groundwater in the investigation areas. The data collected during the RI will be integrated with existing data collected as part of work previously completed for NYSDEC and used for feasibility study and risk evaluation purposes. Therefore, the sampling and analysis program has been based on:

- A sampling protocol designed to obtain sufficient data to characterize the media of interest in the investigation areas;
- The use of sample collection and handling procedures that will ensure the representativeness and integrity of the samples; and
- An analytical program designed to generate definitive data of sufficient quality and sensitivity to meet the project objectives. Comprehensive data deliverables will allow validation of the data and reproduction of the reported results.

The design of the RI was based on the data quality objectives (DQO) process, a multi-step, iterative process that ensures that the type, quantity, and quality of environmental data used in decision making is appropriate for its intended application. This process is summarized below.

4.1.1 Problem Definition and Decision Identification

The tasks to be conducted at the Site include soil gas, soil and groundwater contaminant delineation, testing soil hydraulic conductivity and determining groundwater level measurements. The data collected under these tasks will be used:

- To determine the extent and level of VOC contamination in soil gas, soil and groundwater;
- To determine groundwater flow; and
- To provide information for remedial design.

4.1.2 Inputs to the Decision

The inputs to the decisions will include:

- Sample collection records and analytical results for soil gas, soil and groundwater samples,

- Field measurements (water levels, water quality parameters, and soil VOC headspace), and
- Sample locations.

4.1.3 Study Boundary Definition

The study boundaries are limited to the Site described above and the Site vicinity as defined in the Work Plan. The study area is depicted on Figures 3 and 4 attached to the RI/FS.

4.1.4 Decision Rules and Decision Error Limits

If concentrations of constituents of interest are detected in soil and groundwater, the data will be compared to the standards listed in Table 8-1. Results that exceed the standards may warrant further action.

The data will be considered acceptable if they are collected according to the RI Work Plan and FSP and meet the appropriate data validation criteria. Validation criteria are presented in Section 4.2 and the validation guidelines cited in Section 17.2.2.

4.1.5 Optimization of Study Design

Achievement of the objectives listed in Section 4.0 has been maximized by designing a program that incorporates chemical analysis of soil gas, soil and groundwater and field measurements (e.g., VOC headspace in soil, and water levels). However, as stated in the DQO guidance, optimization of study design may be an iterative process. It is possible that field conditions encountered during the RI will entail changes to the proposed scope (e.g., relocation of sampling points). All reasons for changes will be documented and communicated as described in Section 15.0, Corrective Action.

4.2 Measurement Performance Criteria

4.2.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement.

Field Precision Objectives: Field precision will be assessed by the collection and analysis of field duplicate samples and will be expressed as relative percent difference (RPD). The equation for this calculation is presented in Section 14.4.2.1 of this QAPP.

Field duplicate samples will be collected at a frequency of one for every 10 analytical samples, or Sample Delivery Group (SDG), whichever is less. Field duplicates for solid samples should have an RPD of less than or equal to 50%; field duplicates for aqueous samples should have an RPD of less than or equal to 30%.

Laboratory Precision Objectives: Precision in the laboratory is assessed by calculating the RPD for matrix spike/matrix spike duplicates (MS/MSDs). The equation for this calculation is presented in Section 14.4.2.1. The acceptance criteria for precision for this project will be the control limits established by the laboratory at the time the analyses are performed.

4.2.2 Accuracy

Accuracy is the degree of agreement between the observed value and an accepted reference or true value.

Field Accuracy Objectives: The achievement of accurate data in the field will be addressed through the use of procedures that minimize bias, the calibration of field instruments, and adherence to sample holding times and preservation requirements. Accuracy in the field will be evaluated through the use of trip blanks, and equipment rinsate blanks. Accuracy objectives for trip blanks and equipment rinsate blanks are given in Section 9.1.2.

Laboratory Accuracy Objectives: Laboratory accuracy will be expressed as percent recoveries and will be determined through the analysis of matrix spikes, laboratory control samples (LCSs), and surrogate compounds, and the subsequent determination of percent recoveries (%Rs). The equation that will be used to calculate percent recovery is included in Section 14.4.2.2. Accuracy objectives will be the control limits established by the laboratory at the time the analyses are performed.

4.2.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan were implemented as planned. The equation for completeness is presented in Section 14.4.1.

Field Completeness Objective: Field completeness will be measured on the basis of comparing the number of valid samples collected to those proposed in the FSP. The objective for field completeness is greater than 90%.

Laboratory Completeness Objective: Laboratory completeness will be measured by the number of valid measurements obtained compared to the number of valid samples submitted. The completeness objective for the laboratory is greater than 95%.

4.2.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Measures to Ensure Representativeness of Field and Laboratory Data: Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and proper laboratory protocol. The rationale of the sampling program is discussed in the FSP. Representativeness will be satisfied by ensuring that the FSP is followed, proper sampling techniques are used, proper analytical procedures are followed, and holding times of the samples are not exceeded in the laboratory.

4.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another.

Measures to Ensure Comparability of Field and Laboratory Data: The extent to which existing and planned data will be comparable depends on the similarity of methods. The procedures used to obtain the planned data, as documented in this QAPP, are expected to provide comparable data. Any changes in procedures or QA objectives, however, may affect data comparability.

Comparability will be maximized by the use of standard operating procedures (SOPs) throughout the project; by the recording of data in a standardized format; by the use of recognized, USEPA methods; and by the reporting of data in appropriate, consistent units.

5.0 DOCUMENTATION AND RECORDS

Project records are necessary to support the validity of the work, to allow it to be recreated if necessary, and to furnish documentary evidence of quality. The evidentiary value of data is dependent upon the proper maintenance and retrieval of quality assurance records. Therefore, procedures are established to assure that all documents attesting to the validity of work are accounted for when the work is completed.

Records must be legible, filled out completely, and adequately identified as to the item or activity involved. Records are considered valid only if initialed, signed, or otherwise authenticated and dated by authorized personnel. These records may either be originals or reproduced copies.

5.1 Project Files

The project files will be the central repository for all documents, which constitute evidence relevant to sampling and analysis activities as described in this QAPP. Each of Endzone, Inc.'s contractors will be the custodian of the project files relevant to their respective tasks and will maintain the contents of the project files for the investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews.

The project files will include at a minimum:

- Proposals;
- Contracts and purchase orders;
- Correspondence, including incoming and outgoing letters, memoranda, emails, and telephone records;
- Reference materials;
- Field logbooks;
- Field data and data deliverables;
- Photographs;
- Drawings and maps;
- Sample collection logs;
- Laboratory data deliverables;
- Data validation reports;

- Data assessment reports;
- Progress reports, QA reports, interim project reports, etc.; and
- All custody documentation (tags, forms, airbills, etc.).

Records will be retained according to the document control policies of each of the respective contractors.

5.2 Field Records

Field logbooks will provide the means of recording the data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the site could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks that have been logged in and assigned a unique QA/QC ID number. Logbooks will be maintained by the Field Team Leader until archived. Each logbook will contain the name of the person to whom the logbook is assigned, the logbook number, project identification, and project start and end dates. Entries into the logbook will include the date, start time, weather, and names of all sampling team members present. The names of visitors to the site, and the purpose of their visit, will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. A detailed description of the sampling location, including compass and distance measurements, will be recorded. The number of photographs taken of the sampling location, if any, will be noted. All instruments used to make measurements will be identified, along with the date of calibration. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers.

Standard forms will be used to record data. Examples of the types of logs to be used include:

- Boring log;
- Monitoring well construction log;
- Monitoring well development log;
- Water quality parameter instrument log;
- Water level record;
- Soil, soil gas and groundwater sample collection records; and
- Chain-of-custody form

Logs will include entries in every blank, with appropriate use of the abbreviations NA (not applicable) and NR (not recorded). All "NR" entries should be accompanied by an explanation. All entries will be recorded in waterproof ink, or in pencil if cold weather prevents the use of ink, and signed and dated by the person making the entry. No erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, the correct entry recorded, and the change initialed and dated by the person making the correction.

5.3 Laboratory Records and Deliverables

Laboratory data reduction procedures will be performed according to the following protocol. All information related to analysis will be documented in controlled laboratory logbooks, instrument printouts, or other approved forms. All entries that are not generated by an automated data system will be made neatly and legibly in permanent, waterproof ink. Information will not be erased or obliterated. Corrections will be made by drawing a single line through the error and entering the correct information adjacent to the cross-out. All changes will be initialed, dated, and, if appropriate, accompanied by a brief explanation. Unused pages or portions of pages will be crossed out to prevent future data entry. Analytical laboratory records will be reviewed by the supervisory personnel on a regular basis, and by the Laboratory QA Manager periodically, to verify adherence to documentation requirements.

Data deliverables will be provided within standard turnaround time (i.e., 3 weeks). The laboratory will provide at least one copy of hard copy report and one copy of an electronic diskette deliverable (EDD). The EDD will be provided in a mutually-agreeable format (e.g., EQuIS). The hard copy data package will be equivalent to ASP Category B deliverable, i.e., consisting of all the information presented in a Category B package, including Category B-like summary forms.

6.0 FIELD SAMPLING ACTIVITIES

The following activities will be implemented during the RI field tasks:

- Soil gas sampling;
- Drilling and subsurface soil sampling;
- Groundwater sampling during completion of soil borings;
- Monitoring well installation and development;
- Water level measurements;
- Groundwater sampling from monitoring wells; and
- Surveying.

Sampling locations and the rationale for collecting the samples are provided in Section 3.0 of the Work Plan and Section 2.0 of the FSP. All soil and groundwater samples will be submitted for analysis of Target Compound List (TCL) VOCs. In addition, surface soil samples may be collected and analyzed for semivolatile organics (SVOCs) and RCRA metals.

6.1 Sampling Procedures

During implementation of the RI soil and groundwater will be collected. Sampling will be conducted in accordance with the procedures described in the following sections of the RI/FS Work Plan and the FSP:

Sample Matrix	Work Plan Section(s)	FSP Section(s)
Soil Gas	3.1	3.2
Soil	3.2	3.3
Groundwater	3.3	3.3

Applicable SOPs for the RI field tasks (included as attachments to the FSP) will be followed to ensure that each sample collected is representative of the conditions at that location, and that the sample is neither altered nor contaminated by the sampling and handling procedures. A detailed description of the specific procedures to be followed during these field activities is provided in the FSP. In order to ensure their integrity, all samples will be handled in a manner consistent with the sample container, preservation, and holding time requirements specified in Section 6.3.

6.2 Decontamination Procedures

All non-dedicated equipment used in the field activities at the site will be cleaned before and after sample collection. Cleaning of equipment is performed to prevent cross-contamination between samples and to maintain a clean working environment for all personnel. All down-hole boring equipment will be steam cleaned between sampling location. General procedures for equipment decontamination are described in the applicable SOP included in Appendix A of the FSP. Decontamination procedures for the sampling equipment are:

- Clean equipment with tap water and a laboratory grade non-phosphate detergent;
- Rinse thoroughly with tap water;
- Rinse with pesticide-grade methanol;
- Rinse thoroughly with deionized (DI) water;
- Air dry; and
- Wrap in aluminum foil if the equipment will be stored or transported.

6.3 Sample Containers, Preservation, and Holding Times

The laboratory will provide sample bottles and chemical preservatives. The containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest USEPA *Specifications and Guidance for Contaminant-Free Sample Containers*. Certificates of analysis will be provided with each lot of containers and kept on file at the laboratory to document conformance to USEPA specifications.

A summary of sample container, preservation, and holding time requirements is presented below

Sample Matrix	Parameter	Container and Preservation	Holding Time
Soil	VOCs	3 EnCores; chill, 4°C	48 hours from collection to preservation in MeoH and sodium bisulfate; 14 days from preservation to analysis
	SVOCs (Surface soil only)	8 oz. wide mouth glass jar	14 days to extraction; 40 days from extraction to analysis

Sample Matrix	Parameter	Container and Preservation	Holding Time
Soil	RCRA Metals (Surface soil only)	4 oz. wide mouth glass or plastic jar	28 days – mercury; 6 months all others
	% Solids	2-oz plastic or glass; chill, 4°C	None specified
Groundwater	VOCs	3 40-mL VOA vials; no headspace; pH<2 with HCl; chill, 4°C	14 days
Soil gas	VOCs	Summa canister	30 days

7.0 SAMPLE HANDLING AND CUSTODY

7.1 Chain of Custody

Documentation of custody is one of several factors that are 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. A sample is considered to be in a person's custody if:

- It is in the actual possession of an authorized person or it is in the view of an authorized person, after being in his or her possession;
- It was in the actual physical possession of an authorized person and then was locked or sealed to prevent tampering; or
- It is in a secure area.

7.2 Field Custody Procedures

The field samplers will be personally responsible for the care and custody of the samples until they are transferred or dispatched properly. As few people as possible should handle the samples.

7.2.1 Sample Labeling Procedures

All sample containers will be labeled with a unique sample identifier. The sample identification code will consist of up to seven characters, as described below. Any other pertinent information regarding sample identification will be recorded in the field logbooks or on sample log sheets.

The first three characters to indicate the area from which the sample is to be collected:

- Site - S
- Site Vicinity – SV and Street Number

Two characters to indicate the sample matrix type:

- Subsurface soil – SB
- Surface soil - SS
- Groundwater – GW
- Soil gas – SG
- Ambient air - AA

Two to three characters to indicate the location and/or depth of the sample. Two characters will be used to indicate the location of samples collected from all media types. An additional character (third) may be needed to further identify the depth (e.g., A = shallow; B, C = increasing depth). The actual location ID and depth in feet will be recorded in the field records and will be cross-referenced to the sample identifier.

A dash (-)

The last character indicates the sample type as follows:

- A = Investigative sample;
- B = Field duplicate; and
- C = Equipment rinsate blank.

Samples collected for MS/MSD will have the designation “MS/MSD” noted in the “remarks” section of the chain-of-custody. Trip blanks will be identified by the date in the format mm-dd-yy (e.g., 040503), preceded by a “TB”.

Pre-affixed labels will be completed for each sample with the site name, sample collection date and time, analysis requested, and preservative (if any) and will be initialed by the sample collector. Waterproof ink will be used unless prohibited by weather conditions. If waterproof ink cannot be used, pencil may be substituted; however, the logbook must contain an explanation.

The Field Team Leader will review field activities to determine whether proper custody procedures were followed during the field work and will decide if additional samples are required.

7.2.2 Transfer of Sample Custody and Shipment Procedures

Samples will be accompanied by a properly completed chain-of custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date and note the time on the record. This record documents the transfer of custody of samples from the sampler, to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage location. An example chain-of-custody form is presented in Figure 7-1.

Information recorded on the chain-of-custody record, in addition to the signatures and dates of all custodians, typically includes:

- Client/project name;
- Project location;
- Project number;

- Field logbook number;
- Chain-of-custody tape number;
- The person to whom results should be reported to;
- Field sampling number/identification;
- Sampling date and time;
- Type of sample (grab or composite);
- Identification of sample collector and his/her affiliation;
- Sample container number, size, and material;
- Sample description (matrix);
- Sample preservative; and
- Analyses to be performed.

Whenever samples are split with another party, such splitting will be noted in the "Remarks" section of the chain-of-custody form. The note will indicate with whom the samples were split and will be signed by both the sampler and representative of the appropriate party. If a representative is unavailable or refuses to sign, this will be noted in the "Remarks" space. When appropriate, as in the case where the representative is unavailable, the custody record should contain a statement that the samples were delivered to the designated location at the designated time.

Samples will be shipped via overnight courier daily from the field to the laboratory as needed to meet sample holding times. Samples will be packaged properly and be accompanied by a separate signed chain-of-custody record identifying the contents in each sample cooler.

7.3 Laboratory Custody Procedures

The Laboratory Sample Custodian will be responsible for receiving the samples and logging them in. On arrival at the laboratory, all samples will be inspected thoroughly to confirm that the integrity of the samples and containers has not been compromised. The cooler custody seals will be inspected to verify that they are still intact and were properly signed and dated by the field sampling team. The individual sample containers will be inspected to verify that each has a sample label. The temperature of the cooler will be measured to determine if the temperature required by the requested testing program has been maintained during shipment. The cooler temperature and the condition of the samples will be noted on the chain-of-custody form or on a laboratory approved worksheet.

The sample containers will be checked against the accompanying chain-of-custody to verify that the cooler contents are identical to the samples described on the chain-of-custody documents and that holding times have not been exceeded. If discrepancies exist, they will be reported to the Laboratory Project Manager, who will immediately notify the Project QA Officer. The problem will be resolved, in writing before the samples are logged in.

After the Sample Custodian has determined that the samples are in satisfactory condition and the documents are in order, each sample will be assigned a unique laboratory identification number. A sample log-in sheet will be initiated and will serve as documentation as to the condition of the samples upon receipt and the cross-reference between field identification numbers and assigned laboratory numbers.

The samples will be entered into the laboratory information management system (LIMS). At a minimum, the following information will be entered: project name or identification, unique samples numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel. After the samples have been entered into the laboratory tracking system, copies of the log-in forms and chain-of-custody records will be sent to the Consultant Project QA Officer, who will verify that the specified samples and parameters correspond to the samples and parameters identified in the FSP. After verification, the completed chain-of-custody, waybills, and any additional documentation will be placed in the project file.

The samples will be placed in a secured storage area, under the conditions called for by the analytical method, until taken for analysis. The appropriate laboratory personnel will be notified of sample arrival. Samples removed from the secure area for preparation or analysis will be tracked using internal custody forms.

Samples delivered on Saturday will be received by the Sample Custodian and placed in a secure location until they can be logged in on the next business day. No samples will be delivered on Sunday.

Specific details of laboratory custody procedures for sample receiving, sample identification, sample control, and record retention are described in the laboratory's SOPs.

Figure 7-1 Example of Chain of Custody Form

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ENSR **CHAIN OF CUSTODY RECORD** Page ____ of ____

Client/Project Name:	Project Location:	Analysis Requested
Project Number:	Field Logbook No.:	
Sampler: (Print Name) /Affiliation:	Chain of Custody Tape No.:	
Signature:	Send Results/Report to:	

Field Sample No./ Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered							Lab I.D.	Remarks

Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	Analytical Laboratory (Destination):
Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	ENSR 4303 W. LaPorte Ave. Fort Collins, CO 80521 (970) 416-0916
Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	Serial No.

8.0 ANALYTICAL METHOD REQUIREMENTS

8.1 Soil and Groundwater

Soil and groundwater samples will be submitted to the laboratory for analysis of TCL VOCs as listed in Table 8-1. Analysis of soil samples will be conducted using SW-846 Methods 5035A/8260B. Aqueous samples will be analyzed using SW-846 Methods 5030B/8260B.

In addition, surface soil samples may be collected and analyzed for SVOCs by SW-846 Method 8270C and RCRA metals by SW-846 Methods 7471 (mercury) and 6010B (all others). Analyte lists and reporting limits will be established if the decision is made to analyze samples for these parameters.

Samples will be analyzed by a NYSDOH ELAP certified laboratory. The laboratory selected to perform the analyses of both soil and water samples is:

Columbia Analytical Services
1 Mustard Street
Suite 250
Rochester, NY 14609
(585) 288-5380

Analytical data will be reported according to the specifications of ASP Category B deliverables.

8.2 Soil Gas

Soil gas and ambient air samples in Summa canisters will be submitted to ENSR's Air Toxics laboratory for analysis of TCL VOCs as listed in Table 8-2, using EPA Method TO-15.

ENSR's Air Toxics Laboratory is a NYSDOH NELAC certified laboratory. The address and point of contact for the laboratory is:

ENSR Air Toxics Laboratory
325 Ayer Road
Harvard, MA 01451
(978) 772-2345
Attn: Ms. Alyson Fortune

A complete data package, including QC summary and all raw data will be reported with the results.

9.0 QUALITY CONTROL REQUIREMENTS

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results that are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, instrument calibration, laboratory analysis, reporting of data, internal QC audits, preventative maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the specific objectives of accuracy, precision, completeness, representativeness, and comparability. These terms are described below.

9.1 Field QC Requirements

9.1.1 Field Measurement

The QC level of effort for the field measurement of water quality parameters and total VOCs in soil headspace will include pre-operational calibrations and periodic calibration checks. The types of instruments that may be used to perform these measurements are identified in Section 10.1 of this QAPP. Initial calibrations and routine checks will be performed in accordance with the SOPs included in Appendix A of the FSP.

9.1.2 Field QC Samples

Equipment rinsate blank, trip blank, and matrix spike samples will be analyzed to assess the accuracy of the data resulting from the field sampling and analytical programs. Duplicate samples will be taken to evaluate the precision.

Equipment rinsate blanks are obtained under representative field conditions by running analyte-free deionized/distilled water (provided by the laboratory) through/over sample collection equipment after decontamination and prior to use, and placing it in the appropriate sample containers for analysis. These samples are used to assess the effectiveness of decontamination procedures. Rinsate blanks will be collected at a frequency of one for every 15 samples submitted to the laboratory for each piece of decontaminated equipment. No equipment rinsate blanks will be collected for disposable equipment (e.g., groundwater sampling tubing, GeoProbe liner). Equipment rinsate blanks should contain no target analytes above the quantitation limit.

Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be prepared in the laboratory by filling sets of 40-ml VOC vials with deionized water, sealing the vials with septum-lined caps (allowing no headspace), and shipping one set of vials from the laboratory with every sampling kit. The vials will remain in the shipping container from the time the sampling kit leaves the laboratory until it is received back from the field. Trip blanks will be required at a frequency of one set per daily shipment of soil and groundwater samples. Trip blanks should contain no VOC target compounds above the quantitation limit.

Matrix spikes provide information about the effect of the sample matrix on the preparation and measurement methodology. Matrix spikes are performed in duplicate and are hereinafter referred to as MS/MSD samples. For each matrix, one MS/MSD sample will be collected for every 20 samples or each SDG per sample matrix, whichever is less. Soil MS/MSD samples require the collection of double sample volume (i.e., six EnCores). Aqueous MS/MSD samples require triplicate volume. MS/MSD analyses are not applicable to soil gas and ambient air samples.

Field duplicate results are used to assess the combined field and laboratory precision. The results are anticipated to exhibit more variability than laboratory duplicates, which measure only laboratory precision. Duplicate samples will be collected by alternately filling sample containers from the source being sampled. Field duplicate samples will be collected at a frequency of one for every 10 samples collected or each SDG, whichever is less.

9.2 Laboratory QC Requirements

Each laboratory has a QA/QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical procedures are documented in writing as SOPs and each SOP includes the minimum requirements for the procedure. The internal QC checks for the analyses for this program include the following:

- Blanks (method, reagent/preparation, instrument);
- MS/MSDs (soil and groundwater);
- Laboratory duplicates (soil gas and ambient air);
- Surrogate spikes (soil and groundwater);
- LCSs;
- GC/MS tuning; and
- Internal standard areas (GC/MS analysis).

A summary of the QC checks is presented in the following table.

Parameter	QC Check	Frequencies	Control Limits	Laboratory Corrective Actions
VOCs by 8260B	Method blanks	One per 12 hour analytical shift of a similar matrix	No target analytes above PQL	Reanalysis of entire batch
	Surrogate spikes	Every sample, blank, standard	Per current laboratory limits.	Reextract or flag data
	MS/MSD samples	One pair per analytical batch	Per current laboratory limits.	Check LCS, reanalyze, flag results
	LCS	One per analytical batch	Per current laboratory limits.	Reanalysis of entire batch
	GC/MS tuning	At beginning of each 12 hour shift	Control criteria listed in SOP	Recalibrate instrument until control criteria are met
	Internal standards	Every sample, blank, standard prior to analysis	Area within 50-200% and RT within 0.5 min of IS in associated calibration standard	Reanalyze sample if no interference present
SVOCs by 8270C	Method blanks	One per extraction batch of 20 or fewer samples	No target analytes above PQL	Reextraction/reanalysis of entire batch
	Surrogate spikes	Every sample, blank, standard prior to extraction	Per current laboratory limits.	Reextract or flag data
	MS/MSD samples	One pair per analytical batch	Per current laboratory limits.	Check LCS, reanalyze, flag results
	LCS	One per analytical batch	Per current laboratory limits.	Reextraction/reanalysis of entire batch
	GC/MS tuning	At beginning of each 12 hour shift	Control criteria listed in SOP	Recalibrate instrument until control criteria are met
	Internal standards	Every sample, blank, standard prior to analysis	Area within 50-200% and RT within 0.5 min of IS in associated calibration standard	Reanalyze sample if no interference present
Metals by 7471/6010B	Method blanks	One per 12 hour analytical shift of a similar matrix	No target analytes above PQL	Reextraction/reanalysis of entire batch
	Laboratory duplicate	One per analytical batch	30% RPD	Flag results
	LCS	One per analytical batch	Per current laboratory limits.	Reextraction/reanalysis of entire batch
	MS samples	One per analytical batch	Per current laboratory limits.	Check LCS, reanalyze, flag results
VOCs by TO-15	Method blanks	One per 12 hour analytical shift of a similar matrix	No target analytes above PQL	Reextraction/reanalysis of entire batch
	Laboratory duplicate	One per analytical batch	30% RPD	Flag results
	LCS	One per analytical batch	Per current laboratory limits.	Reextraction/reanalysis of entire batch
	GC/MS tuning	At beginning of each 12 hour shift	Control criteria listed in SOP	Recalibrate instrument until control criteria are met
	Internal standards	Every sample, blank, standard prior to analysis	Area within 50-200% and RT within 0.5 min of IS in associated calibration standard	Reanalyze sample if no interference present

10.0 INSTRUMENT/EQUIPMENT CALIBRATION AND MAINTENANCE

Instruments used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Field instruments will be issued through a formal tracking system and operated by trained personnel, in accordance with the appropriate SOPs or manufacturer's specifications. Each instrument used in the field will be examined daily by the Field Team Leader or his/her designee to verify that it is operating properly.

10.1 Field Instrument Calibration

Field instruments for the RI field activities may include organic vapor monitors (e.g., photoionization detector [PID]), water level instrumentation, and water quality measurement instrumentation for turbidity, dissolved oxygen, specific conductivity, temperature, pH, and oxidation reduction potential. Calibration of all field instruments with the exception of the water level instrumentation and turbidity meter (turbidimeter), is governed by the SOPs included in the FSP. The water level instrumentation and turbidimeter meter will be calibrated according to the guidelines described below. The frequency of calibration for all instruments will be daily before initial use and at the end of each day.

Calibration procedures will be documented in the field records. Documentation will include the date and time of calibration, the identity of the person performing the calibration, the reference standard used, the readings taken, and any corrective action taken.

10.1.1 Turbidimeter

The turbidimeter will be checked against a known standard before being taken to the field. In the field the instrument will be checked each time it is turned on against a known formazine standard visually close to the anticipated turbidity of the samples (2, 19.8, or 198 NTUs). The calibration procedure is described below.

- Turn on the turbidimeter.
- Select a sample tube containing a standard with a value visually close to the anticipated samples.
- Clean the outside surface of the sample tube with a clean lint-free, absorbent wipe until the tube is dry and smudge free.
- Insert the sample tube into the turbidimeter chamber and cap the chamber; adjust the "Standardization" control so that the meter reads the known value of the chosen standard.
- Withdraw the standard.

- Set aside a sample of the liquid to be measured to equilibrate to ambient air temperature.
- Following equilibration, rinse a sample tube with the sample and fill the sample tube, taking care to pour the sample gently to avoid creating air bubbles.
- Cap the sample tube and, while holding the tube by the cap only, wipe the outside surface with a clean, lint-free, absorbent wipe until the tube is dry and smudge-free.
- Insert the sample tube into the turbidimeter chamber and cap the chamber; read the turbidity measurement as displayed.
- Remove the sample tube from the turbidity meter and rinse with distilled water.
- Recalibrate the meter daily, or if it starts giving erratic results.
- Check the calibration every 15 samples against the reference standard. Recalibrate the instrument if the meter value varies more than 10% from the reference standard.

10.1.2 Water Level Instrumentation

The electronic water level instruments are factory calibrated. Once in the field, the water level instruments should be checked against a manual water level measurement. The two readings should be within 0.1 ft. If this criterion is not met, the calculation for computing elevation should be adjusted to agree with the manual water elevation measurement. Periodic checks, at least at the beginning, middle, and end of the field program, should be performed using the same procedure.

10.2 Laboratory Instrument Calibration

Calibration is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet the detection limits established for the method. The analytical methodology described in Section 8.0 will be used to analyze the samples collected for this project. This method includes specific instrument calibration procedures and frequencies that will be followed by the laboratory. If an instrument has not been properly calibrated and the quality of the data has been adversely affected, the corrective actions outlined in the methodologies will be implemented.

Calibration procedures for laboratory instruments will consist of initial calibrations, initial calibration verifications, and continuing calibration verification. The SOP for each analysis performed in the laboratory describes the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration.

The laboratory maintains documentation for each instrument which includes the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions, and the samples associated with these calibrations.

10.3 Preventative Maintenance

10.3.1 Field Instruments

The field instrumentation for this project is listed in Section 10.1. Preventive maintenance will be performed according to manufacturer's instructions and applicable SOPs (see Appendix A of the FSP).

Instrument instruction manuals will be available on-site. Critical spare parts such as lamps, probes, and battery chargers will be kept on-site to minimize downtime.

10.3.2 Laboratory Instruments

To minimize downtime, preventive maintenance will be routinely performed on each analytical instrument. Analytical instruments will be maintained and serviced in accordance with the manufacturer's specifications, laboratory SOPs, and analytical methods. When repairs are necessary, they will be performed by either in-house trained personnel or the instrument manufacturer under service contracts and warranties. A log will be kept for each analytical instrument and will contain a record of all routine maintenance and repairs.

11.0 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

11.1 Field

Critical supplies for field activities will be tracked in the following manner.

Critical Supplies and Consumables	Inspection Requirements and Acceptance Criteria	Responsible Individual
Sample containers	Visually inspected upon receipt for cracks, breakage, and cleanliness. Must be accompanied by certificate of analysis.	Field Team Leader
Chemicals and reagents	Visually inspected for proper labeling, expiration dates, appropriate grades.	Field Team Leader
Field measurement equipment	Functional checks to ensure proper calibration and operating capacity.	Field Team Leader
Sampling equipment	Visually inspected for obvious defects, damage, and contamination.	Field Team Leader

Supplies and consumables not meeting acceptance criteria will initiate the appropriate corrective action. Corrective measures may include repair or replacement of measurement equipment, and/or notification of vendor and subsequent replacement of defective or inappropriate materials. All actions will be documented in the project files.

11.2 Laboratory

The laboratory system of inspection and acceptance of supplies and consumable is described in the laboratory Quality Manual.

12.0 NON-DIRECT MEASUREMENTS

Section 2.0 of the RI/FS Work Plan summarizes the regulatory events and investigations conducted to date at the facility. Where possible, the data collected under the RI will be integrated with existing data collected during previous sampling events. Data collected during previous investigations is expected to be of equivalent quality to that collected during the RI. In the event that previously collected data is determined to be of lesser quality, the data may be qualified and its use restricted.

The RI data necessary to meet the objectives specified in Section 4.0 of the QAPP will come from the following sources:

- Field records (sample locations, sample observations, sample collection information);
- Field measurements (water quality measurements, VOCs in soil headspace, and water levels); and
- Analytical results for chemical testing of soils and groundwater.

The data collected under this QAPP has been designed to be of sufficient quality to meet the program objectives.

13.0 DATA MANAGEMENT

The project data management process encompasses data acquisition in the field and laboratory, verification and validation procedures, transfer, handling, and storing, and data analysis.

13.1 Data Acquisition

13.1.1 Field Records

Data generated in the field will include, but not be limited to:

- Chronology of site activities;
- Water level measurements for groundwater;
- Monitoring well construction and development data;
- Water quality measurements of groundwater;
- VOC measurements in soil headspace;
- Soil cores logging data;
- Sample collection and handling information;
- Chain-of-custody records; and
- Vertical and horizontal survey data.

The format and content of these records is described in Section 5.2.

13.1.2 Laboratory

Laboratory deliverables will include hard copy data packages and electronic data deliverables (EDDs). Data recording requirements are described in Section 5.3 and in the individual laboratory SOPs. Deliverables will adhere to the format and content requirements described in Section 5.3.

13.2 Verification and Validation

13.2.1 Field

Field data verification and validation will be conducted as described in Sections 17.1.1 and 17.2.1. The Field Team Leader will be responsible for ensuring that field data are accurate and complete prior to submitting the records to the Consultant Data Manager for entry and/or storage.

13.2.2 Laboratory

All data will receive an internal review and verification by the laboratory prior to being released. Verification procedures are discussed in Section 17.1.2. An independent validation of the analytical data will be performed by the consultant. This validation will be performed and documented as described in Section 17.2.2.

13.3 Data Tracking and Control

Management of field data is described in Section 5.2. Laboratory data will be maintained according to laboratory policies and procedures, as described in the laboratory QA Manual. Copies of all field and laboratory data will be maintained in the project files as described in Section 5.1. The project files will be secured in a limited access area until ultimate delivery to Endzone, Inc.

13.4 Data Handling and Management

Field data will be recorded directly in logbooks or on standardized forms and will require no data reduction or transformation. Laboratory data will be reduced according to the equations in the analytical methodologies and/or laboratory SOPs.

All data entry performed by the consultant or its subcontractors will be proofed 100% for accuracy. Verification will be carried out either by manual proofing or by duplicate entry to detect discrepancies.

Data analysis will be performed in order to present the data in the RI Report in graphic and tabular formats. Examples of the types of information presented include maps and tables of constituent concentrations by location, groundwater flow maps and geologic cross sections. Field logs will be attached to the report as appendices. Additional information on the RI Report is included in Section 6.0 of the Work Plan.

14.0 ASSESSMENT AND RESPONSE ACTIONS

A technical system audit (TSA) is defined as a thorough, systematic, and qualitative evaluation of the components of a measurement system used in environmental data operations. A performance audit is a quantitative evaluation of the measurement system that requires testing of the system with samples of known composition or behavior to evaluate precision and accuracy.

14.1 TSAs

14.1.1 Field TSAs

There may be at least one internal audit of field activities conducted by the Consultant Project QA Officer or another qualified individual during the field sampling program. This audit would occur early in the field program to ensure the early detection and correction of deficiencies. The TSA will include examination of field sampling records, field measurement results, field instrument operating and calibration records, sample collection, handling, and packaging procedures, QA procedures, chain-of-custody, sample documentation, etc. Follow-up audits will be conducted if serious problems are encountered.

During the audit, the Consultant Project QA Officer will maintain a record of the audit with written field notes. Preliminary results of the audit will be reviewed with the Field Team Leader. Corrective action for deficiencies that adversely affect the quality of the data will be implemented immediately.

Upon completion of the audit, the Consultant Project QA Officer will develop an audit report that summarizes the audit findings and identifies those areas still requiring corrective measures. This report will be submitted to the Consultant Project Manager and the resolution of final action as described in Section 15.0 of the QAPP will be subsequently implemented.

14.1.2 Laboratory TSAs

An on-site audit of the laboratory may be conducted by the Consultant Project QA Officer or another qualified individual. This audit would be conducted after approval of the QAPP and in the early stages of the analytical work. The audit would include a review of the following areas:

- QA organization and procedures;
- Personnel training and qualifications;
- Sample log-in procedures;

- Sample storage facilities;
- Analyst techniques;
- Adherence to the QAPP;
- Compliance with QA/QC objectives;
- Adherence to laboratory SOPs;
- Instrument calibration and maintenance;
- Data recording, reduction, review, and reporting;
- Sample measurement; and
- Cleanliness and housekeeping.

Preliminary results of the audit will be discussed with the Laboratory Manager, the Laboratory Project Manager, and the Laboratory QA Manager. A report that identifies deficiencies and recommends corrective measures will be prepared and submitted to the Laboratory Manager for response. The results of the audit, including resolution of any deficiencies, will be included in the QA reports to management. Follow-up audits will be scheduled on an as-needed basis if serious deficiencies are noted during the initial audit.

14.2 Performance Audits

Performance audits are not applicable to the field portion of the project.

Within the analytical laboratory, performance audits involve the preparation and submittal of blind performance evaluation (PE) samples. This PE samples may be prepared internally as part of the QA Program or may be obtained from outside sources as part of a certification program. The laboratory will conduct PE sample analyses according to written protocols established by the laboratory QA Program. PE samples may be submitted for this project at the discretion of the Consultant Project Manager.

14.3 Data Package Audits

Audits of analytical data packages will be conducted for 100% of the packages received as part of the data validation process (Section 17.0). The review will include an evaluation of the package to ensure that (1) all required deliverables are provided, (2) the package contains the information necessary to reproduce the reported results, and (3) the QC acceptance criteria specified in the QAPP were met. Any deficiencies will be communicated to the laboratory and documented in the data validation reports.

14.4 Data Assessment Procedures

14.4.1 Field Measurements

Field data will be reviewed by the Field Team Leader for compliance with the RI FSP and QAPP. Accuracy and precision will be evaluated on the basis of daily instrument calibration, periodic calibration checks, and analysis of blanks. Completeness will be determined using the following equation:

$$\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100$$

14.4.2 Laboratory Data

Laboratory analytical results will be assessed for compliance with precision, accuracy, completeness, and sensitivity requirements as described in the following sections.

14.4.2.1 Precision

Precision of laboratory analyses will be assessed by comparing the analytical results between MS/MSD samples. The relative percent difference (%RPD) will be calculated for each pair of MS/MSD analyses using the following equation:

$$\%RPD = (S - D)/[(S + D)/2] \times 100$$

where S = original sample data
D = duplicate sample data

14.4.2.2 Accuracy

Accuracy of laboratory results will be assessed for compliance with the criteria established in Section 4.2.2 of this QAPP using the analytical results of method blanks, trip blanks, equipment blanks, and MS/MSD samples. The percent recovery (%R) of matrix spike samples will be calculated using the following equation:

$$\%R = (A2/A1) \times 100$$

where A2 = observed sample results
A1 = expected sample results

14.4.2.3 Completeness

The completeness of laboratory analytical results will be assessed for the amount of data required in Section 6.0 of this QAPP. The completeness will be calculated using the equation in Section 14.4.1 of this QAPP.

14.4.2.4 Sensitivity

The achievement of method detection limits depends on instrumental sensitivity and matrix effects. Therefore, it is important to monitor the data quality through constant instrument performance. The instrument sensitivity will be monitored through the use of method blanks, calibration check samples, laboratory control samples, etc., in accordance with the method listed in Section 8.0 of this QAPP. Method detection limits (MDLs) will be calculated according to 40 CFR Part 136 Appendix B. Sample results detected above the MDLs, but below the sample reporting limits, will be considered estimated and reported by the laboratory with a "J" qualifier.

15.0 CORRECTIVE ACTION

Corrective actions are defined as those measures taken to rectify a laboratory or field measurement system that exceeds its control limits. These actions may be initiated by any person performing work in support of the RI field activities. The need for corrective action may be identified by system or performance audits or by standard QC checks. The essential steps in the corrective action process are:

- Identifying, defining, and documenting the problem;
- Assigning responsibility for investigating the problem;
- Investigating and determining the cause of the problem;
- Determining a corrective action to eliminate the problem;
- Assigning and accepting responsibility for implementing the corrective action;
- Implementing the corrective action and evaluating its effectiveness;
- Verifying that the corrective action has eliminated the problem; and
- Documenting the verification of effectiveness.

15.1 Field Measurements/Sample Collection

Corrective action in the field may be needed when;

- The sample network is changed (i.e., more/less samples, sampling locations other than those specified in the FSP, etc.);
- Sampling procedures and/or field analytical procedures require modification due to unexpected conditions; or
- The integrity of field measurements or samples is in question.

The field team members will be responsible for identifying any suspected technical or QA deficiencies and reporting them to the Field Team Leader. The Field Team Leader will be responsible for assessing the suspected deficiency, for determining the impact on the quality of the data (in consultation with the Consultant Project QA Officer and Consultant Project Manager), developing the appropriate corrective action, and ensuring it is implemented.

If the corrective action augments the original scope of the RI Work Plan (i.e., increases the numbers or types of samples/analyses), and uses existing and approved procedures outlined in this QAPP, approval by the Field Team Leader and the Consultant Project Manager will be sufficient to implement the proposed action. If the corrective action results in a reduced scope of the work, significant alterations in sample locations, or major modifications to analytical methods, or causes the project data quality objectives not to be achieved, it will be necessary for all levels of project management to concur with the proposed action.

If problems with field measurements occur, corrective action may include:

- Repeating the measurement to check the error;
- Checking for all proper adjustments for ambient conditions (i.e. temperature);
- Checking equipment batteries or power sources;
- Recalibrating equipment;
- Checking instrument calibration;
- Replacing the instrument or piece of equipment; and
- Stopping work.

Deficiencies may also be noted during internal field audits (if completed). The Consultant Project QA Officer will identify the deficiencies and recommend the appropriate corrective action to the Project Manager. Upon his/her approval, the Field Team Leader and field team members will be responsible for implementing the corrective action. If the use of unapproved methods, or the improper use of approved methods, is adversely affecting the data, corrective action may be implemented immediately.

Corrective actions will be documented in the field records. Documentation will include:

- A description of the circumstance that initiated the corrective action;
- The action taken in response and the names of participants;
- The final resolution; and
- Any necessary approvals.

Corrective action resulting from internal field audits will be documented in QA reports to management (Section 16.0 of this QAPP). No staff member will initiate corrective action without prior communication of findings through the proper channels.

15.2 Laboratory Analyses

Laboratory personnel will be alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in quantitation limits;
- Deficiencies are detected by the QA department during internal or external audits or from the results of performance evaluation samples; or
- Inquiries concerning data quality are received.

Corrective action procedures may be handled at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors, check the instrument calibration, spike and calibration mixes, or instrument sensitivity. Corrective action will be in accordance with method protocol (when applicable). If the problem persists or cannot be identified, the matter will be referred to the laboratory supervisor, manager and/or QA department for further investigation. Once resolved, full documentation of the corrective action procedure, including approval by the appropriate management representative, will be filed with the laboratory QA department.

Corrective action in the laboratory may occur prior to, during, or after initial analyses. A number of conditions such as broken sample containers, multiple phases, low/high pH readings, and potentially high concentration samples may be identified during sample log-in or analysis. Following consultation with laboratory analysts and supervisory personnel, it may be necessary for the Laboratory QA Manager to approve the implementation of corrective action. If the nonconformance causes project objectives not to be achieved, the Consultant Project QA Officer will be notified.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in both the laboratory's corrective action files, and in the narrative data report generated by the laboratory. If the corrective action does not rectify the situation, the laboratory will contact the Consultant Project QA Officer, who will determine the action to be taken and inform the appropriate personnel.

15.3 Data Validation/Data Assessment

The need for corrective action may be identified during either data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team, whether the data to be collected are necessary to meet the required QA objectives, and physical limitations on the ability to recollect or reanalyze the sample.

The need for corrective action may be identified by the data validator or by a member of the project team assessing the data. The person responsible for identifying the corrective action situation will notify the Consultant Project Manager, who will be responsible for approving implementation of the corrective action. All corrective actions of this type will be documented by the Consultant Project QA Officer in the QA reports (Section 16.0).

16.0 REPORTS TO MANAGEMENT

QA reports will be submitted to the Consultant Project Manager to ensure that any problems identified during the sampling and analysis programs are investigated and the proper corrective measures taken in response. The QA reports may include:

- All results of field and laboratory audits,
- Problems noted during data validation and assessment, and
- Significant QA/QC problems, recommended corrective actions, and the outcome of corrective actions.

QA reports will be prepared by the Consultant Project QA Officer and submitted on an as-needed basis.

17.0 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

All data generated through field activities or the analytical program will be verified, reduced, and validated prior to reporting. No data will be disseminated by Endzone, Inc. or its contractors until it has been subjected to the procedures summarized below.

17.1 Data Verification

17.1.1 Field Data

Field records will be reviewed by the Consultant Field Team Leader to ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good recordkeeping practices, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the RI/FS Work Plan, and that any deviations were documented and approved by the appropriate personnel.

17.1.2 Laboratory Data

Prior to being released as final, laboratory data will proceed through a tiered review process. Data verification starts with the analyst who performs a review of the data to ensure the work was done correctly the first time. The data reduction and initial verification process must ensure that:

- Sample preparation and analysis information is correct and complete,
- Analytical results are correct and complete,
- The appropriate SOPs have been followed and are identified in the project records,
- Proper documentation procedures have been followed, and
- All nonconformances have been documented.

Following the completion of the initial verification by the analyst performing the data reduction, a systematic check of the data will be performed by an experienced peer or supervisor. This check will be performed to ensure that initial review has been completed correctly and thoroughly and will include a review of:

- Adherence to the requested analytical method SOP;
- Correct interpretation of chromatograms, mass spectra, etc.;
- Correctness of numerical input when computer programs are used (checked randomly);
- Correct identification and quantitation of constituents with appropriate qualifiers;
- Numerical correctness of calculations and formulas (checked randomly);
- Acceptability of QC data;
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.);
- Documentation of dilution factors, standard concentrations, etc.; and
- Sample holding time assessment.

The Laboratory Project Manager will perform a third-level review before results are submitted to clients. This review serves to verify the completeness of the data report and to ensure that project requirements are met for the analyses performed. A narrative to accompany the final report will be prepared by the Laboratory Project Manager.

17.2 Data Validation

17.2.1 Field Data

Field data will be reviewed daily by the Field Team Leader to ensure that the records are complete, accurate, and legible. Additionally, the Field Team Leader will check procedures used in the field, calibration of the field meters and instruments, verify the accuracy of transcriptions, and compare field data to historic measurements (if available).

17.2.2 Laboratory Data

The consultant will provide an independent validation of the laboratory data (performed by Consultant Project QA Officer). The elements reviewed during validation will be consistent with those necessary to develop a Data Usability Summary Report (DUSR) as described in Appendix 2B of the NYSDEC DER-10 Guidance. Specifically, these elements will include:

- Completeness of deliverable;
- Technical holding times;
- Laboratory and field blank contamination;
- Instrument tuning,
- Initial and continuing calibrations;
- Surrogate spike recoveries;
- MS/MSD recoveries and relative percent differences (RPDs);
- LCS recoveries;
- Field duplicates; and
- Conformance to method specifications.

Validation will be performed using the QC summary forms presented in the data package. A spot check of the raw data will be performed to ensure that the results in the raw data agree with the summary sheets.

Validation actions will be based on USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA 1999) and the USEPA Region 2 SOP HW-24 (December 1996). Qualifiers used will be from the USEPA Region II validation guidelines.

18.0 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The field and laboratory data collected during this investigation will be used to achieve the objectives identified in Section 4.1 of this QAPP. The QC results associated with each analytical parameter for each matrix will be compared to the measurement objectives presented in Section 4.2 of this QAPP. Only data that is determined to be valid (i.e., data that is not rejected) will be considered usable for decision making purposes.

In addition, the data obtained will be both qualitatively and quantitatively assessed on a project-wide, matrix-specific, and parameter-specific basis. This assessment will be summarized in a DUSR, which will include, but not necessarily be limited to, an assessment of the following.

- Conformance to the field methodologies and SOPs proposed in the RI/FS Work Plan,
- Conformance to the analytical methodologies provided in the RI/FS Work Plan,
- Adherence to proposed sampling strategy,
- Presence of elevated detection limits due to matrix interferences or contaminants present at high concentrations,
- Presence of analytes not expected to be present at the site,
- Unusable data sets (qualified as "R") based on the data validation results,
- Data sets identified as usable for limited purposes (qualified as "J") based on the data validation results,
- Effect of qualifiers applied as a result of data validation on the ability to implement the project decision rules,
- Status of all issues requiring corrective action, as presented in the QA reports to management,
- Effect of nonconformance (procedures or requirements) on project objectives,
- Adequacy of the data as a whole in meeting the project objectives, and
- Recommendations on resampling/reanalysis.

This assessment will be performed by the project technical team and the results presented and discussed in detail in the final report.

Table 8-1. Target Analytes, Data Quality Levels, and Laboratory Practical Quantitation Limits

Parameter	CAS No.	Soil		Groundwater	
		DQL	PQL	DQL	PQL
Volatile Organic Compounds (μg/kg or μg/L)					
1,1,1-Trichloroethane	71-55-6	800	5	5	1
1,1,2,2-Tetrachloroethane	79-34-5	600	5	5	1
1,1,2-Trichloroethane	79-00-5		5		1
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	6000	5	5	1
1,1-Dichloroethane	75-34-3	200	5	5	1
1,1-Dichloroethene	75-35-4	400	5	5	1
1,2-Dibromo-3-chloropropane	96-12-8		5		1
1,2-Dibromoethane	106-93-4		5		1
1,2-Dichlorobenzene	95-50-1	7900	5	4.7	1
1,2-Dichloroethane	107-06-2	100	5	5	1
1,2-Dichloropropane	78-87-5		5		1
1,2,4-Trichlorobenzene	120-82-1	3400	5	5	1
1,3-Dichlorobenzene	541-73-1	1600	5	5	1
1,4-Dichlorobenzene	106-46-7	8500	5	5	1
2-Butanone	78-93-3	300	10	50	5
2-Hexanone	591-78-6		10		5
4-Methyl-2-pentanone	108-10-1	1000	10	50	1
Acetone	67-64-1	200	10	50	20
Benzene	71-43-2	60	5	0.7	1
Bromodichloromethane	75-27-4		5		1
Bromoform	75-25-2		5		1
Bromomethane	74-83-9		5		1
Carbon disulfide	75-15-0	2700	10	50	1
Carbon tetrachloride	56-23-5	600	5	5	5
Chlorobenzene	108-90-7	1700	5	5	1
Chloroethane	75-00-3	1900	10	50	1
Chloroform	67-66-3	300	5	7	1
Chloromethane	74-87-3		5		1
cis-1,2-Dichloroethene	156-59-2		5		1
cis-1,3-Dichloropropene	10061-01-5		5		1
Cyclohexane	110-82-7		5		1
Dibromochloromethane	124-48-1	NS	5	50	1
Dichlorodifluoromethane	75-71-8		5		1
Ethylbenzene	100-41-4	5500	5	5	1
Isopropylbenzene	98-82-8		5		1
Methyl acetate	79-20-9		5		1
Methylcyclohexane	108-87-2		5		1
Methylene chloride	75-09-2	100	5	5	1
Methyl-tert-butyl-ether	1634-04-4		5		1
Styrene	100-42-5		5		1
Tetrachloroethene	127-18-4	1400	5	5	1
Toluene	108-88-3	1500	5	5	1
trans-1,2-Dichloroethene	156-60-5	300	5	5	1
trans-1,3-Dichloropropene	10061-02-6		5		1

Parameter	CAS No.	Soil		Groundwater	
		DQL	PQL	DQL	PQL
Trichloroethene	79-01-6	700	5	5	1
Trichlorofluoromethane	75-69-4		5		1
Vinyl chloride	75-01-4	200	5	2	1
Xylenes (total)	1330-20-7	1200	5	5	1

DQL – Data quality level. Source: New York State TAGM 4046, Recommended Soil Cleanup Objectives and Groundwater Standards/Criteria
NS – None specified
PQL – Practical Quantitation Limit

Table 8-2. Target Analytes and Laboratory Reporting Limits for Soil Gas and Ambient Air Samples

Parameter	CAS No.	Reporting Limit
Volatile Organic Compounds (ppbV)		
1,1,1-Trichloroethane	71-55-6	0.5
1,1,2,2-Tetrachloroethane	79-34-5	0.5
1,1,2-Trichloroethane	79-00-5	0.5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.5
1,1-Dichloroethane	75-34-3	0.5
1,1-Dichloroethene	75-35-4	0.5
1,2-Dibromo-3-chloropropane	96-12-8	NA
1,2-Dibromoethane	106-93-4	0.5
1,2-Dichlorobenzene	95-50-1	0.5
1,2-Dichloroethane	107-06-2	0.5
1,2-Dichloropropane	78-87-5	0.5
1,2,4-Trichlorobenzene	120-82-1	0.5
1,3-Dichlorobenzene	541-73-1	0.5
1,4-Dichlorobenzene	106-46-7	0.5
2-Butanone	78-93-3	0.5
2-Hexanone	591-78-6	0.5
4-Methyl-2-pentanone	108-10-1	0.5
Acetone	67-64-1	2.0
Benzene	71-43-2	0.5
Bromodichloromethane	75-27-4	0.5
Bromoform	75-25-2	0.5
Bromomethane	74-83-9	2.0
Carbon disulfide	75-15-0	0.5
Carbon tetrachloride	56-23-5	0.5
Chlorobenzene	108-90-7	0.5
Chloroethane	75-00-3	0.5
Chloroform	67-66-3	0.5
Chloromethane	74-87-3	0.5
cis-1,2-Dichloroethene	156-59-2	0.5
cis-1,3-Dichloropropene	10061-01-5	0.5
Cyclohexane	110-82-7	0.5
Dibromochloromethane	124-48-1	0.5
Dichlorodifluoromethane	75-71-8	0.5
Ethylbenzene	100-41-4	0.5
Isopropylbenzene	98-82-8	NA
Methyl acetate	79-20-9	NA
Methylcyclohexane	108-87-2	NA
Methylene chloride	75-09-2	1.0
Methyl-tert-butyl-ether	1634-04-4	0.5
Styrene	100-42-5	0.5
Tetrachloroethene	127-18-4	0.5
Toluene	108-88-3	0.5
trans-1,2-Dichloroethene	156-60-5	0.5
trans-1,3-Dichloropropene	10061-02-6	0.5
Trichloroethene	79-01-6	0.5

Parameter	CAS No.	Reporting Limit
Trichlorofluoromethane	75-69-4	0.5
Vinyl chloride	75-01-4	0.5
Xylenes (total)	1330-20-7	1.5

NA – Not applicable – these analytes are not included on the TO-15 analyte list.

Waverly W. Braunstein

Years Experience: **19**

Professional History

- ENSR Consulting and Engineering
- ICF Kaiser Engineers, Inc.
- Los Alamos National Laboratory
- Controls for Environmental Pollution, Inc.
- James M. Montgomery, Consulting Engineers, Inc.

Education

- BA (Chemistry) Wesleyan University

Representative Project Experience

Chemistry Consulting/Quality Assurance

Consolidated Edison, MGP Site Assessment, New York, NY. Quality Assurance Officer and Project Chemist for ongoing activities at this MGP site. Provide oversight of laboratory performance and manage data validation tasks. Prepare data usability summary reports (DUSRs) in accordance with New York State Department of Conservation (NYSDEC) requirements.

Consolidated Edison, Phase II RFI, Astoria, NY. Quality Assurance Officer and Project Chemist for the RCRA Facility Investigation at this site. Provide laboratory oversight, manage data validation efforts, and interpret data. All activities at this site are performed under New York State Department of Conservation (NYSDEC) guidance.

US Army Corps of Engineers, Baseline Ecological Risk Assessment, Army Materials Technology Laboratory, Watertown, MA. Project Chemist for BERA conducted for USACE in accordance with EPA CERCLA regulations. Prepared QAPP in accordance with rigorous EPA Region I guidelines; provided input on sampling and analysis plans; and evaluated, selected, and managed subcontracted analytical laboratories. Acted as liaison between field crew and analytical laboratories throughout the project. Managed all data validation efforts.

City of Waco, Comprehensive Lake Management Study, Waco, TX. Quality Assurance Chemist for this multitask comprehensive lake management study. Reviewed and evaluated more than 10 component QAPPs prepared by several different commercial, local government, and academic collaborators for individual tasks planned under this study.

ENSR Air Toxics Laboratory, Quality Assurance Manager, Harvard, MA. Quality Assurance Manager for ENSR's Air Toxics Laboratory. Responsibilities include review and approval of laboratory Quality Assurance Manual and all standard operating procedures (SOPs); review of all analysts initial and annual demonstrations of proficiency; annual audit; and approval of corrective actions. Provide support to Laboratory Manager for all QA related issues.

USACE, New England District, Characterization of Combustion Engineering FUSRAP Site, Windsor, CT. Served as the project and QA/QC chemist for the site-wide characterization, specifically six areas identified for investigation under FUSRAP, and related CERCLA support activities. Updated and expanded a draft Quality Assurance Project Plan (QAPP) and assisted with the updating of the Sampling and Analysis Plan. Coordinated procurement of analytical services, by indentifying and evaluating laboratories capable of performing hazardous chemical, radiological, and mixed waste analyses. Selected the most qualified laboratories and ensured that all necessary licenses and permits were in place.

Throughout the 14-week field effort, coordinated field and laboratory efforts and identified and resolved field and laboratory QA/QC issues. Supervised validation of both chemical and radiological analytical data. Prepared quality control summary report (QCSR) upon completion of field, analytical, and data validation activities.

USACE, Baltimore District, Remedial Investigations/Remedial Actions for Vint Hill Farms Station, Virginia. Served as the QA/QC Manager and Project Chemist under multiple Delivery Orders for Remedial Investigations (RIs) and Remedial Actions (RAs) for the site, which served as an Army installation engaged in communications intelligence. RAs were conducted for lead contamination at the pistol range and the skeet range, pesticide and/or metals (in particular mercury) contamination at the former and current sewage treatment plants, total petroleum hydrocarbon contamination related to underground storage tanks and neutralization pits, and pesticide and metals contamination in an on-site surface water tributary. Developed a streamlined Master QAPP designed to cover multiple task orders. Managed analytical services procurement process, evaluating 13 laboratories and selecting and auditing the most qualified. Coordinated field and laboratory efforts and identified and resolved field and laboratory QA/QC issues. These investigations called for the collection and analysis of hundreds of samples for multiple organic and inorganic parameters, all of which required 100% Level IV data validation in accordance with USEPA Region III and USACE requirements.

Perfume Manufacturing and Packaging Facility, Litigation Support, New Jersey. Conducted a data validation on state evidence being used in litigation against the client in an illegal waste hauling/waste disposal case. The validation effort was hampered by the fact that the data packages were often incomplete, illegible, and poorly organized.

Despite these facts, Ms. Braunstein was able to identify numerous inconsistencies and analytical anomalies that had serious impacts on the validity of the data. These findings enabled the client to avoid having to enter into an onerous Consent Agreement with New Jersey that would have required the client to assess and remediate the dumping site.

Manufacturing Plant, RCRA Corrective Action, Dickson, TN. Prepared QAPP, selected analytical laboratory, provided QA/QC oversight to the laboratory, and performed all data validation for more than a hundred soil and groundwater samples for volatile organics in support of the RCRA corrective action requirements for a manufacturing facility located in karst terrain. Data were validated in accordance with USEPA Region III guidelines.

Data Review and Validation. Validated hundreds of organic, inorganic, and radiochemical data packages for commercial and government clients located in multiple states for compliance with applicable technical and contractual requirements. Based on a thorough understanding of both the analytical methods and the clients' project needs, Ms. Braunstein has often had to develop new modifications to published validation guidelines (e.g., USEPA CLP National Functional Guidelines) where project-specific data validation guidelines were not provided.

US Army Corps of Engineers, New England District, MCP Phase II Comprehensive Site Assessment, Central Massachusetts. Served as the Chemistry Task Manager for an investigation of the source, nature, extent, and migration pathways of polychlorinated biphenyl (PCB) contamination in sediments, tissues, and surface water at the Birch Hill Dam Flood Control Project site. Responsibilities included coordination of immunoassay-type PCB field screening, management of analytical subcontractors, data validation, and interpretation of field screening and confirmatory laboratory results.

US Army Corps of Engineers, New England District, Environmental Assessments of Salem and Scituate Harbors, Massachusetts. Served as the Analytical Task Manager for sediment investigations conducted at Salem, MA and Scituate, MA harbors. These projects included the sediment collection, toxicity testing, and the analyses of sediment, elutriate, and seawater for PAHs, pesticides, trace metals, and PCB congeners. Responsibilities included oversight of analytical subcontractors, data validation, and report preparation.

US Army Corps of Engineers, New England District, Characterization, Assessment and CERCLA Support at the FUSRAP Combustion Engineering Site, Windsor, CT. Analytical Task Manager for a project conducted under ENSR's HTRW contract to characterize low-level radioactive waste at the Combustion Engineering site. Soil, sediment, groundwater and surface water samples were collected and analyzed at an on-site laboratory for radiochemical parameters, and off-site for radiochemical, hazardous chemical, and geotechnical analyses. Responsibilities included revision of the QAPP, procurement and oversight of analytical subcontractors, and interpretation of on-site data leading to identification of samples for further confirmatory analyses. Provided oversight of data validation efforts and prepared quality control summary report (QCSR) upon completion of field efforts.

Environmental Laboratory QA/QC. As QA Chemist for an environmental laboratory, developed and implemented a successful laboratory-wide performance evaluation program that included a double-blind performance evaluation (PE) sample program in which Ms. Braunstein routinely submitted samples to the laboratory disguised as actual client samples. The program evaluated laboratory performance under routine conditions and helped the laboratory to identify and correct areas of weakness before they could become problems for its clients.

USEPA QA/QC Chemist, National Pesticide Survey. Served as a former employer's Project Quality Assurance Chemist during the laboratory's participation in the EPA's nationwide evaluation of pesticides in the public drinking water supply. Responsibilities included offering technical expert guidance to analyst's QA/QC questions, preparing detailed monthly audits for each of the three methods performed by the laboratory, communicating QA/QC related problems to the EPA project manager, and providing general QA/QC oversight. The laboratory exceeded the project goals of 90% data completeness and usability.

Laboratory Experience

Directorate of Safety, Health, and the Environment, Aberdeen Proving Ground, Treatability Study Laboratory, Canal Creek Area, Maryland. Set up, operated and managed a state-of-the-art on-site analytical laboratory for a groundwater treatability study system for a site contaminated with volatile organic compounds (VOCs) and heavy metals. Cost-effectively analyzed and managed data from hundreds of groundwater and air samples that were characterized for volatile organics using the GC/ECD and GC/FID instruments. Completed data management and analyses of aqueous samples for iron and manganese using the laboratory spectrophotometer.

Appendix D

HEALTH AND SAFETY PLAN

Former Ozone Industries, Inc. Site

NYSDEC Site # 2-41-033

Order on Consent Index # W2-0922-02-05 (with Endzone, Inc.)

Queens, New York

ENSR Corporation

May 14, 2004

Project No. 08734765

Table of Contents

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

1.1 Purpose

This Health and Safety Plan (HASP) was developed by ENSR Corporation (ENSR). It establishes the health and safety procedures required to minimize any potential risk to personnel involved with the Remedial Investigation/Feasibility Study (RI/FS) being implemented at the Former Ozone Industries, Inc. Site and areas in the vicinity of the Site and located in Ozone Park, Queens, New York (as defined below in Section 2.1).

1.2 Scope and Application

The provisions of this HASP apply to ENSR personnel and subcontractor personnel who will be potentially exposed to safety and/or health hazards associated with the tasks outlined in Section 3.0 of this HASP.

This HASP has been written to comply with OSHA's Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). All activities covered by this HASP must be conducted in complete compliance with all applicable federal, state and local health and safety regulations. Personnel covered by this HASP who cannot or will not comply with these requirements will be excluded from site activities.

1.3 Approval and Dissemination

All ENSR personnel and subcontractors covered by this HASP must receive a copy of it and return the HASP signoff sheet (Attachment A) to the ENSR Project Manager (PM) or ENSR Site Safety Officer (SSO) prior to the start of on-site activities.

1.4 Responsibilities

The implementation of health and safety at this project location will be the shared responsibility of the ENSR Project Manager (PM), the ENSR Regional Health and Safety Manager (RHSM), the ENSR Project Site Safety Officer (SSO) and all other ENSR and contractor personnel.

1.4.1 Project Manager

The ENSR PM (David Austin) is, by designation, the individual who has the primary responsibility for ensuring the overall health and safety of this project. The PM, therefore, has the primary responsibility for ensuring the implementation of the requirements of this HASP. Some of the PM's specific responsibilities include:

- Assuring that all personnel to whom this HASP applies have received a copy of it;

- Providing the RHSM with updated information regarding environmental conditions at the site and the scope of site work;
- Providing adequate authority and resources to the on-site SSO to allow for the successful implementation of all necessary safety procedures;
- Supporting the decisions made by the SSO and RHSM;
- Maintaining regular communications with the SSO and, if necessary, the RHSM; and,
- Coordinating the activities of all ENSR subcontractors and ensuring that they are aware of the pertinent health and safety requirements for this project.

1.4.2 Regional Health and Safety Manager

The ENSR RHSM (Kathleen Harvey) is the individual responsible for the preparation, interpretation and modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the RHSM. Specific duties of the RHSM include:

- Writing, approving and amending the HASP for this project;
- Advising the PM and SSO on matters relating to health and safety on this site;
- Recommending appropriate personal protective equipment (PPE) and air monitoring instrumentation to protect ENSR personnel from potential site hazards;
- Conducting accident investigations; and,
- Maintaining regular contact with the PM and SSO to evaluate site conditions and new information which might require modifications to the HASP.

1.4.3 Site Safety Officer

All ENSR field personnel are responsible for implementing the safety requirements specified in this HASP. However, one field person will serve as the SSO (which may be the Field Team Leader). The SSO will be appointed by the PM. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Assuring that all personnel to whom this HASP applies have received a copy of it and have submitted a completed copy of the HASP sign-off form;
- Assuring that all personnel to whom this HASP applies have attended a pre-entry briefing prior to entering a restricted area;
- Procuring and distributing the PPE needed for ENSR employees;
- Procuring the air monitoring instrumentation required and performing air monitoring for ENSR activities;
- Verifying that all PPE and health and safety equipment used by ENSR is in good working order;
- Setting up and maintaining the cleanup zone within the restricted areas and assuring proper cleanup of all site personnel;
- Notifying the PM of all noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Monitoring and controlling the safety performance of all personnel within the established restricted areas to ensure that required safety and health procedures are being followed and correcting any deficiencies;
- Conducting accident/incident investigations and preparing accident/incident investigation reports;
- Conducting the pre-entry briefing and subsequent safety meetings as required by Section 10.3 of the HASP; and,
- Initiating emergency response procedures in accordance with Section 11.0 of this HASP.

1.4.4 Field Personnel

All ENSR field personnel and subcontractor personnel are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading the HASP in its entirety prior to the start of on-site work;
- Submitting a completed HASP Acceptance Form and documentation of medical surveillance and training to the PM prior to the start of work;

- Attending the pre-entry briefing (prior to beginning on-site work) and daily safety meetings as discussed in Section 10.3;

- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the RHSM prior to the start of work or the SSO during on-going field activities;

- Reporting all accidents, injuries and illnesses, regardless of their severity, to the ENSR SSO; and,

- Complying with the requirements of this HASP and the requests of the SSO.

1.4.5 Contractors

Additionally, subcontractors are responsible for:

- Reading the HASP in its entirety prior to the start of on-site work;

- Ensuring, via daily inspections, that their equipment is in good working order;

- Operating their equipment in a safe manner;

- Appointing an on-site safety coordinator to interface with the ENSR SSO;

- Providing ENSR with copies of material safety data sheets (MSDS) for all hazardous materials brought on-site; and,

- Providing all the required PPE and respiratory protection for their employees.

1.5 Management of Change/Modifications to HASP

1.5.1 Management of Change

The specific chemical hazards that are known or anticipated for the proposed investigations are based on ENSR's review of existing reports regarding previous environmental investigations at the Site. Every effort has been made to address the chemical hazards that may be encountered during the implementation of the proposed RI/FS. Similarly, this document also discusses the physical hazards associated with the proposed investigative activities. However, unanticipated site-specific conditions or situations may occur during the implementation of this project. Also, ENSR and the chosen contractor may elect to perform certain tasks in a manner that is different from what was originally intended due to a change in field conditions. As such, this HASP must be considered a *working document* that is subject to change to meet the needs of this dynamic project.

Therefore, ENSR and/or the selected contractor will complete a Job Hazard Analysis (JHA) prior to the beginning of each major phase of work to ensure that all chemical and physical hazards have been properly addressed. The use of new techniques will be reviewed and if new hazards are associated with the proposed changes, they will be documented on the JHA. An effective control measure must also be identified for each new hazard. The JHA will be reviewed by the SSO prior to being implemented. Once approved, the JHA will be reviewed with all field staff during the daily safety meeting. A blank JHA is presented as Attachment B

1.5.2 Modification to HASP

Should additional information become available prior to or during the RI/FS program regarding unique site hazards or should the scope of investigative activities change, it may be necessary to modify this HASP. All proposed modifications to this HASP must be reviewed and approved by the ENSR RHSM before such modifications are implemented.

Any significant modifications must be incorporated into the written document as addenda and the HASP must be reissued. The ENSR SSO will ensure that all personnel covered by this HASP receive copies of all issued addenda. Sign-off forms will accompany each addendum and must be signed by all personnel covered by the addendum. Sign-off forms will be submitted to the ENSR SSO. The HASP addenda should be distributed during the daily safety meeting so that they can be reviewed and discussed. Attendance forms will be collected during the meeting.

2.0 SITE HISTORY/DESCRIPTION

2.1 Site Location

The investigation is taking place in an area located within a city block in Ozone Park, Queens, New York that is bounded by 99^{th} and 100^{th} Streets to the west and east and by 101^{st} and 103^{rd} Avenues to the north and south, and is beneath an abandoned elevated Long Island Railroad (collectively referred to as the Site). The investigation also pertains to areas in the vicinity of the Site, referred to as the Site vicinity (see Figure 1).

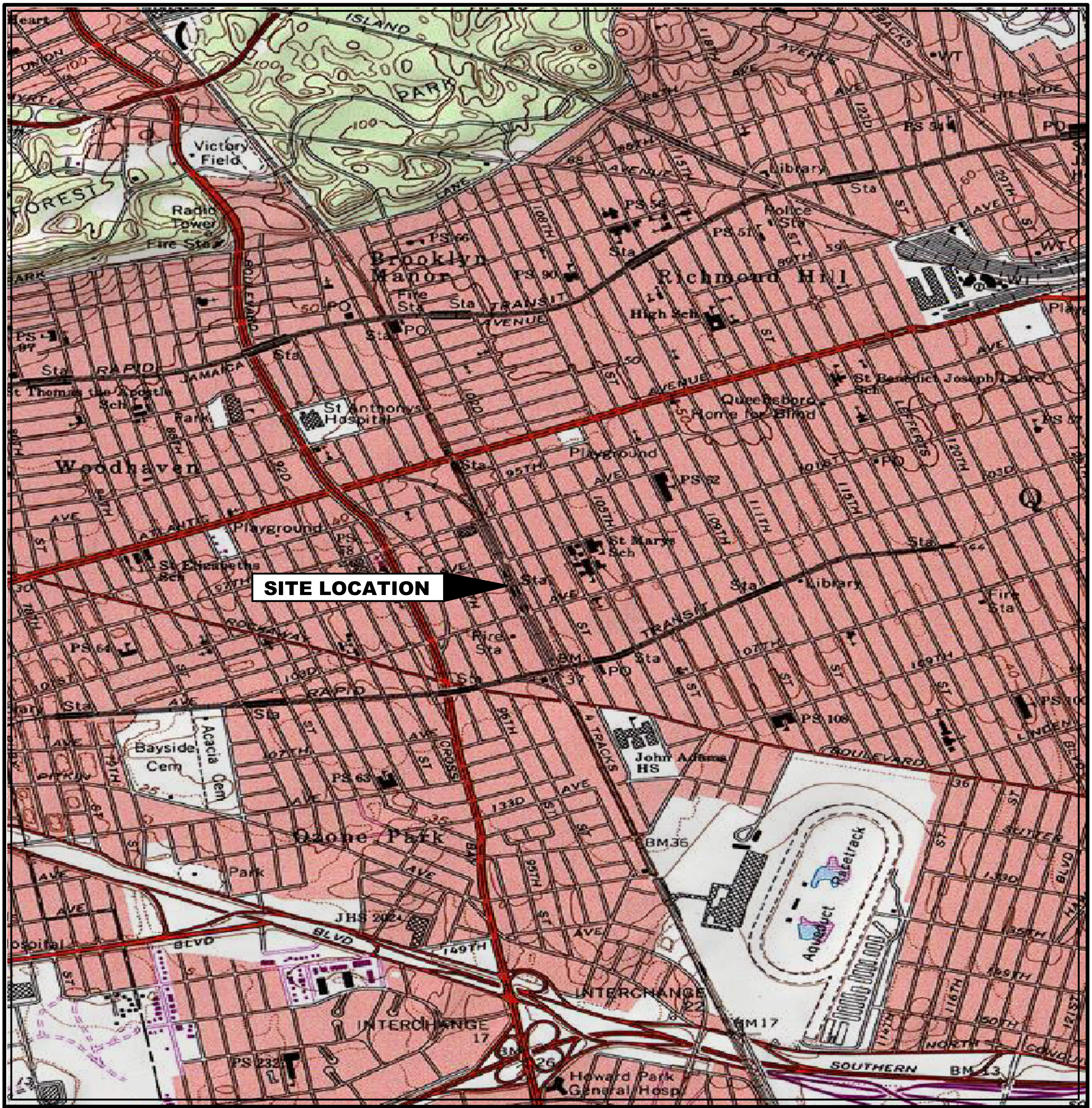
2.2 Site History

Ozone Industries, Inc. rented/operated for storage purposes a portion of the Site for a period prior to 1998, possibly starting as early as 1961. During that period, a portion of the Site was used to store solvents, hydraulic fluids and scrap metal chips in roll-off containers that resulted from Ozone Industries, Inc. manufacturing activities. The portion of the Site utilized by Ozone Industries, Inc. was constructed of cinder block walls and contained a dirt floor. During that period it is believed that releases of solvents, oils and/or fluids which coated the metal chips may have occurred at the Site. The nature and extent of those releases is not presently known. At the property across 100^{th} Street from the Site, Ozone Industries, Inc. manufactured aircraft parts including landing gears, hydraulic assemblies, aircraft steering wheel assemblies, flight controls, etc.

2.3 Environmental History – Site Vicinity

No environmental assessment data has been collected at the Site. In the Site vicinity, a Preliminary Site Assessment was performed in response to a Phase I and II conducted in 1996 for the New York City School Construction Authority of the former Voges Manufacturing Company at 103-22 99^{th} Street (south of the Site) that was proposed for a school construction. (The School, PS 65 opened in September 1996.) The former Voges Manufacturing Company used the Public School 65 property from 1920 to 1995 for the manufacturing of buttons, molding of plastic parts and machining of aircraft parts.

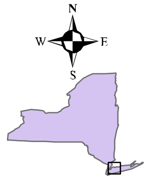
The Phase I and II work included the installation of groundwater monitoring wells in the vicinity of the former Voges Manufacturing Company property and sampling groundwater for volatile organic compounds (VOCs). Trichloroethene (TCE) was detected in groundwater samples collected upgradient and downgradient (in relation to assumed groundwater flow direction at the time) of the former Voges Manufacturing Company property.



SCALE 1:24,000

0.5 | 0.25 | 0 | 0.5 | 1 Miles

1,200 | 600 | 0 | 1,200 | 2,400 | 3,600 | 4,800 | 6,000 | 7,200 | 8,400 Feet



USGS Quadrangle
Queens,
New York

Site Locus

Former Ozone Industries, Inc.
NYSDEC Site # 2-41-033
Block Bounded by 99th & 100th Streets
and 101st & 103rd Avenues
Ozone Park, Queens, New York

RI/FS Work Plan

Job Number 08734765

Figure 1

ENSR INTERNATIONAL

This PSA was conducted by Lawler, Matusky & Skelly Engineers LLP between June and August 1999 and consisted of the installation of 21 probe points and four groundwater piezometers, groundwater sampling for VOC analysis, measuring groundwater elevations, and determining groundwater flow direction. In general, samples collected from investigation points upgradient or north of the Site (GP-1 through GP-6, and PZ-1) did not contain VOCs above Class GA groundwater standards and TCE was not detected. Samples from investigation points along 100th Street east of the Site contained levels of various VOCs, and TCE levels ranging from 23 micrograms per liter (ug/l) to 2,200 ug/l (GP-17, 40 foot sample). The highest TCE levels were detected in samples from PZ-2 (6,800 ug/l) and from GP-11 located adjacent to the Site, detected at 22,000 ug/l (water table sample), with decreasing levels at depth (50 and 60 feet bgs). Samples from the four points on 99th Street (GP-18 through GP-21) and the two downgradient along 98th Street (GP-22 and GP-23) contained TCE levels ranging from 70 ug/l to 1,400 ug/l (GP-21) (water table samples). In general, the TCE concentrations (and VOC levels) decreased with depth (GP-20 and –23).

Based upon measurements in the four piezometers, the groundwater flow direction was determined to be southerly across the Site vicinity.

URS Corporation conducted further investigations in the Site vicinity in June 2001. In general, the groundwater analyses indicated TCE concentrations ranging from 3 ug/l (GP-31) to 510 ug/l (PZ-08). Higher levels were detected in samples from GP-35 (1,600 ug/l), PZ-09 (2,100 ug/l) and GP-36 (2,200 ug/l); all of which were located along 99th Street adjacent to or just south of the Site. The sample from PZ-01 (upgradient along 101st Avenue) contained non-detectable VOC levels. The results of soil analyses indicated very low levels of TCE (11 and 45 micrograms per kilogram).

Based upon measurements at the time of the work, the groundwater flow direction was determined to be southerly across the Site vicinity.

URS Corporation conducted further investigations in the Site vicinity in July and August 2002. The analyses of soil samples for VOCs did not indicate detectable levels in the majority of the samples. A low level of TCE was detected in the sample from GP-108 located south of the Site near the intersection of 103rd Avenue and 99th Street. The groundwater sampling in July 2002 generally indicated decreasing VOC and TCE concentrations with depth, and the higher levels were detected at the groundwater interface. The samples collected at the groundwater interface contained various VOCs, with the highest TCE levels detected in samples from investigation points along 98th Street (1,200 ug/l in GP-16 to 2,400 ug/l in GP-13), on 99th Street (1,400 ug/l in GP-09), and along 103rd Avenue near 99th Street in GP-111 (2,700 ug/l) and GP-108 (2,800 ug/l). The highest level was detected in the 53 to 55 foot sample from GP-13 (2,900 ug/l). The August 2002 sampling round also indicated various VOCs in the samples and TCE levels ranging from non-detectable (PZ-01) to 929 ug/l (MW-19, located along 98th Street). The highest TCE concentration was detected in the sample from well PZ-09 (1,180 ug/l) located along 99th Street adjacent to the Site.

Based upon measurements at the time of the work, the groundwater flow direction was determined to be southerly across the Site vicinity, with a low or anomaly in the area of PZ-11 (103rd Avenue, between 100th and 101st Streets).

URS Corporation also conducted groundwater and soil gas sampling and analyses in March and April 2003. The results indicate similar results as indicated above and are described in the Work Plan.

3.0 SCOPE OF WORK

3.1 Purpose of Investigation

The proposed investigation is intended to further evaluate the presence of VOCs in soil and groundwater at the Site and Site vicinity. Data gaps to be further investigated as part of the proposed RI/FS include:

- Soil conditions (i.e. contaminant concentrations) at the Site;
- Subsurface soil gas conditions to evaluate the potential migration of vapors from impacted groundwater and soil to indoor air;
- Groundwater and soil conditions, shallow and deep near the Site and location GP-11;
- Refinement of the groundwater monitoring well network to supplement previously estimated groundwater flow directions and to provide additional information on groundwater contaminant levels; and
- Identify other potential source areas that may be contributing to groundwater contamination (with installation of cross-gradient and upgradient monitoring wells, and possible collection of additional history and use information for other properties in the Site vicinity and/or bays at the Site).

3.2 Investigative Tasks

The proposed RI/FS field program will consist of a focused soil gas and soil investigation at the Site and Site vicinity, a groundwater investigation and in-situ hydraulic conductivity testing. Specific tasks include:

- Collecting soil gas samples from approximately 8 feet below ground surface (bgs) in bays beneath the elevated former railroad bed (Site) and in the nearby street;
- Collecting soil samples, by installing soil borings using hollow-stem augers and/or direct-push methods, in bays beneath the elevated former railroad bed (same location as soil gas survey sample points) and in the Site vicinity;
- Field screening each soil boring for the presence of VOCs and submitting samples for subsequent laboratory analyses;

- Installing five monitoring wells during the completion of the above-mentioned soil borings at four locations along 98th, 99th and 100th Streets and 101st Avenue using hollow-stem auger drilling methods;

- Developing newly installed wells and collection water level measurements;

- Collecting groundwater samples during the installation of select soil borings, and collecting two rounds of groundwater sampling from newly installed wells and at selected existing wells; and,

- Perform rising head permeability tests (slug tests) at each of the newly installed monitoring wells and at a selection of existing wells (MW-01, -06S, -06D, -09, -13S, -13D and –101) to assess the permeability of the soils.

4.0 HAZARD ASSESSMENT

The following chemical and physical hazard assessment applies only to the proposed tasks as described in Section 3.0.

4.1 Chemical Hazards

Trichloroethylene has been identified as the major contaminant of concern (COC) for this proposed investigation.

4.1.1 Trichloroethylene

Trichloroethylene is a colorless to blue liquid with a sweet, chloroform odor. Trichloroethylene is a common metal degreaser and industrial solvent. The OSHA permissible exposure limit (PEL) for TCE is 100 ppm, as an 8-hour, time-weighted average (TWA). However, the American Conference of Governmental Industrial Hygienists (ACGIH) recommends a threshold limit value (TLV) of 50 ppm, as an 8-hr TWA.

Exposure to TCE may result in irritation to the eyes, skin and respiratory tract. Inhalation of TCE vapors may cause drunken-like behaviors and an irregular heart beat. Chronic overexposure may lead to liver and kidney damage. Animal studies suggest that chronic overexposure to TCE may cause birth defects and cancer.

4.2 Exhaust Gases Associated with Interior Drilling

Soil borings are being advanced beneath the floors of the bays. It is assumed that a drill rig can be used to install the borings. As such, the build up of exhaust gases from fuel-powered internal combustion engines is a concern. Carbon monoxide is the most toxic of the exhaust gases. Carbon monoxide is an asphyxiant in that it prevents hemoglobin from binding with oxygen. Symptoms of acute carbon monoxide poisoning include intense headache, dizziness, nausea, and collapse. Initially the victim is pale; later the skin and mucous membranes may turn cherry-red in color. The OSHA PEL for carbon monoxide is 35 ppm, as an 8-hour TWA with a ceiling value of 200 ppm. The ACGIH recommends a TLV of 25 ppm, as an 8-hr TWA.

4.3 Hazardous Substances Brought On-Site by ENSR or Subcontractors

A material safety data sheet (MSDS) must be available for each substance that ENSR or its subcontractors bring on the Site. This includes solutions/chemicals that will be used to decontaminate sampling equipment as well as calibration gases. All containers of hazardous materials must be labeled in accordance with OSHA's Hazard Communication Standard.

4.4 Chemical Hazard Potential/Control

4.4.1 Chemical Hazard Potential

Based on the results of previous investigations, soil does not appear to be largely impacted. However, no soil samples have been collected from the Site itself, only the Site vicinity. Groundwater has been impacted with TCE. During this investigation, soil borings are being advanced in areas where solvents were previously stored by Ozone Industries. Therefore, the field team should anticipate that impacted soils will be encountered. Therefore, the primary routes of potential exposure to the contaminants of concern include:

- Inhalation of TCE vapors during drilling activities; and,
- Direct dermal contact with impacted soils and groundwater during sampling events.

4.4.2 Chemical Hazard Control

ENSR will use a combination of exposure controls during the proposed investigations:

- Direct-reading air monitoring instrumentation will be used, as described in Section 6.0 of this HASP, to determine the concentration of VOC vapors that may be present in the work area and in the employee's breathing zone during site activities as described above. If necessary, respiratory protection, as defined in Section 7.2 of this HASP, may be donned to control employee exposure to the VOC vapors.

- A carbon monoxide meter will be used during indoor activities to ensure that exhaust gas from the drill rigs is being adequately controlled. Even if the building is well-ventilated and the exhaust gas is ducted to the outside, a carbon monoxide meter is still required.

- To reduce the potential for contact with potentially contaminated soils and groundwater, personal protective equipment (PPE), as described in Section 7.1 of this HASP, will be worn.

- To reduce the potential of off-site migration of vapors, ENSR will implement a community air monitoring plan (CAMP) as discussed in Section 6.0 of this HASP and further detailed in Appendix E of the RI/FS Work Plan.

5.0 PHYSICAL HAZARDS

5.1 Traffic Hazards

Wells are being installed along the streets. As such, a police detail will be required whenever the drilling activities force traffic out of its normal course on any of these streets. Additionally, when working in a high traffic area, the following precautions should be followed. All are designed to draw attention to the field personnel to warn other people of your presence:

- Wear an orange safety vest. If work is being performed at dawn or dusk, the vests must have reflective tape.

- Set up traffic cones 50 feet in front of the work area. "Men at Work" signs should also be placed in a conspicuous area to warn others of your presence.

Prior to working in the streets, a street opening permit will be secured.

5.2 Utility Hazards

5.2.1 Overhead Utilities and Other Structures

Field personnel should be particularly aware of overhead lines, especially slack lines, in the work area. All equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a minimum clearance of 20 feet {29 CFR 1910.133 (c) (3) (iii)} is maintained. Operating or erecting any machinery within 20 feet of high-voltage lines is a prohibited activity as defined in 12 NYCRR Part 57 (high voltage proximity). The conventional drill rig mast must be lowered before moving.

5.2.2 Underground Utility Screening

New York law requires that a utility clearance be performed at least two (2) days prior to initiation of any subsurface work. The contractor will contact New York City- Long Island One Call Center (1-800-272-4480) to request a mark-out of natural gas, electric, telephone, cable television, water and sewer lines in the proposed drilling locations. Work will not begin until the required utility clearances have been performed. Public utility clearance organizations typically do not mark-out underground utility lines that are located on private property. As such, contractors must exercise due diligence and try to identify the location of any private utilities on the properties being investigated. The contractor can fulfill this requirement in several ways, including:

- obtaining as-built drawings for the areas being investigated from the property owner;

- visually reviewing each proposed drilling locations with the property owner or knowledgeable site representative;

- performing a geophysical survey to locate utilities or hiring a private line locating firm to determine the location of utility lines that are present at the property;

- identifying a no-drill zone; or

- hand digging in the proposed drilling locations if insufficient data is available to accurately determine the location of the utility lines.

As an additional precaution, ENSR is requiring that all boring locations outside of the bays be cleared of underground utilities to a depth of six feet using vacuum excavation methods subsequent to soil sampling with a hand auger within the utility clearance zone from ground surface to 6 feet bgs. Utility clearance in soil borings conducted beneath bays will be conducted with a hand auger to 6 feet bgs. Vacuum excavation will be used to advance the boring beyond the expected zone in which high-energy and unknown subsurface utilities are expected to be encountered. With this method, an approximately 10-inch diameter hole will be advanced from ground surface to approximately 6 feet bgs using a truck-mounted vacuum excavator. If utilities are encountered but do not pose a concern, the boring will be advanced. If the utility encountered poses a concern, the hole will be abandoned and another attempt will be made approximately 5 feet away.

5.3 Drilling Hazards

5.3.1 Rotary Drilling

Use of a hollow-stem auger (HSA) drill rig for soil boring and well installation will require all personnel in the vicinity of the operating rig to wear steel-toed boots, hardhats, hearing protection and safety eyewear. Personnel shall not remain in the vicinity of operating equipment unless it is required as part of their work responsibilities.

Additionally, the following safety requirements must be adhered to:

- Drill rigs and other machinery with exposed moving parts must be equipped with an operational emergency stop device. Drillers and geologists must be aware of the location of this device. This device must be tested prior to job initiation and periodically thereafter. The driller and helper shall not simultaneously handle augers unless there is a standby person to activate the emergency stop;

- The driller must never leave the controls while the tools are rotating unless all personnel are kept clear of rotating equipment;

- A long-handled shovel or equivalent must be used to clear drill cuttings away from the hole and from rotating tools. Hands and/or feet are not to be used for this purpose;

- A remote sampling device must be used to sample drill cuttings if the tools are rotating or if the tools are readily capable of rotating. Samplers must not reach into or near the rotating equipment. If personnel must work near any tools which could rotate, the driller must shut down the rig prior to initiating such work;

- Drillers, helpers and geologists must secure all loose clothing when in the vicinity of drilling operations;

- Only equipment that has been approved by the manufacturer may be used in conjunction with site equipment and specifically to attach sections of drilling tools together. Pins that protrude excessively from augers shall not be allowed;

- No person shall climb the drill mast while tools are rotating; and

- No person shall climb the drill mast without the use of ANSI-approved fall protection (approved belts, lanyards and a fall protection slide rail) or portable ladder which meets the requirements of OSHA standards.

5.3.2 Geoprobe™ Hazards

Use of the Geoprobe™ System (or equivalent direct push method) to collect soil samples (and possibly grab groundwater samples) will require all personnel in the vicinity of the operating unit to wear steel-toed boots, hardhats, hearing protection and safety eyewear. Personnel shall not remain in the vicinity of operating equipment unless it is required as part of their work responsibilities.

Additionally, the following safety requirements must be adhered to:

- A remote vehicle ignition is located on the control panel of the Geoprobe™ unit. This allows the operator to start and stop the vehicle engine from the rear. This device must be tested prior to job initiation and periodically thereafter. All employees should be aware of how to access and operate the rear ignition;

- The driller must never leave the controls while the probe is being driven;

- Drillers, helpers and geologists must secure all loose clothing when in the vicinity of drilling operations;

- The Geoprobe™ vehicle shall not be moved any distance with the probe in the extended position. Check for clearance before folding the Geoprobe™ probe out of the vehicle;

- Be sure the parking brake is set before probing;
- Never allow the derrick foot to be lifted more than 6" off of the ground surface;
- Deactivate hydraulics when adding or removing probe rods, anvils or any tool in the hammer; and
- Verify that all threaded parts are completely threaded together before probing.

5.4 Cuts and Lacerations

When using knives or blades to cut open the acetate soil sample liners from the Geoprobe™ soil boring activities or when cutting tubing to facilitate groundwater sampling, follow the safety precautions listed below:

- Keep your free hand out of the way;
- Secure your work if cutting through thick material;
- Use only sharp blades; dull blades require more force which results in less knife control;
- Pull the knife toward you; pulling motions are easier to manage;
- Use a self-retracting blade;
- Use a tube cutter when cutting tubing for groundwater sampling; and
- Wear leather or Kevlar™ gloves when using knives or blades.

5.5 Noise

Use of drilling equipment may expose the field team to noise levels that exceed the OSHA PEL of 90 dBA for an 8-hour day. Exposure to noise can result in the following:

- Temporary hearing losses where normal hearing returns after a rest period;
- Interference with speech communication and the perception of auditory signals;
- Interference with the performance of complicated tasks; and
- Permanent hearing loss due to repeated exposure resulting in nerve destruction in the hearing organ.

Since personal noise monitoring will not be conducted during the proposed activities, employees must follow this general rule of thumb: **If the noise levels are so loud that you must shout at someone who is 5 feet away from you, you need to be wearing hearing protection.** ENSR employees can wear either disposable earplugs or earmuffs but all hearing protection must have a minimum noise reduction rating (NRR) of 27 db.

5.6 Back Safety

Using the proper techniques to lift and move heavy pieces of equipment is important to reduce the potential for back injury. The following precautions should be implemented when lifting or moving heavy objects:

- Bend at the knees, not the waist. Let your legs do the lifting;
- Do not twist while lifting;
- Bring the load as close to you as possible before lifting;
- Be sure the path you are taking while carrying a heavy object is free of obstructions and slip, trip and fall hazards;
- Use mechanical devices to move objects, such as drums of investigation derived wastes or generators, that are too heavy to be moved manually;
- If mechanical devices are not available, ask another person to assist you.

5.7 Using Electrically Powered Tools

If using portable tools that are electrically powered, follow the safety precautions listed below:

- Check to see that electrical outlets used to supply power during field operations is of the three wire grounding type.
- Extension cords used for field operations should be of the three wire grounding type and designed for hard or extra-hard usage. This type of cord uses insulated wires within an inner insulated sleeve and will be marked S, ST, STO, SJ, SJO or SJTO.
- NEVER remove the ground plug blade to accommodate ungrounded outlets.
- Do not use extension cords as a substitute for fixed or permanent wiring. Do not run extension cords through openings in walls, ceilings or floors.

- Protect the cord from becoming damaged if the cord is run through doorways, windows or across pinch points.

- Examine extension and equipment cords and plugs prior to each use. Damaged cords with frayed insulation or exposed wiring and damaged plugs with missing ground blades MUST BE REMOVED from service immediately.

- All portable or temporary wiring which is used outdoors or in other potentially wet or damp locations must be connected to a circuit that is protected by a ground fault circuit interrupter (GFCI). GFCI's are available as permanently installed outlets, as plug-in adapters and as extension cord outlet boxes. DO NOT CONTINUE TO USE A PIECE OF EQUIPMENT OR EXTENSION CORD THAT CAUSES A GFCI TO TRIP.

- When working in flammable atmospheres, be sure that the electrical equipment being used is approved for use in Class I, Division I atmospheres.

- Do not touch a victim who is still in contact with current. Separate the victim from the source using a dry, nonmetallic item such as a broomstick or cardboard box. Be sure your hands are dry and you are standing on a dry surface. Turn off the main electrical power switch and then begin rescue efforts.

5.8 Compressed Gas Handling

Compressed air will be used to inflate the bladder pumps being used for groundwater sampling. Follow the compressed gas handling procedures as outlined below:

- Inspect all cylinders upon delivery and verify that they are properly labeled.

- Do not store cylinders in direct sunlight (increase in temperature will increase pressure)

- Use a cylinder dolly to move the cylinders.

- Keep cylinder valves closed at all times (except when in use)

- Open valves slowly and away from people

- Close the valve and relieve the pressure before removing the regulator

- Always keep the valve cap over the valve assembly when not in use (break in valve will cause cylinder to become a projectile).

- Cylinders must be stored in the upright position and must be secured by a chain or rope.

* Segregate empty cylinders from full cylinders.

5.9 Thermal Stress

5.9.1 Cold Stress

Types of Cold Stress

Cold injury is classified as either localized, as in frostbite, frostnip or chilblain; or generalized, as in hypothermia. The main factors contributing to cold injury are exposure to humidity and high winds, contact with wetness and inadequate clothing.

The likelihood of developing frostbite occurs when the face or extremities are exposed to a cold wind in addition to cold temperatures. The freezing point of the skin is about 30^{o} F. The fluids around the cells of the body tissue freeze, causing the skin to turn white. This freezing is due to exposure to extremely low temperatures. As wind velocity increases, heat loss is greater and frostbite will occur more rapidly.

Symptoms of Cold Stress

The first symptom of frostbite is usually an uncomfortable sensation of coldness, followed by numbness. There may be a tingling, stinging or aching feeling in the affected area. The most vulnerable parts of the body are the nose, cheeks, ears, fingers and toes.

Symptoms of hypothermia, a condition of abnormally low body temperature, include uncontrollable shivering and sensations of cold. The heartbeat slows and may become irregular, the pulse weakens and the blood pressure changes. Pain in the extremities and severe shivering can be the first warning of dangerous exposure to cold.

Maximum severe shivering develops when the body temperature has fallen to 95^{o} F. This must be taken as a sign of danger and exposure to cold must be immediately terminated. Productive physical and mental work is limited when severe shivering occurs.

Methods to Prevent Cold Stress

When the ambient temperature, or a wind chill equivalent, falls to below 40^{o} F (American Conference of Governmental Industrial Hygienists recommendation), site personnel who must remain outdoors should wear insulated coveralls, insulated boot liners, hard hat helmet liners and insulated hand protection. Wool mittens are more efficient insulators than gloves. Keeping the head covered is very important, since 40% of body heat can be lost when the head is exposed. If it is not necessary to wear a hard hat, a wool knit cap provides the best head protection. A facemask may also be worn.

Persons should dress in several layers rather than one single heavy outer garment. The outer piece of clothing should ideally be wind and waterproof. Clothing made of thin cotton fabric or synthetic fabrics such as polypropylene is ideal since it helps to evaporate sweat. Polypropylene is best at wicking away moisture while still retaining its insulating properties. Loosely fitting clothing also aids in sweat evaporation. Denim is not a good protective fabric. It is loosely woven which allows moisture to penetrate. Socks with a high wool content are best. If two pairs of socks are worn, the inner sock should be smaller and made of cotton, polypropylene or a similar type of synthetic material that wicks away moisture. If clothing becomes wet, it should be taken off immediately and a dry set of clothing put on.

If wind conditions become severe, it may become necessary to shield the work area temporarily. The SSO and the PM will determine if this type of action is necessary. Heated break trailers or a designated area that is heated should be available if work is performed continuously in the cold at temperatures, or equivalent wind chill temperatures, of 20^{o} F.

Dehydration occurs in the cold environment and may increase the susceptibility of the worker to cold injury due to significant change in blood flow to the extremities. Drink plenty of fluids, but limit the intake of caffeine

5.9.2 Heat Stress

Types of Heat Stress

Heat related problems include **heat rash, fainting, heat cramps, heat exhaustion and heat stroke**. **Heat rash** can occur when sweat isn't allowed to evaporate, leaving the skin wet most of the time and making it subject to irritation. **Fainting** may occur when blood pools to lower parts of the body and, as a result, does not return to the heart to be pumped to the brain. Heat related fainting often occurs during activities that require standing erect and immobile in the heat for long periods of time. **Heat cramps** are painful spasms of the muscles due to excessive salt loss associated with profuse sweating.

Heat exhaustion results from the loss of large amounts of fluid and excessive loss of salt from profuse sweating. The skin will be clammy and moist and the affected individual may exhibit giddiness, nausea and headache.

Heat stroke occurs when the body's temperature regulatory system has failed. The skin is hot, dry, red and spotted. The affected person may be mentally confused and delirious. Convulsions could occur. **EARLY RECOGNITION AND TREATMENT OF HEAT STROKE ARE THE ONLY MEANS OF PREVENTING BRAIN DAMAGE OR DEATH.** A person exhibiting signs of heat stroke should be removed from the work area to a shaded area. The person should be soaked with water to promote evaporation. Fan the person's body to increase cooling.

Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks.

Early Symptoms of Heat-Related Health Problems:

- decline in task performance
- uncoordination
- decline in alertness
- unsteady walk
- excessive fatigue
- reduced vigilance
- muscle cramps
- dizziness

Susceptibility to Heat Stress Increases due to:

- lack of physical fitness
- lack of acclimation
- increased age
- dehydration
- obesity
- drug or alcohol use
- sunburn
- infection

People unaccustomed to heat are particularly susceptible to heat fatigue. First timers in PPE need to gradually adjust to the heat.

The Effect of Personal Protective Equipment

Sweating normally cools the body as moisture is removed from the skin by evaporation. However, wearing certain personal protective equipment (PPE), particularly chemical protective coveralls (e.g., Tyvek), reduces the body's ability to evaporate sweat and thereby regulate heat buildup. The body's efforts to maintain an acceptable temperature can therefore become significantly impaired by the wearing of PPE.

Measures to Avoid Heat Stress

The following guidelines should be adhered to when working in hot environments:

- Establish work-rest cycles (short and frequent are more beneficial than long and seldom);
- Identify a shaded, cool rest area;
- Rotate personnel, alternative job functions;
- Water intake should be equal to the sweat produced. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst. **DO NOT DEPEND ON THIRST**

TO SIGNAL WHEN AND HOW MUCH TO DRINK. For an 8-hour work day, 50 ounces of fluids should be drank;

- Eat lightly salted foods or drink salted drinks such as Gatorade to replace lost salt;
- Save the most strenuous tasks for non-peak heat hours such as the early morning or at night;
- Avoid alcohol during prolonged periods of heat. Alcohol will cause additional dehydration; and
- Avoid double shifts and/or overtime.

The implementation and enforcement of the above-mentioned measures will be the joint responsibility of the ENSR project manager, on-site field coordinator, and health and safety officer. Potable water and fruit juices should be made available each day for the field team.

Heat Stress Monitoring Techniques

Site personnel should regularly monitor their heart rate as an indicator of heat strain by the following method:

Check the radial pulse rate using fore-and middle fingers and applying light pressure to the pulse in the wrist for one minute at the beginning of each rest cycle. If the pulse rate exceeds 110 beat/minute, shorten the next work cycle by one-third and keep the rest period the same. If, after the next rest period, the pulse rate still exceeds 110 beats/minute, shorten the work cycle again by one-third.

6.0 AIR MONITORING

6.1 Direct Reading Instrumentation

Instrument I –Photoionization Detector (PID) – RaeSystems Mini-Rae 2000 with a 10.6 ev lamp

A RaeSystems Mini-Rae 2000 PID with a 10.6 ev lamp will be used to monitor the breathing zone of personnel during all subsurface investigations and sampling activities. When the PID indicates sustained (15 minute) breathing zone vapor concentrations in excess of 25 units or more, respiratory protection, as described in Section 7.0 of this HASP, will be donned. This action level is based on the ACGIH TLV for TCE (50 ppm) and the reported response of TCE to the selected instrument.

Instrument 2 - Carbon Monoxide Meter

A carbon monoxide meter must be used to monitor the build up of exhaust gas in the bays if a drill rig is used to advance the proposed borings. The unit will be set to alarm at 25 ppm. If the alarm sounds, work will cease until levels are reduced to below 25 ppm. If levels are repeatedly exceeding 25 ppm, mechanical ventilation will be mobilized to the bay to remove the vapors from the room. Even if the building is well-ventilated and the exhaust gas is ducted to the outside, a CO meter is still required.

6.2 Personal Exposure Monitoring

Personal exposure monitoring will not be conducted during this phase of investigation.

6.3 Community Air Monitoring Plan

Consistent with the New York State Department of Health guidance for generic CAMPs, ENSR will implement a CAMP that requires VOC monitoring during intrusive activities and non-intrusive work such as groundwater sampling. The specifics of the CAMP are described in Appendix E of the RI/FS Work Plan.

6.4 Calibration and Record Keeping

The PID will be calibrated to a 100 ppm isobutylene-in-air mixture on a daily basis in accordance with ENSR's Standard Operating Procedures (SOPs). The carbon monoxide meter will be calibrated in accordance with the manufacturer's requirements. All PID and carbon monoxide readings, as well as general weather conditions, will be recorded in the field notebook or on dedicated air monitoring sheets. In addition, all calibrations must be recorded.

7.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) will be worn during RI field activities to prevent on-site personnel from being injured by the safety hazards posed by the site and/or the activities being performed. In addition, chemical protective clothing will be worn to prevent direct dermal contact with the site's chemical contaminants.

7.1 Protective Clothing By Task

PPE Item	Task 1	Task 2	Task 3	Task 4	Task 5
Hard Hat		✓	✓	✓	
Steel Toed Safety Shoes	✓	✓	✓	✓	✓
Safety Glasses with Sideshields	✓	✓	✓	✓	✓
Traffic Vests (when working in high traffic area)		✓	✓	✓	✓
Leather or Kevlar gloves		✓	✓	*	*
Inner PVC/Outer Nitrile Gloves	✓		✓	✓	✓
Hearing Protection		✓	✓		

Task 1 - Soil Gas Sampling

Task 2 -Soil Boring Using Direct Puch Method (e.g., Geoprobe™)

Task 3 – Soil Boring/Well Installation Using Rotary Drilling

Task 4 – Soil Sampling During Boring

* -when cutting open soil liners

Task 5 – Monitoring Well Development/Groundwater Sampling/Water Level Surveys/Slug Tests

*- wear Kevlar gloves when cutting tubing to facilitate groundwater sampling

7.2 Respiratory Protection

Direct reading instrumentation will be used to screen the breathing zone of employees during subsurface investigations and sampling activities conducted in areas where VOCs are known or expected to be present. When the PID indicates sustained (15-minute) breathing zone vapor concentrations in excess of 25 units or more, Level C respiratory protection will be donned.

Level C Specification – Half-mask, air-purifying respirators with organic vapor cartridges

Level C protection can also be donned if odors become objectionable.

All personnel who are expected to don respiratory protection must have been successfully fit-tested, either qualitatively or quantitatively, for the brand and size respirator that they plan to wear for this project.

A carbon monoxide meter must be used to monitor the build up of exhaust gas in the bays if a drill rig is used to advance the proposed borings. The unit will be set to alarm at 25 ppm. Air-purifying respirators are not adequate to protect employees from carbon monoxide If the alarm sounds, work will cease until levels are reduced to below 25 ppm. If levels are repeatedly exceeding 25 ppm, mechanical ventilation will be mobilized to the bay to remove the vapors from the room.

7.3 Other Safety Equipment

The following additional safety equipment will be brought to the site for ENSR's use:

- Portable eye wash;
- First Aid Kit;
- Cellular Telephone; and
- Type A-B-C fire extinguisher (it is sufficient to have such an extinguisher on the back of the drill rig and other machinery).

8.0 SITE CONTROL

To prevent exposure to unprotected personnel and migration of contamination due to tracking by personnel or equipment, work areas along with PPE requirements will be clearly defined.

8.1 Designation of Zones

The following zones will be established in order to maintain site control:

- Exclusion or "Hot" Zone;
- Contamination Reduction Zone (CRZ); and
- Support Zone.

8.1.1 Exclusion Zone

An exclusion zone will be established around each subsurface activity location as well as each sampling location. This zone will serve to protect ENSR employees from street traffic and will protect neighboring businesses and their employees from any chemical or physical hazards that are associated with the proposed activities. Since the wells may be located in traffic areas, these same zones will be established during groundwater sampling. The perimeter of the exclusion zone will be marked with Caution tape or indicated by traffic cones. All personnel entering these areas must wear the prescribed level of protective equipment.

8.1.2 Contamination Reduction Zone

A mini-contamination reduction zone (CRZ) will be established immediately adjacent to each exclusion zone to facilitate prompt removal of contaminated PPE. This is where personnel will begin the sequential decontamination process (see Section 9.0 this HASP) when exiting the exclusion zone. If necessary, contaminated PPE, such as boots, will be rinsed free of gross contamination, scrubbed clean in a detergent solution and then rinsed clean. To facilitate this sort of decontamination process, it may be necessary to establish a three basin wash system on site. To prevent cross contamination and for accountability purposes, all personnel will enter and leave the exclusion zone through the contamination reduction zone.

8.1.3 Support Zone

The support zone will consist of those areas around the exclusion zone where equipment is staged.

8.2 Safety Measures/Precautions

The following measures are designed to augment the specific health and safety guidelines provided in this plan:

- The "buddy system" will be used at all times by all field personnel. Each team member must be intimately familiar with the procedures for initiating an emergency response;
- Avoidance of contamination is of the utmost importance. Whenever possible, avoid contact with contaminated (or potentially contaminated) surfaces or materials. Walk around (not through) puddles and discolored surfaces. Do not kneel on the ground or set equipment on the ground. Protect air monitoring equipment from water by bagging;
- Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in the immediate work area and the decontamination zone;
- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking or any other activities;
- Beards or other facial hair that interfere with respirator fit are prohibited;
- The use of alcohol or illicit drugs is prohibited during the conduct of field operations;
- All equipment must be decontaminated or properly discarded before leaving the site in accordance with the field sampling plan; and
- Safety equipment described in Section 7.0 of this HASP will be required for all field personnel unless otherwise approved by the RHSM.

9.0 DECONTAMINATION

9.1 Personnel Decontamination

Proper decontamination is required of all personnel and equipment before leaving the site. The extent of personnel decontamination will depend on the amount of contamination encountered. Personnel decontamination will be accomplished by following a systematic procedure of cleaning (when necessary) and removing PPE. If necessary, contaminated PPE, such as boots, will be rinsed free of gross contamination, scrubbed clean in a detergent solution and then rinsed clean. To facilitate this decontamination process, it may be necessary to establish a three basin wash system on site.

Disposable PPE such as gloves will be disposed of in accordance with the Field Sampling Plan (FSP) (Appendix B to Work Plan).

Regardless of the type of decontamination system required, if washing facilities are unavailable, a container of potable water and liquid soap must be made available so employees can wash their hands and face before leaving the site for lunch or for the day.

9.2 Equipment Decontamination

The decontamination of small tools, heavy equipment and sampling equipment will be conducted in accordance with the field sampling and analysis plan. Specifically, sampling equipment will be decontaminated prior to sampling and between samples. Decontamination will generally consist of tap water rinse followed by a non-phosphate detergent rinse, a methanol rinse and finally a de-ionized water rinse.

Heavy equipment, including the drill rig, rods and augers and other downhole equipment will be decontaminated prior to beginning work and between all boreholes using a high-pressure steam wash at the point closest to generation. Washwater will be containerized and managed as investigation-derived waste in accordance with Section 3.8 of the FSP.

10.0 MEDICAL/TRAINING REQUIREMENTS

10.1 Medical Surveillance

All personnel performing activities covered by this HASP must be active participants in a medical monitoring program which complies with 29 CFR 1910.120(F). Each individual must have completed an annual surveillance examination and/or an initial baseline examination within the last year prior to performing any work on this site covered by this HASP.

10.2 Training

10.2.1 HAZWOPER

Additionally, all personnel performing activities covered by this HASP must have completed the appropriate training requirements specified in 29 CFR 1910.120(E). Each individual must have completed an annual 8-hour refresher-training course and/or initial 40-hour training course within the last year prior to performing any work on this site covered by this HASP.

10.2.2 Pre-Entry Briefing

Prior to the commencement of the investigative activities, a site safety meeting will be conducted by the SSO to review the specific requirements of this HASP. Attendance at this pre-entry briefing is mandatory and will be documented (see Attachment C). On-going safety meetings will be held each morning to review any new information or new procedures required for controlling identified hazards.

11.0 EMERGENCY RESPONSE

OSHA defines **emergency response** as any "response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result in an **uncontrolled release of a hazardous substance**." According to ENSR policy, ENSR personnel shall not participate in any emergency response where there are potential safety or health hazards (i.e., fire, explosion, or chemical exposure). ENSR response actions will be limited to making adequate notifications to local emergency responders, evacuation and medical/first aid as described within this section below. As such, this section of the HASP has been written to comply with 29 CFR 1910.38 (a).

The basic elements of an emergency evacuation plan include employee training, alarm systems, escape routes, escape procedures, critical operations or equipment, rescue and medical duty assignments, designation of responsible parties, emergency reporting procedures and methods to account for all employees after evacuation.

Employee Training: Employees must be instructed in the specific aspects of emergency evacuation applicable to the site as part of the pre-entry briefing prior to the commencement of all on-site activities. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed.

Alarm Systems/Emergency Signals: An emergency communication system must be in effect at all sites. The most simple and effective emergency communication system in many situations will be **direct verbal communications**.

There are no telephone facilities at the Site or Site vicinity. Therefore, additional communications equipment is required.

Escape Routes and Procedures: The SSO will verify the escape routes from the specific work location. Some of the sampling locations are located along a major roadway that can serve as an escape route. However, several borings will be completed beneath the railroad tracks within bays that have rigid walls. In these situations, escape routes will need to be identified. The escape routes will be reviewed in the pre-entry briefing.

Critical Operations and Equipment: All equipment and operations are required to cease in the event of site evacuation. The only exception will be related to health and safety. The PM or SSO must determine at the time of an emergency if health and safety will be jeopardized by immediate stoppage of any particular piece of equipment or personal activities. If such a determination is made, personnel involved in critical duties must be minimized and special instructions must be established.

Rescue and Medical Duty Assignments: Prior to initiating work at the site, an ENSR field team member, usually the SSO, shall be appointed to activate emergency response actions. In the event an injury or illness requires more than first aid treatment, which individual will accompany the injured person to the medical facility and will remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the on-site project manager and the RHSM.

If the injured employee can be moved from the accident area, he or she will be brought to the CRZ where their PPE will be removed. If the person is suffering from a back or neck injury the person will not be moved and the requirements for decontamination do not apply. The SSO must familiarize the responding emergency personnel about the nature of the site and the injury. If the responder feels that the PPE can be cut away from the injured person's body, this will be done on-site. If this not feasible, decontamination will be performed after the injured person has been stabilized.

Accident Reporting/Investigation: If an ENSR employee is injured, his/her supervisor must be notified immediately. If the Project Manager is not on-site, s/he should also be notified. An ENSR Accident Investigation form (Attachment D) must be completed as soon as possible and submitted to the RHSM.

If an ENSR subcontractor is injured, s/he should report to their supervisor immediately, who in turn, must report the injury to the ENSR SSO

Designation of Responsible Parties: The SSO is responsible for initiating emergency response. In the event the SSO can not fulfill this duty, the alternate SSO will take charge. All personnel on-site are responsible for knowing the escape route from the site.

Employee Accounting Method: The on-site project manager or SSO is responsible for identifying all ENSR and subcontractor personnel on-site at all times. On small, short duration jobs this can be done informally as long as accurate accounting, via a head-count, is possible.

EMERGENCY REFERENCES

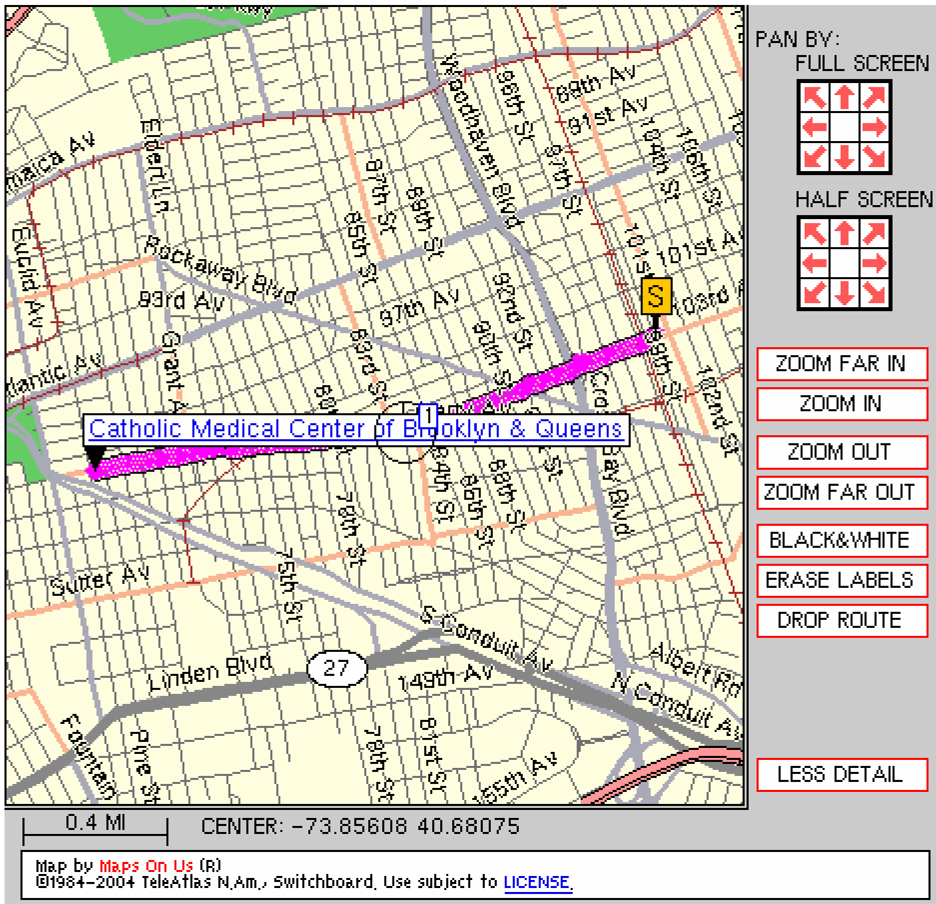
Ambulance:	911
Fire:	911
Police:	911
Medical Services:	718-827-5009 Catholic Medical Center of Brooklyn and Queens 1061 Liberty Avenue Brooklyn
Directions to Hospitals:	From 101st Street, head west onto 103Rd Avenue. Follow for 0.7 miles. Turn right onto Liberty Ave. Follow for 0.9 miles to hospital

ENSR REPRESENTATIVES:

ENSR/WESTFORD, MA	978-589-3000
-Kathleen Harvey (RHSM)	x 3325
-David Austin (PM)	x 3495

ROUTE FROM SITE TO CATHOLIC MEDICAL CENTER

1061 Liberty Ave - Brooklyn



ATTACHMENT A

Health and Safety Plan Signoff Sheet

Remedial Investigation

Former Ozone Industries, Inc.

Ozone Park, Queens New York

I have received a copy of the Health and Safety Plan prepared for the above referenced site, I have read and understand its content and I agree that I will abide by its requirements.

____

Name

____

Signature

____

Company

____

Date

ATTACHMENT B

Job Hazard Analysis Form

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
SAFETY EQUIPMENT	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**

ATTACHMENT C

Pre-Entry Briefing Attendance Sheet

ENSR HEALTH AND SAFETY PLAN PRE-ENTRY BRIEFING ATTENDANCE FORM

Remedial Investigation

Former Ozone Industries, Inc.

Ozone Park, Queens New York

Briefing Conducted By: ______________________________

Date Performed: ______________________________

Printed Name	Signature	Representing

ATTACHMENT D

Accident Investigation Report

H&S SOP NUMBER: 4.2

SUPERVISOR'S ACCIDENT INVESTIGATION REPORT

Injured Employee ________________________________ Job Title ________________________________

Home Office __________________________ Division/Department ________________________________

Date/Time of Accident ____

Location of Accident ____

Witnesses to the Accident ____

Injury Incurred?________ Nature of Injury ____

____

Engaged in What Task When Injured?____

____

Will Lost Time Occur? _______ How Long? _________ Date Lost Time Began _______________________

Were Other Persons Involved/Injured? ____

____

How Did the Accident Occur? ____

____

____

____

____

What Could Be Done to Prevent Recurrence of the Accident?____________________________________

____

____

What Actions Have You Taken Thus Far to Prevent Recurrence?__________________________________

____

____

Supervisor's Signature __________________________ Title ____________________ Date ______________

Reviewer's Signature ____________________________ Title ____________________ Date ______________

Note: If the space provided on this form is insufficient, provide additional information on a separate page and attach. The completed accident investigation report must be submitted to the Regional Health and Safety Manager.

Appendix E

COMMUNITY AIR MONITORING PLAN

Former Ozone Industries, Inc. Site

NYSDEC Site # 2-41-033

Order on Consent Index # W2-0922-02-05 (with Endzone, Inc.)

Queens, New York

ENSR INTERNATIONAL

ENSR Corporation
May 14, 2004
Project No. 08734765

CONTENTS

1.0 INTRODUCTION

As described in the body of the Work Plan, a Remedial Investigation/Feasibility Study (RI/FS) is being conducted pursuant to an Order on Consent issued by the New York State Department of Environmental Conservation (NYSDEC) to Endzone, Inc. (formerly Ozone Industries, Inc.), with an effective date of February 15, 2003. This Community Air Monitoring Plan (CAMP) is included as Appendix E to the revised RI/FS Work Plan that has been prepared by ENSR Corporation (ENSR) for an area located within a city block in Ozone Park, Queens, New York. This area is bound by 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south (Site) as referenced in the Order on Consent. The RI/FS is intended to further evaluate the presence of volatile organic compounds (VOCs), primarily trichloroethene (TCE) in soil gas, soil and groundwater at the Site and the Site vicinity. Figures 1 and 2 in the Work Plan depict the Site location.

The original RI/FS Work Plan has been revised following written comments from the NYSDEC in a letter dated December 22, 2003 and subsequent telephone conversations. The original RI/FS Work Plan was submitted to the NYSDEC on April 15, 2003. A copy of the NYSDEC review comment letter is attached in Appendix A of the Work Plan. The comments have been addressed and included in the revised RI/FS Work Plan and attachments as applicable. Also attached in Appendix A of the Work Plan, is a copy of the review comments by the NYSDEC with notes following each indicating how and where the comments are addressed in the revised RI/FS Work Plan if applicable.

ENSR has consulted the New York State Department of Health (NYSDOH) generic CAMP guidance (NYSDOH gCAMP rev. 1 06/00) in preparing this CAMP for the RI. The scope of the field work includes soil gas sampling, the advancement of soil borings (with groundwater sampling during the completion of some soil borings), some of which will be completed as groundwater monitoring wells, and the development and collection of groundwater samples from these wells for laboratory analysis. This CAMP specifies real-time air monitoring requirements for total volatile organic vapors or compounds (TVOCs) to be performed during intrusive activities (drilling), and periodic monitoring for TVOCs during non-intrusive activities (i.e. groundwater sampling). These activities are not expected to create any significant particulates, which would warrant a fenceline monitoring program. However, ENSR will be prepared to monitor for particulates in the unlikely chance that dust is generated. Therefore, the objective of the CAMP will be to measure TVOCs in the breathing zone of the workers during drilling activities and monitoring well development and groundwater sampling activities. As this area is in an urban commercial/residential setting, background conditions will also be evaluated before sampling starts.

During the intrusive and non-intrusive sampling activities, it is estimated that four weeks of drilling (soil and soil gas sampling) and three weeks of well development and groundwater sampling will occur where air emissions may be generated. This air monitoring program is detailed in the following sections.

2.0 COMMUNITY AIR MONITORING PLAN (CAMP) OBJECTIVES

The four primary objectives of this CAMP are to:

- Help protect human health and the environment;
- Use real-time monitoring results in conjunction with worker health and safety programs;
- Evaluate the effectiveness of, and need for, additional vapor suppression controls; and
- Document air quality during site activities.

The specific air monitoring and data quality objectives are outlined below.

2.1 Air Monitoring Objectives

Consistent with the NYSDOH guidance for generic CAMPs, ENSR will implement a CAMP to monitor quantitative TVOCs with a portable photoionization instrument (PID) during intrusive activities (soil gas sampling, soil borings and monitoring well installations) and non-intrusive activities (well development and groundwater sampling).

Air monitoring of the work area is designed to accomplish the objectives described above as well as:

- Establish background levels of TVOCs in ambient air;
- Develop action levels which are protective of worker and public safety for TVOCs at the Site;
- Monitor and document ambient air TVOC levels during the days when field sampling activities (drilling, soil and soil gas sampling, and well development and groundwater sampling) may produce air emissions; and
- Evaluate the need for vapor control measures to reduce airborne concentrations.

Personal exposure monitoring will not be conducted during this phase of remedial investigation. Instead, a RaeSystems Mini-Rae 2000 PID, or equivalent, with a 10.6 eV lamp will be used to monitor the breathing zone of personnel during all subsurface investigations and sampling activities. When the PID indicates sustained (15 minute) breathing zone vapor concentrations in excess of 25 units, respiratory protection will be donned as described in Section 7.0 of the HASP (Appendix D of the Work Plan). This action level is based on the ACGIH TLV for TCE (50 parts per million [ppm]) and the reported response of TCE to the selected PID instrument.

3.0 REAL-TIME AIR MONITORING

The air monitoring system is intended to be protective of worker and public health in the vicinity of soil gas sampling and soil boring/monitoring well installations, and groundwater sampling activities. The sampling program is designed to provide real-time air monitoring during the days of potential air emissions so that acceptable risks for acute and subchronic exposures are not exceeded. Monitoring will be conducted during the drilling (soil gas, soil and groundwater sampling), well development and groundwater sampling activities according to the NYSDOH CAMP guidance.

An overview of the monitoring activities is as follows:

Endzone Inc. is proposing to monitor TVOCs in the work area during the drilling (soil gas, soil and groundwater sampling), well development and groundwater sampling activities on a continuous basis using a PID. The PID will be calibrated to a 100 ppm isobutylene-in-air mixture on a daily basis in accordance with ENSR's Standard Operating Procedures (SOPs). All PID readings will be recorded in the field notebook or on a dedicated PID calibration log sheet.

Air Monitoring during Intrusive Activities

The following protocol will be used to monitor ambient air conditions during intrusive (drilling) activities. It is important to note that permanent air monitoring points will not be established because of the nature of the work, and temporary work zones will be established at each investigative location.

- The monitoring technician (Field Team Leader or designee) will establish background (upwind) TVOC concentrations prior to the start of intrusive activities.

- TVOCs will be measured on a continuous basis within the work area. If ambient air concentrations of TVOCs exceed 5 ppm above background levels for a 15-minute average at an assumed edge of work zone (e.g., 10 feet from drill rig) (separate from breathing zone of worker in work zone), work activities will be temporarily halted and monitoring will continue for one minute at a downwind location five feet from the original edge of work zone. If the TVOC concentration at the new downwind location decreases to below 5 ppm above background, work activities can resume with continued monitoring.

- If TVOCs persist in excess of 5 ppm above background levels after stepping back five feet as discussed above, work activities will be temporarily halted and monitoring will continue for one minute at a location five feet from the previous assumed edge of work zone. If the next TVOC concentration decreases to below 5 ppm above background levels, work activities can resume with continued monitoring.

Monitoring will continue and work can continue provided that TVOCs are below 5 ppm above background levels at a location 200 feet downwind from the work area or half the distance to the nearest receptor, whichever is less. Otherwise, work activities must be suspended until the source of the VOCs is identified and abated.

Air Monitoring during Non-Intrusive Activities

The following protocol will be used to monitor ambient air conditions during non-intrusive (well development and groundwater sampling) activities.

- The monitoring technician (Field Team Leader or designee) will establish background (upwind) TVOC concentrations prior to the start of non-intrusive activities.

- Prior to the start of well development or groundwater sampling activities, a reading of the air at the top of the well casing and the breathing zone will be recorded immediately after the expansion plug has been removed.

- Subsequent periodic PID measurements (from the temporary work zone) will be recorded at 15-minute intervals during the time work is being conducted at a particular location.

- If ambient air concentrations of TVOCs exceed 5 ppm above background at one 15-minute interval, monitoring will continue for 15-minutes. If the average 15-minute TVOC concentration decreases to below 5 ppm above background levels, work activities can resume with continued monitoring.

- If average ambient air concentrations of TVOCs exceed 5 ppm above background for the 15-minute period discussed above, activities will be temporarily halted and monitoring will continue for one minute at a downwind location five feet from the original work area. If TVOC concentration decreases to below 5 ppm above background levels, work activities can resume with continued monitoring.

- If TVOCs persist in excess of 5 ppm above background after stepping back five feet as discussed above, work activities will be temporarily halted and monitoring will continue for one minute at a location five feet from the previous location. If the next TVOC concentration decreases to below 5 ppm above background levels, work activities can resume with continued monitoring.

Monitoring will continue and work can continue provided that TVOCs are below 5 ppm above background at a location 200 feet downwind from the work area or half the distance to the nearest receptor, whichever is less. Otherwise, work activities must be suspended until the source of the VOCs is identified and abated.

Appendix F

CITIZEN PARTICIPATION PLAN

Former Ozone Industries, Inc. Site

NYSDEC Site # 2-41-033

Order on Consent Index # W2-0922-02-05 (with Endzone, Inc.)

Queens, New York

ENSR Corporation
May 14, 2004
Project No. 08734765

CONTENTS

ATTACHMENTS

1 RI and FS Fact Sheets

2 Citizen Participation Record

3 Site Communication Needs

4 List of Residents and Businesses within Contact List Area

1.0 INTRODUCTION

This Citizen Participation Plan (CPP) is an attachment (Appendix F) to a revised Remedial Investigation and Feasibility Study (RI/FS) Work Plan that has been prepared by ENSR Corporation for an area located within a city block in Ozone Park, Queens, New York that is bounded by 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south (Site). The RI/FS Work Plan has been prepared in accordance with the Order on Consent between the New York State Department of Environmental Conservation (NYSDEC) and Endzone, Inc., with an effective date of February 15, 2003. The investigation is intended to further evaluate the presence of volatile organic compounds (VOCs) in soil gas, soil and groundwater at the Site and Site vicinity.

The original RI/FS Work Plan has been revised following written comments from the NYSDEC in a letter dated December 22, 2003 and subsequent telephone conversations. The original RI/FS Work Plan was submitted to the NYSDEC on April 15, 2003. A copy of the NYSDEC review comment letter is attached in Appendix A of the Work Plan. The comments have been addressed and included in the revised RI/FS Work Plan as applicable. Also attached in Appendix A of the Work Plan, is a copy of the review comments by the NYSDEC with notes following each indicating how and where the comments are addressed in the revised RI/FS Work Plan if applicable.

Endzone, Inc., in cooperation with the NYSDEC is committed to informing and involving the public during the upcoming RI and FS at the Site. This document provides an overview of the public participation process, potential community issues, the Site history and the proposed investigation, and presents public repositories for Site documents, a Site contact list, and a listing of public participation activities.

2.0 OVERVIEW OF THE CITIZEN PARTICIPATION PROGRAM

The RI is a detailed study to evaluate the nature and extent of environmental issues related to VOC-containing soils, soil gas and groundwater, including evaluation of potential threats to public health and the environment. Information developed during the RI will be used in the FS to evaluate if clean up is necessary, and if so, what methods can be used to clean up the Site. The preferred method of clean up will be described in a Proposed Remedial Action Plan (PRAP). After public comment, the selection of a clean-up alternative is finalized in a Record of Decision (ROD). Once the ROD has been executed, the clean up remedy is designed and constructed. RI and FS Fact Sheets for the site are included as Attachment 1.

2.1 Goals and Objectives of the Citizen Participation Program

This CPP identifies important community issues and information needs that relate to the Site and Site vicinity. In addition, the plan identifies information that Endzone, Inc. and NYSDEC need from the community. This CPP also describes activities to be conducted during the RI/FS. The activities are designed to accomplish the following objectives:

- Help the interested and affected public to understand the environmental issues at the Site, and the nature and progress of the program to investigate and clean up the Site;
- Provide open communication between the public and project staff throughout the remedial process;
- Create opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about the Site's investigation and clean up; and
- Show that public input was received and considered, and how it was factored into decision making.

Endzone, Inc. will conduct the RI/FS under NYSDEC oversight. The NYSDEC will implement the activities described in this CPP. The New York State Department of Health (NYSDOH) may participate in many of these activities. Endzone, Inc. will assist with the CPP activities under NYSDEC oversight, review, and approval.

3.0 SITE BACKGROUND

3.1 Site Description and History

The Site is located between a block that is bounded by 99th and 100th Streets to the west and east, and by 101st and 103rd Avenues to the north and south, and is beneath an abandoned elevated Long Island Railroad. Ozone Industries, Inc. rented/operated for storage purposes a portion of the Site for a period prior to 1998, possibly starting as early as 1961. During that period, a portion of the Site was used to store solvents, hydraulic fluids, and scrap metal chips in roll-off containers that resulted from Ozone Industries, Inc. manufacturing activities. The portion of the Site utilized by Ozone Industries, Inc. was constructed of cinder block walls, and contained a dirt floor. During that period it is believed that releases of solvents, oil and/or fluids which coated the metal chips may have occurred at the Site. The nature and extent of those releases is not presently known. At the property across 100th Street from the Site, Ozone Industries, Inc. manufactured aircraft parts including landing gears, hydraulic assemblies, aircraft steering wheel assemblies, flight controls, etc.

Since the Ozone Park facility was sold by Ozone Industries, Inc. in 1998, Endzone, Inc. is not familiar with the nature of the operations at the Site since that time.

3.2 Preliminary Conceptual Site Model

Environmental investigations have been completed by others for the Site vicinity on behalf of the NYSDEC, Division of Environmental Remediation. The information is presented in five reports completed between January 2000 and May 2003 as listed in Section 7.2 of the RI/FS Work Plan. Details of the work are presented in Section 2.0 of the RI/FS Work Plan.

As discussed in the Work Plan, the Site vicinity is characterized by the presence of certain VOCs (primarily TCE) above potentially relevant regulatory criteria in groundwater.

Based on the site characterization information obtained to date, a preliminary conceptual site model (CSM) has been developed that presents potential sources of contamination, pathways and receptors.

The primary potential source of constituents to environmental media and potential receptors at the Site includes historical handling and storage at the Site of solvents, hydraulic fluids, and scrap metal chips in roll-off containers that resulted from former Ozone Industries, Inc. manufacturing activities.

Based upon the groundwater flow direction (south across the Site vicinity) and distribution of TCE in groundwater, the most TCE-impacted area is located in the vicinity of the Site, potentially a result of the storage and handling practices at the Site. The highest TCE level in groundwater was detected at GP-

11 near the Site (22,000 ug/l). Many of the higher levels detected in the Site vicinity were between 1,000 ug/l and 3,000 ug/l, detected in samples from near the Site and south of the Site. It is not clear if other sources of TCE and/or chlorinated VOCs are present south of the Site.

Data are being collected as part of this RI in part to further assess what pathways are complete, and if so, what potential there is for impacts to receptors. The CSM will be further refined in the RI with a focus towards these potentially complete pathways and receptors, as follows.

Human receptors/pathways to be evaluated during the RI/FS include:

- Potential migration of vapors from impacted groundwater to indoor air; and
- Exposure to potentially contaminated soil at the Site.

Currently, no ecological receptors/pathways will require evaluation during the RI/FS.

3.2.1 Data Gaps

Data gaps to be further investigated as part of the RI/FS include:

- Soil conditions (i.e. contaminant concentrations) at the Site;
- Subsurface soil gas conditions to evaluate the potential migration of vapors from impacted groundwater and soil to indoor air;
- Groundwater and soil conditions, shallow and deep near the Site and location GP-11;
- Refinement of the groundwater monitoring well network to supplement previously estimated groundwater flow directions and to provide additional information on groundwater contaminant levels; and
- Identify other potential source areas that may be contributing to groundwater contamination (with installation of cross-gradient and upgradient monitoring wells, and possible collection of additional history and use information for other properties in the Site vicinity and/or bays at the Site).

4.0 PROJECT DESCRIPTION

4.1 Task Description

The tasks that will be implemented during the RI/FS are summarized below. Additional details regarding the activities are provided in the RI/FS Work Plan. Sampling locations are shown on Figures 3 and 4 attached to the RI/FS Work Plan.

The RI/FS will consist of the following activities:

- Surface (if applicable) and Subsurface Soil Investigation;
- Subsurface Soil Vapor Investigation;
- Groundwater Investigation;
- In-Situ Hydraulic Conductivity Testing;
- Site Survey;
- Progress Reports;
- Phase Reports/Additional FFI Work Plan(s) (as appropriate); and
- RI/FS Report.

5.0 COMMUNITY ISSUES AND CITIZEN PARTICIPATION ACTIVITIES

This section of the CPP describes the public participation activities to be conducted during the RI/FS. Some of these activities are required by regulation. Several additional public participation activities will also be conducted. Project Staff (as defined in Section 6.0) will perform these activities to inform and involve the community in the investigation and remediation activities for the Site.

The **Citizen Participation Record** for the Site is included as Attachment 2 to the CPP (from the NYSDEC Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook, dated June 1998). This form identifies the public participation activities required to be conducted during the RI/FS. The Citizen Participation Record helps to document for the project staff and the public the activities that will be performed during the site investigation and remediation process and tracks their completion.

A major emphasis for the public participation program is to conduct activities that are responsive to significant issues of community concern, and to major information needs of both the community and the NYSDEC. The Citizen Participation Record is accompanied by a supporting document entitled **Site Communication Needs** (Attachment 3). Preparation of this support document helped project staff to profile the structure and make-up of the community, key issues of community concern and public information needs, and the particular groups or individuals who have those concerns and needs. Understanding issues of public concern and public information needs will help Endzone, Inc. and NYSDEC to:

- effectively conduct the CPP activities required by law, regulation, and policy; and
- choose and effectively conduct CPP activities beyond the requirements that may be necessary to design and implement an effective citizen participation program for the Site.

The primary issue at the site is the known presence of VOCs in soil, soil gas and groundwater. The soil gas, soil and groundwater will be investigated more thoroughly as part of the RI and a remedial alternative selected in the FS. There will likely be general public interest in the nature of the investigation to be conducted at the Site, the possible remedial alternatives, and their cost and impacts on the economic well-being of the Site vicinity.

The public is encouraged to review the issues and information needs of the community identified in this CPP. Interested people are encouraged to contact project staff at any time with additional issues or information needs, to recommend how public participation activities can be effectively conducted, or to suggest additional activities that may be needed to improve the outreach effort.

6.0 PROJECT CONTACTS

For additional information about the upcoming RI/FS at Site, the public is encouraged to contact any of the following project staff:

Endzone, Inc.:

Steven E. Pazar, Esq.
401 Edgewater Place
Suite 670
Wakefield, MA 01880
Phone: (781) 246-1068
Fax: (781) 245-2227

NYSDEC:

NYSDEC Project Manager -

John Durnin, P.E.
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016
Phone: (518) 402-9774
Fax: (518) 402-9773

NYSDOH:

Dawn Hettrick, Senior Sanitary Engineer
Bureau of Environmental Exposure Investigation
Flanigan Square
547 River Street
Room 300
Troy, NY 12180-2216, or
1-800-458-1158, extension 2-7870
Phone: (518) 402-7880
Fax: (518) 402-7859

ENVIRONMENTAL CONSULTANT

David G. Austin
ENSR International
2 Technology Park Drive
Westford, MA 01886
Phone: (978) 589-3495
Fax: (978) 589-3100

7.0 DOCUMENT REPOSITORIES AND LIST OF AVAILABLE DOCUMENTS

Document repositories have been established to provide the public with convenient access to important project documents and other information. This information will include reports, data and other information gathered and developed during the course of the RI/FS, as well as fact sheets, public meeting announcements, and proposed remedial activities and the ROD for the Site.

Document Repositories:

NYSDEC
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016
Telephone: (518) 402-9774
Hours of Operation: Mon. – Fri. 8:30 am to 4:45 pm
Contact: John Durnin

NYSDEC Region 2
1 Hunter's Point Plaza
47-40 21st Street
Long Island City, NY 11101-5407
Phone: (718) 482-4900

Local Repositories –

Queens Borough Public Library
The Central Library - Long Island Division
89-11 Merrick Blvd.
Jamaica, NY 11432-5248
Phone: (718) 990-0770
Attn: Judith Box

Hours:
Monday: 10-9
Tuesday - Thursday: 10-7
Friday: 10-6
Saturday: 10-5:30
Sunday: 12-5 (September through May Only)

Available Site Vicinity Documents:

Preliminary Site Assessment Report (January 2000)

Public School 60/62 (Former Voges Manufacturing Company) and Ozone Industries, Inc.

Prepared by Lawler, Matusky & Skelly Engineers, LLP, Prepared for NYSDEC, Division of Environmental Remediation

Immediate Investigation Work Assignment Field Investigation Letter Report (Final September 2001)

Former Ozone Industries

Prepared by URS Corporation Group Consultants, Prepared for NYSDEC, Division of Environmental Remediation

Immediate Investigation Work Assignment Interim Letter Report Phase I Field Activities (Draft Final July 2002)

Former Ozone Industries (Public School 65)

Prepared by URS Corporation Group Consultants, Prepare for NYSDEC, Division of Environmental Remediation

Field Investigation Letter Report For Phase I and Phase II Field Activities (Final September 2002)

Former Ozone Industries (Public School 65)

Prepared by URS Corporation Group Consultants, Prepared for NYSDEC, Division of Environmental Remediation

Field Investigation Letter Report For The 2003 Groundwater and Soil Gas Sampling Event (Final May 2003)

Former Ozone Industries (Public School 65)

Prepared by URS Corporation Group Consultants, Prepared for NYSDEC, Division of Environmental Remediation

At the start of the RI/FS, copies of the documents will be placed in the repositories listed over.

Additional information and documents that are developed during the course of the project will be made available in the repositories. Their availability will be announced through fact sheets, press releases, and other means.

8.0 POTENTIALLY AFFECTED/INTERESTED PUBLIC (CONTACT LIST)

The Contact List has been developed to help Endzone, Inc. and NYSDEC to keep the community informed about and involved in the RI/FS process at the Site. This list includes adjacent/nearby property owners; local, regional and state officials; local media; civic, business and environmental organizations and others. The list of property owners in the Site vicinity includes properties (as agreed to with the NYSDEC) east of 97th street and west of 101st street, and south of 101st Avenue and north of Liberty Avenue (Contact List Area). See Attachment 4 for the local resident and business addresses within the Contact List Area. Residents and businesses in the Contact List Area not included on the attached list are encouraged to contact one of the Project Contacts to be added to the list. The contact list will be reviewed periodically and updated as appropriate.

Note: Adjacent/affected property owner and resident contact information is confidential and is maintained separately in NYSDEC project files.

LOCAL OFFICIALS

Borough of Queens

Helen M. Marshall, Borough President
120-55 Queens Blvd
Kew Gardens, NY 11424
Phone: (718) 286-3000
Fax: (718) 286-2876

Community Board
CB-10
115-01 Lefferts Boulevard
South Ozone Park, NY 11420
Phone: (718) 843-4488

City of New York
Joseph Addabbo. Jr., District 32 Councilman
159-53 102 Street
Queens, NY 11414
Phone: (718) 738-1111

Michael R. Bloomberg, Mayor
City Hall
New York, NY 10007
Phone: (212) 788-9600
Fax: (212) 788-2460

STATE OFFICIALS

George E. Pataki, Governor
State Capitol
Albany, NY 12224

Serphin R. Maltese, Senator
413 State Capitol Building
Albany, NY 12247
Phone: (518) 455-3281

or

71-04 Myrtle Avenue
Glendale, NY 11385
Phone: (718) 497-1800

Audrey I. Pheffer, Assemblywoman
District Office
108-14 Crossbay Blvd
Ozone Park, NY 11417
Phone: (718) 641-8755

or

District Office
90-16 Rockaway Beach Blvd.
Rockaway Beach, NY 11693
Phone: (718) 945-9550

or

Albany Office
LOB 941
Albany, NY 12248
Phone: (518) 455-4292

Anthony Seminerio, Assemblyman
District Office
114-19 Jamaica Avenue
Richmond Hill, NY 11418
Phone: (718) 847-0770

or

District Office
68-28 Myrtle Avenue
Glendale, NY 11385
Phone: (718) 366-6725

or

Albany Office
LOB 818
Albany, NY 12248
Phone: (518) 455-4621

Diane Gordon, Assemblywoman
District Office
669 Vermont Street
Brooklyn, NY 11207
Phone: (718) 257-5824

or

Albany Office
LOB 920
Albany, NY 12248
Phone: (518) 455-5912

Darryl C. Towns, Assemblyman
District Office
264 Jamaica Avenue
Brooklyn, NY 11207
Phone: (718) 235-5627

or

Albany Office
LOB 626
Albany, NY 12248
Phone: (518) 455-5821

FEDERAL OFFICIALS

Hillary Clinton, Senator
476 Russell Senate Office Building
Washington, DC 20510
Phone: (202) 224-4451

Charles Schumer, Senator
313 Hart Senate Office Building
Washington, DC 20510
Phone: (202) 224-6542

Anthony D. Weiner, Congressman
District Office
80-02 Kew Gardens Rd. Suite 5000
Kew Gardens, NY 11415
Phone: (718) 520-9001

or

District Office
1800 Sheepshead Bay Road
Brooklyn, NY 11235
Phone: (718) 520-9001

or

District Office
90-16 Rockaway Beach Blvd.
Rockaway, NY 11693
Phone: (718) 318-9255

or

1122 Longworth HOB
Washington, DC 20515
Phone: (202) 225-6616

LOCAL/REGIONAL MEDIA

WABC - 7
7 Lincoln Square
New York, NY 10023-6298
Phone: (212) 456-3173
Fax: (212) 456-2381
Attn: Assignment Desk

WCBS - 2
524 West 57 Street
8th Floor
New York, NY 10019
Phone: (212) 975-5867
Fax: (212) 975-9387
Attn: Assignment Desk

WNBC - 4
30 Rockefeller Plaza
New York, NY 10112
Phone: (212) 664-4227
Fax: (212) 790-4717
Attn: Anna Carbonell

New York Times
229 W. 43rd Street
New York, NY 10036
Phone: (212) 556-1234

New York Daily News
450 West 33rd Street
New York, New York, 10001-2681
Phone: (212) 949-2000
Phone outside NYC: 1-800-223-1660

Queens Tribune
174-15 Horace Harding Expressway
Fresh Meadows, NY 11365
Phone: (718) 357-7400
Fax: (718) 357-9417
Attn: News Department

Queens Courier
38-15 Bell Blvd.
Bayside, NY 11361
Phone: (718) 224-5863
Fax: (718) 224-5441
Attn: Editorial

Newsday
80-02 Kew Gardens Rd
4th Floor,
Kew Gardens, NY 11415-1154
Phone: (718) 575-2550
Fax: (718) 793-6422
Attn: Carl MacGowan

WINS 1010 – Radio Station
888 Seventh Avenue
10th Floor
New York, NY 10106
Phone: (212) 315-7081
Fax: (212) 489-7034
Attn: Steve Ziegler

WCBS 880 – Radio Station
524 West 57 Street
8th Floor
New York, NY 10019
Phone: (212) 975-2127
Fax: (212) 975-1907
Attn: Frank Rayfield

LOCAL RESIDENTS/BUSINESSES

See Attachment 4 for the local resident and business addresses. Residents and businesses in the Contact List Area not included on the attached list are encouraged to contact one of the Project Contacts to be added to the list.

9.0 CPP SUMMARY

The following Citizen Participation activities are anticipated for this site:

Document Repositories: Document repositories have been established to provide the public with convenient access to important project documents and other information. This information will include reports, data and other information gathered and developed through the RI/FS process, as well as fact sheets, public meeting announcements, and proposed remedial activities and the Record of Decision for the Site. The repositories are located at the Queens Borough Public Library, NYSDEC Region 2 Office and NYSDEC Albany office.

Mailing Lists: A mailing list of people potentially interested in the Site and residing or doing business in the Site vicinity has been developed. This list includes area residents, government representatives, media, and potentially interested civic, environmental, and/or business groups. Fact sheets and notices of public meetings will be distributed to those individuals on the mailing list.

Fact Sheets: The NYSDEC will mail a fact sheet describing the planned investigation activities to the Mailing List prior to initiation of RI field activities. A fact sheet describing the Proposed Remedial Action Plan (PRAP) will be mailed to the Mailing List after the RI/FS has been completed and the PRAP has been written. Additionally, a fact sheet describing the results of the RI may be developed if off-site impacts are identified. After the Record of Decision (ROD) has been signed, a fact sheet will be mailed to the Mailing List describing the selected remedy.

Public Comment Period: After the fact sheet announcing the PRAP has been mailed, the public will be allowed 30 days to comment on the PRAP. During that time a public meeting will be held.

Public Meetings: A public meeting will be held prior to initiating the proposed RI field work. A public meeting will also be held during the 30-day comment period for the PRAP. The purpose of the public meeting will be to discuss the PRAP. Additionally, a public meeting may be held after the RI has been completed if off-site impacts are identified.

Attachment 1

RI/FS Fact Sheets

Fact Sheet

Remedial Investigation/Feasibility Study (RI/FS)

The New York State Department of Environmental Conservation (NYSDEC), along with the New York State Departments of Health (NYSDOH) 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 NYSDEC and NYSDOH that verify hazardous wastes are present and that the wastes pose a significant threat to public health and the environment.

NYSDEC and NYSDOH gather detailed site information to work toward an effective remedial action.

NYSDEC'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. NYSDEC, along with NYSDOH, 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 NYSDEC 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.

NYSDOH evaluates ways people may be exposed to hazardous waste.

NYSDOH 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 NYSDEC screen each alternative to make sure the remedy is technically suitable for the site. Following the initial screening, NYSDEC and NYSDOH 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.

NYSDEC 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, NYSDEC and NYSDOH 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.

NYSDEC 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. NYSDOH and DOL have an opportunity to comment on the draft ROD before final NYSDEC 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 health impacts of a hazardous waste site, contact the Department of Health's Outreach Program at **1 (800) 458-1158**.

Fact Sheets produced by the
New York State Department of Environmental Conservation
in cooperation with the
New York State Departments of Health and Law

Attachment 2

Citizen Participation Record

New York State Department of Environmental Conservation
Division of Environmental Remediation

This form is available for completion on computer.

Citizen Participation Record [See Instructions]

Site Remedial Investigation, Feasibility Study and Record of Decision

Site Name: ______________________ Site No.: ________

Op. Unit No.: ___ Region: ___ Municipality and County: ______________

Part 1. Listed Below Are the CP Activities Required to Be Performed During a Site's Remedial Investigation, Feasibility Study and Record of Decision. Check Off an Activity When Completed and Fill In Appropriate Date:

Site Citizen Participation Requirements

CP Requirement	Remedial Time frame	Part 375 Reference	Completed/Date
Citizen Participation Plan	Before Start of RI/FS	375-1.5(b)(1)	❑ ___/___/___
Contact List (Residents, Media, Government Representatives, Civic and Environmental Groups, Business Interests, etc.)	Before Start of RI/FS	375-1.5(b)(2)	❑ ___/___/___
Document Repositories (Regional NYSDEC Office and Local to Site)	Before Start of RI/FS	375-1.5(b)(3)	❑ ___/___/___
Mailing to Contact List Describing Proposed RI Work plan	At Start of RI	375-1.5(b)(4)	❑ ___/___/___
Mailing to Contact List Describing Proposed Remedial Action Plan (PRAP) and Announcement of Comment Period	At End of FS/ Completion of PRAP	375-1.5(c)(1)	❑ ___/___/___
30-Day Comment Period for PRAP	At End of FS/ Completion of PRAP	375-1.5(c)(2)	❑ ___/___/___
Public Meeting to Discuss PRAP/ Gather Public Comments	At End of FS/ Completion of PRAP	375-1.5(c)(2)	❑ ___/___/___
Mailing to Contact List Describing Selected Remedy and Responding to Significant Comments	During/After Completion of ROD	375-1.5(c)(3)	❑ ___/___/___

Part 2. Stop! Evaluate Issues Important to the Community and Information the Department and Public Need to Exchange -- Complete and Attach the Site Issues and Community Profile Scoping Sheet for Remedial Investigation, Feasibility Study and Record of Decision.

As a Result, Should CP Activities Beyond the CP Activities Required Above Be Conducted? ❑ Yes; ❑ No

Why or Why Not? ______________________________

____

(Over)

Citizen Participation Record -- Site Remedial Investigation, Feasibility Study and Record of Decision **(Continued)**

Part 3. If Answer to **Part 2.** Is "Yes" and If There Are Sufficient Staff, Resources and Time, List Below the Additional CP Activity(ies) to Be Conducted. Check Off the Activity(ies) When Completed and Fill in Appropriate Date(s):

Additional Site Citizen Participation Activity(ies) for Remedial Investigation, Feasibility Study and Record of Decision

CP Activity	Remedial Time frame	Completed/Date
• ______________	______________	❑ __/__/__
• ______________	______________	❑ __/__/__
• ______________	______________	❑ __/__/__
• ______________	______________	❑ __/__/__

Check ❑ if input from a Citizen Participation Specialist was received and reviewed during drafting of this CP Record.

Approved By:

____

Project Manager (Signature) Date

Attachment 3

Site Communication Needs

Site Communication Needs

This section of the CPP is designed to help Endzone, Inc. and the NYSDEC identify and document Site-related issues important to the community in the Site vicinity, as well as to identify the information needs of the community and the NYSDEC. This information will help Endzone, Inc. and the NYSDEC to effectively implement the CPP requirements and to identify any additional CPP activities that should be conducted.

a) Below is a list of major items that Endzone, Inc. is aware are of interest to the community surrounding the Site:

1. Residents are concerned about potential exposure to hazardous chemicals that may exist on or near the Site.

2. Residents are concerned about their property values.

b) Below is a list of information that Endzone, Inc. needs from the community to assist with the RI/FS and determination of an appropriate clean up:

1. Any additional information the public would like the Project Staff to be aware of that may affect the completion of the RI/FS and clean up of the Site.

c) Below is a list of information that Endzone, Inc. wants to communicate to the community through the CPP Program:

1. Why the investigation is being completed.

2. The investigation and clean up of the Site will have minimal impacts to the community.

Attachment 4

Contact List

Attachment 4
Local Resident/Business

Name	Street	Community	State	Zip Code	Phone Number
Northpoint Mortgage Corp	10002 101st Ave	Ozone Park	NY	11416	(718)641-7000
C Ladyman	10002 103rd Ave	Ozone Park	NY	11417	(718)641-2177
Joldeson One Aerospace Ind	10002 103rd Ave	Ozone Park	NY	11417	(718)848-7396
Robert Joldeson	100-02 103rd Ave	Ozone Park	NY	11417	(718)738-7837
Triangle Supply Inc	10004 101st Ave	Ozone Park	NY	11416	(718)322-8234
Rueben Kaykov	100-04 101st Ave	Ozone Park	NY	11416	(718)322-8007
Resident	10004 103rd Ave	Ozone Park	NY	11417	
Yahaira Gutierrez	10005 101st Ave	Ozone Park	NY	11416	(718)738-9419
Sarzaad Ghanie	100-05 101st Ave	Ozone Park	NY	11416	(718)322-2961
Savitire Singh	100-05 101st Ave	Ozone Park	NY	11416	(718)848-9768
Singh's Sporting Goods	100-06 101st Ave	Ozone Park	NY	11416	
Resident	10006 101st Ave	Ozone Park	NY	11416	
Alex Jones	10008 101st Ave	Ozone Park	NY	11416	(718)323-8945
Dhoorpatie Greenidge	10008 101st Ave	Ozone Park	NY	11416	(718)323-2152
Oneoone Discounting	10008 101st Ave	Ozone Park	NY	11416	(718)322-1246
Sharon Singh	10008 101st Ave	Ozone Park	NY	11416	(718)659-7593
John Reisert	100-08 101st Ave	Ozone Park	NY	11416	(718)845-1124
Stay Slim Inc	10009 101st Ave	Ozone Park	NY	11416	(718)843-8163
Ozone Grafx Corp	10010 101st Ave	Ozone Park	NY	11416	(718)845-3322
Glenn Conforti	100-10 101st Ave	Ozone Park	NY	11416	(718)845-5684
M Picano	100-10 101st Ave	Ozone Park	NY	11416	(718)845-4575
Resident	10010 103rd Ave	Ozone Park	NY	11417	
Mirage	10010 Liberty Ave	Ozone Park	NY	11417	(718)835-7600
International Auto Recovery	10011 Liberty Ave	Ozone Park	NY	11417	(718)323-1400
Kim Moonyan MD	10012 101st Ave	Ozone Park	NY	11416	(718)848-6666
Carmelo Passaggio	100-12 101st Ave	Ozone Park	NY	11416	(718)845-1673
Ryan Noyan	10012 103rd Ave	Ozone Park	NY	11417	(718)659-5004
Laundry Five Star	10014 Liberty Ave	Ozone Park	NY	11417	(718)641-5937
Resident	10101 103rd Ave	Ozone Park	NY	11417	
Resident	10102 103rd Ave	Ozone Park	NY	11417	
Resident	10104 Liberty Ave	Ozone Park	NY	11417	
Maria L Diaz	10106 103rd Ave	Ozone Park	NY	11417	(718)845-2466
Sunil Bridgemohan	101-06 103rd Ave	Ozone Park	NY	11417	(718)659-1634
Antony Naccarelli	101-07 98th St	Ozone Park	NY	11416	(718)843-8541
Juan A Ramos	101-07 98th St	Ozone Park	NY	11416	(718)845-0123
Katiuska Hernandez	101-07 98th St	Ozone Park	NY	11416	(718)323-7008
Vito Montemarano	101-07 98th St	Ozone Park	NY	11416	(718)845-4288
Luciano Previcano	101-08 103rd Ave	Ozone Park	NY	11417	(718)835-8965
Mary Mazzullo	101-08 103rd Ave	Ozone Park	NY	11417	(718)843-8072
Mildred Charbonier	101-08 103rd Ave	Ozone Park	NY	11417	(718)738-2230
Tavella Plumbing & Htg Corp	10111 100th St	Ozone Park	NY	11416	(718)843-2542
Adram Atreopersaud	101-11 103rd Ave	Ozone Park	NY	11417	(718)843-3883
Olympic Fence & Railing Co	10111 99th St	Ozone Park	NY	11416	(718)296-2008
Ozone One Iron Work	10112 100th St	Ozone Park	NY	11416	(718)848-3058
Tavella Plumbing & Htg Corp	10112 101st St	Ozone Park	NY	11416	(718)843-2542
Cheuk Fung	10112 98th St	Ozone Park	NY	11416	(718)835-8618
Luis Vargas	10112 98th St	Ozone Park	NY	11416	(718)843-3537
Carpet World & Assoc Inc	10112 Liberty Ave	Ozone Park	NY	11417	(718)925-1808
Sharmilla Lewis	101-12 Liberty Ave	Ozone Park	NY	11417	(718)848-6934
Nick Allocco	101-13 101st St	Ozone Park	NY	11416	(718)845-4193
Resident	10113 103rd Ave	Ozone Park	NY	11417	

Attachment 4
Local Resident/Business

Name	Street	Community	State	Zip Code	Phone Number
L Macchia	101-13 98th St	Ozone Park	NY	11416	(718)845-3026
Chan Heihoi	101-14 98th St	Ozone Park	NY	11416	(718)845-5382
Rafael Pujos	101-14 98th St	Ozone Park	NY	11416	(718)323-9014
Ocean Motors Ltd	10114 99th St	Ozone Park	NY	11416	(718)322-3088
B Messner	101-14 99th St	Ozone Park	NY	11416	(718)835-9031
Resident	10114 Liberty Ave	Ozone Park	NY	11417	
N Y Water Svc Corp	10115 100th St	Ozone Park	NY	11416	(718)843-2181
Gennaro Massimo	101-15 103rd Ave	Ozone Park	NY	11417	(718)641-4543
Ernesto Mendoza	10115 98th St	Ozone Park	NY	11416	(718)738-0604
Ilya Surazhsky	101-15 98th St	Ozone Park	NY	11416	(718)641-3561
Mikhail Surazhsky	101-15 98th St	Ozone Park	NY	11416	(718)845-6879
Delilah Gutierrez	10116 98th St	Ozone Park	NY	11416	(718)845-0798
Zaman Hassan	10116 98th St	Ozone Park	NY	11416	(718)323-6261
Nesha Ferreira	101-16 98th St	Ozone Park	NY	11416	(718)843-5606
Fareeda Ali	10116 Liberty Ave	Ozone Park	NY	11417	(718)323-2151
Meadows Chocolate & Cake	10116 Liberty Ave	Ozone Park	NY	11417	(718)835-3600
Hock Y Teo	101-17 103rd Ave	Ozone Park	NY	11417	(718)323-4066
Steve Tang	101-17 103rd Ave	Ozone Park	NY	11417	(718)641-4729
Herbert Cumming	101-17 98th St	Ozone Park	NY	11416	(718)845-3576
Nicole Hodges	10118 98th St	Ozone Park	NY	11416	(718)845-5593
Teresa Rondinela	101-18 98th St	Ozone Park	NY	11416	(718)925-8763
Liberty Suds Cleaners Inc	10118 Liberty Ave	Ozone Park	NY	11417	(718)835-9555
Haimwattie Toolsie	101-18 Liberty Ave	Ozone Park	NY	11417	(718)529-1904
Metropolitan Garment Cleaning	10120 101st St	Ozone Park	NY	11416	(718)323-5783
Nutherrane Barran	101-20 98th St	Ozone Park	NY	11416	(718)323-5049
Lisena Landscaping	10120 99th St	Ozone Park	NY	11416	(718)845-5185
Madelleine Rodriguez	10120 99th St	Ozone Park	NY	11416	(718)529-2034
Michael V Costanza	10120 99th St	Ozone Park	NY	11416	(718)323-5668
Maria Cardenas	101-20 99th St	Ozone Park	NY	11416	(718)738-5345
Golden National Mortgage	10120 Liberty Ave	Ozone Park	NY	11417	(718)323-6333
Horizion Health Systems	10120 Liberty Ave	Ozone Park	NY	11417	(718)641-8527
Kala Fashion	10120 Liberty Ave	Ozone Park	NY	11417	(718)659-6404
Leona Bisram	101-20 Liberty Ave	Ozone Park	NY	11417	(718)323-9632
A Moving Right Along Self	10121 101st St	Ozone Park	NY	11416	(718)738-4265
Debono Brothers General Contr	10121 101st St	Ozone Park	NY	11416	(718)529-8805
Moving Right Along Movers	10121 101st St	Ozone Park	NY	11416	(718)738-2468
Mra Express	101-21 101st St	Ozone Park	NY	11416	(718)997-6868
Hanipha Nazir	101-24 98th St	Ozone Park	NY	11416	(718)845-5039
Gabriel Martinez	10125 98th St	Ozone Park	NY	11416	(718)845-0239
M Le-Grow	101-25 98th St	Ozone Park	NY	11416	(718)738-4676
Secure Garage Door Systems	10126 98th St	Ozone Park	NY	11416	(718)848-9477
James Whyms	101-26 98th St	Ozone Park	NY	11416	(718)843-7503
Resident	10128 99th St	Ozone Park	NY	11416	
Motorcycles Unlimited	10130 100th St	Ozone Park	NY	11416	(718)845-6969
Resident	10131 98th St	Ozone Park	NY	11416	
Resident	10132 100th St	Ozone Park	NY	11416	
Five Star Electric Corp	10132 101st St	Ozone Park	NY	11416	(718)641-5000
Maribel Salgado	10134 98th St	Ozone Park	NY	11416	(718)641-0696
Nickolai Potapenkov	101-35 98th St	Ozone Park	NY	11416	(718)641-9088
S Wojda	101-36 98th St	Ozone Park	NY	11416	(718)738-5591
Resident	10137 99th St	Ozone Park	NY	11416	

Attachment 4
Local Resident/Business

Name	Street	Community	State	Zip Code	Phone Number
A Toro	101-38 98th St	Ozone Park	NY	11416	(718)845-0522
L Rivera	101-38 98th St	Ozone Park	NY	11416	(718)843-5916
Catherine Blades	101-39 98th St	Ozone Park	NY	11416	(718)641-7337
George Papashvili	101-39 98th St	Ozone Park	NY	11416	(718)845-1615
Tara Impelli	101-39 98th St	Ozone Park	NY	11416	(718)323-3453
Krzysztof Sokolowski	101-40 98th St	Ozone Park	NY	11416	(718)835-7472
R & K Design	10141 99th St	Ozone Park	NY	11416	(718)641-7982
Gregory Kaczkowski	10142 98th St	Ozone Park	NY	11416	(718)848-6255
Silipo Welding Inc	10142 99th St	Ozone Park	NY	11416	(718)845-3890
Elena F Deborgeat	10143 98th St	Ozone Park	NY	11416	(718)529-0725
John Augello	101-44 98th St	Ozone Park	NY	11416	(718)845-0221
Maria Iannacci	101-44 98th St	Ozone Park	NY	11416	(718)843-6425
Nancy Piccolo	10145 101st St	Ozone Park	NY	11416	(718)441-7699
Norberto Borgeat	10147 98th St	Ozone Park	NY	11416	(718)659-0456
C Gomez	101-47 98th St	Ozone Park	NY	11416	(718)738-4078
Elena M Petruzzi	101-47 98th St	Ozone Park	NY	11416	(718)845-9526
Marta Bianco	101-47 98th St	Ozone Park	NY	11416	(718)843-3817
Juan Angulo	101-48 98th St	Ozone Park	NY	11416	(718)659-6524
Lizzette Perez	101-48 98th St	Ozone Park	NY	11416	(718)845-3408
Resident	10149 98th St	Ozone Park	NY	11416	
Zagas Sportswear Inc	10151 101st St	Ozone Park	NY	11416	(718)641-5230
Verai Sewgobind	101-51 98th St	Ozone Park	NY	11416	(718)843-7439
Diana R Vargas	101-52 98th St	Ozone Park	NY	11416	(718)641-5676
Segundo Chabla	101-52 98th St	Ozone Park	NY	11416	(718)641-5499
Bob Vlada	10154 98th St	Ozone Park	NY	11416	(718)835-5836
L Lozado	10154 98th St	Ozone Park	NY	11416	(718)659-7764
Resident	101-55 98th St	Ozone Park	NY	11416	
Meereen Mcconnew	10156 98th St	Ozone Park	NY	11416	(718)835-4137
Sherrod Staton	10156 98th St	Ozone Park	NY	11416	(718)835-2083
Centre Interiors Woodworking	10157 100th St	Ozone Park	NY	11416	(718)323-1343
Resident	10157 98th St	Ozone Park	NY	11416	
Elsie Alemen	10158 98th St	Ozone Park	NY	11416	(718)323-3560
O Z Health Club Inc	10160 99th St	Ozone Park	NY	11416	(718)641-5456
Wall.Com Systems	10160 99th St	Ozone Park	NY	11416	(718)322-5518
Tadco Construction Corp	10161 99th St	Ozone Park	NY	11416	(718)529-4842
T Accardi	101-69 100th St	Ozone Park	NY	11416	(718)845-3937
C-Tec Electric Corp	10170 99th St	Ozone Park	NY	11416	(718)323-4400
Queens Farms Dairy Inc	10170 99th St	Ozone Park	NY	11416	(718)738-7712
Upstate Home Improvement Inc	10173 100th St	Ozone Park	NY	11416	(718)641-0306
Resident	10302 101st St	Ozone Park	NY	11417	
Resident	10307 99th St	Ozone Park	NY	11417	
Resident	10309 101st St	Ozone Park	NY	11417	
Resident	10309 99th St	Ozone Park	NY	11417	
Resident	10311 98th St	Ozone Park	NY	11417	
Car Place Inc	10312 101st St	Ozone Park	NY	11417	(718)738-0736
Elegant Limousine Svc	10312 101st St	Ozone Park	NY	11417	(718)738-1000
St Mary Gate Of Heaven	10312 101st St	Ozone Park	NY	11417	(718)847-5957
Brahm Boodhoo	103-12 98th St	Ozone Park	NY	11417	(718)845-8060
Hardai Ramdial	103-12 98th St	Ozone Park	NY	11417	(718)848-0277
Resident	10315 100th St	Ozone Park	NY	11417	
Hi Tech Medical Equipment Inc	10315 101st St	Ozone Park	NY	11417	(718)738-6000

Attachment 4
Local Resident/Business

Name	Street	Community	State	Zip Code	Phone Number
Resident	10315 99th St	Ozone Park	NY	11417	
Amelie Hallare	103-18 98th St	Ozone Park	NY	11417	(718)845-1863
Omeshur Kuppan	103-18 98th St	Ozone Park	NY	11417	(718)843-5935
Scott Cunniffe	103-18 98th St	Ozone Park	NY	11417	(718)843-3810
Catalino Vielma	10320 101st St	Ozone Park	NY	11417	(718)641-7708
Victor Kil	10320 101st St	Ozone Park	NY	11417	(718)641-7064
Altagracia Torres	103-20 98th St	Ozone Park	NY	11417	(718)845-1609
Justina Tapia	103-20 98th St	Ozone Park	NY	11417	(718)641-4062
Abraham M Ramos	103-21 101st St	Ozone Park	NY	11417	(718)738-6335
Vinco Mechanical	10321 98th St	Ozone Park	NY	11417	(718)835-6820
Rosa Moreno	103-22 101st St	Ozone Park	NY	11417	(718)529-4097
C Messina	103-22 98th St	Ozone Park	NY	11417	(718)848-8182
Carol Hunstein	103-22 98th St	Ozone Park	NY	11417	(718)845-5638
Public School 65/Principal Iris Nelson	10322 99th St	Ozone Park	NY	11417	(718)323-1685
Teachers Center	10322 99th St	Ozone Park	NY	11417	(718)848-5144
Resident	10323 100th St	Ozone Park	NY	11417	
Evelio Morales	10323 101st St	Ozone Park	NY	11417	(718)641-1410
Edilma Henao	103-23 101st St	Ozone Park	NY	11417	(718)641-7857
Maximiliano Suarez	103-23 101st St	Ozone Park	NY	11417	(718)529-2478
Budget General Contractors	10324 101st St	Ozone Park	NY	11417	(718)641-7939
Savino General Contracting	10324 101st St	Ozone Park	NY	11417	(718)322-3910
Zameena Mohamed	10324 98th St	Ozone Park	NY	11417	(718)845-1085
Bibi S Rhiman	103-24 98th St	Ozone Park	NY	11417	(718)845-3994
Efrain Jaime	103-24 98th St	Ozone Park	NY	11417	(718)845-4166
Ernest Lall	103-24 98th St	Ozone Park	NY	11417	(718)738-5812
Car Haven 99	10324 99th St	Ozone Park	NY	11417	(718)848-7124
Mechanic Corp Amigo Collission	10324 99th St	Ozone Park	NY	11417	(718)835-6691
June Santia	10325 101st St	Ozone Park	NY	11417	(718)738-8952
Michael Sanford	10325 101st St	Ozone Park	NY	11417	(718)843-2066
Mariano Martinis	103-25 101st St	Ozone Park	NY	11417	(718)835-9096
Resident	10325 98th St	Ozone Park	NY	11417	
Richmond Remodeling & Constr	10326 100th St	Ozone Park	NY	11417	(718)835-9010
Resident	10326 98th St	Ozone Park	NY	11417	
Resident	103-27 99th St	Ozone Park	NY	11417	
Bugzy Beverage	10328 101st St	Ozone Park	NY	11417	(718)738-9038
Ganga Persaud	103-28 98th St	Ozone Park	NY	11417	(718)848-3629
Puranbai Ramlakhan	103-28 98th St	Ozone Park	NY	11417	(718)322-9353
Liberty Creations Inc	10329 101st St	Ozone Park	NY	11417	(718)845-4069
P & S Custom Tailoring	10329 101st St	Ozone Park	NY	11417	(718)738-4205
Mohammed Ahmed	10330 98th St	Ozone Park	NY	11417	(718)529-9185
Farhana Iqbal	103-30 98th St	Ozone Park	NY	11417	(718)925-0399
Syed S Ali	103-30 98th St	Ozone Park	NY	11417	(718)641-2036
Reliable Auto Ctr	10332 101st St	Ozone Park	NY	11417	(718)843-9316
Lucy Collazo	103-32 98th St	Ozone Park	NY	11417	(718)848-3955
Basilio De-Simone	103-35 101st St	Ozone Park	NY	11417	(718)835-2185
Mary Skelly	103-35 101st St	Ozone Park	NY	11417	(718)843-4141
A Ramos	10336 98th St	Ozone Park	NY	11417	(718)843-7814
Ismael Ramos Jr	10336 98th St	Ozone Park	NY	11417	(718)659-4915
Resident	10337 101st St	Ozone Park	NY	11417	
Lorraine E Mole	10338 101st St	Ozone Park	NY	11417	(718)323-5591
R Todd	103-38 101st St	Ozone Park	NY	11417	(718)845-0558

Attachment 4
Local Resident/Business

Name	Street	Community	State	Zip Code	Phone Number
Janeth Deleon	10338 98th St	Ozone Park	NY	11417	(718)843-6791
Sunita Bheir	10338 98th St	Ozone Park	NY	11417	(718)322-8947
Magda Resto	103-38 98th St	Ozone Park	NY	11417	(718)323-6656
Antonio Provvisiero	103-39 101st St	Ozone Park	NY	11417	(718)835-7408
Rita Provvisiero	103-39 101st St	Ozone Park	NY	11417	(718)835-2636
Forge Fabricators	10340 100th St	Ozone Park	NY	11417	(718)845-3317
Mohammed Ally	10340 98th St	Ozone Park	NY	11417	(718)835-6726
Surujmoney Jagernauth	10340 98th St	Ozone Park	NY	11417	(718)843-6234
Nick Caccavalla Jr	10341 101st St	Ozone Park	NY	11417	(718)835-7335
Anna Caccavalla	103-41 101st St	Ozone Park	NY	11417	(718)848-8188
Resident	10341 98th St	Ozone Park	NY	11417	
Resident	10342 100th St	Ozone Park	NY	11417	
Charran Surajpal	103-42 98th St	Ozone Park	NY	11417	(718)641-1127
3 Kings Collision Inc	10343 100th St	Ozone Park	NY	11417	(718)843-2525
Jian X Wu	103-44 98th St	Ozone Park	NY	11417	(718)738-9832
Resident	10345 98th St	Ozone Park	NY	11417	
King C Tin	103-46 98th St	Ozone Park	NY	11417	(718)641-2303
Resident	10347 99th St	Ozone Park	NY	11417	
Li H Ling	103-48 98th St	Ozone Park	NY	11417	(718)843-4229
Resident	10349 101st St	Ozone Park	NY	11417	
Resident	10349 98th St	Ozone Park	NY	11417	
Anthony Avella	103-50 101st St	Ozone Park	NY	11417	(718)843-1391
Richard Austin	10351 101st St	Ozone Park	NY	11417	(718)641-5843
Bertha Madrid	103-51 101st St	Ozone Park	NY	11417	(718)843-5906
Resident	10351 98th St	Ozone Park	NY	11417	
Nyc Police Dept Precinct 106	10353 101st St	Ozone Park	NY	11417	(718)845-2211
Mikes Auto Repairs	10354 100th St	Ozone Park	NY	11417	(718)659-2906
Kathleen Jogie	103-55 100th St	Ozone Park	NY	11417	(718)641-3849
Chaitram Dindial Auto Repair	10355 99th St	Ozone Park	NY	11417	(718)738-3707
Johnnys Auto Repairs	10355 99th St	Ozone Park	NY	11417	(718)659-8561
Laura Murphy	103-56 101st St	Ozone Park	NY	11417	(718)323-7735
Ozone Park Auto Body Inc	10357 100th St	Ozone Park	NY	11417	(718)738-5468
R & C Automotive	10357 99th St	Ozone Park	NY	11417	(718)641-3866
Heerdaynauth Jugistir	10358 101st St	Ozone Park	NY	11417	(718)641-9254
Heidy Colin	10358 101st St	Ozone Park	NY	11417	(718)529-6315
Razack Mohamed	10358 101st St	Ozone Park	NY	11417	(718)659-3957
Hope For The Disabled Kids Inc	10359 100th St	Ozone Park	NY	11417	(718)843-9363
Salim Auto Body & Car Sales	10359 100th St	Ozone Park	NY	11417	(718)738-6555
Resident	10359 99th St	Ozone Park	NY	11417	
Nelly E Kippins	103-62 101st St	Ozone Park	NY	11417	(718)738-7313
Deochand Hemraj	103-63 100th St	Ozone Park	NY	11417	(718)848-7570
Tommys Auto Repair	10363 99th St	Ozone Park	NY	11417	(718)843-1180
S Banggaroo	10364 101st St	Ozone Park	NY	11417	(718)835-0994
Ruth Archibald	103-64 101st St	Ozone Park	NY	11417	(718)845-1843
Hansrai Ramkaran	10365 100th St	Ozone Park	NY	11417	(718)848-5592
Ganesh Orilall	10366 101st St	Ozone Park	NY	11417	(718)659-8734
Khemraj Ramkaran	103-66 101st St	Ozone Park	NY	11417	(718)843-8242
Medtrac Imaging Inc	10367 100th St	Ozone Park	NY	11417	(718)925-0111
Agapito Cofresi	103-67 100th St	Ozone Park	NY	11417	(718)848-9791
T H Young	103-67 100th St	Ozone Park	NY	11417	(718)738-3582
Resident	10367 99th St	Ozone Park	NY	11417	

Attachment 4
Local Resident/Business

Name	Street	Community	State	Zip Code	Phone Number
Resident	10368 101st St	Ozone Park	NY	11417	
Resident	10371 99th St	Ozone Park	NY	11417	
Resident	10399 98th St	Ozone Park	NY	11417	
Conza Salvatore P	9701 101st Ave	Ozone Park	NY	11416	(718)845-5555
Peter J Conza	9701 101st Ave	Ozone Park	NY	11416	(718)845-6110
Eichler Pharmacy	9702 101st Ave	Ozone Park	NY	11416	(718)845-5620
Molinaro Sergio Dds	9703 101st Ave	Ozone Park	NY	11416	(718)845-4242
101 Ave Foot Care	9704 101st Ave	Ozone Park	NY	11416	(718)641-2100
Meller Edward Dpm	9704 101st Ave	Ozone Park	NY	11416	(718)641-2100
Anton Adjustment Co	9704 101st Ave #2	Ozone Park	NY	11416	(718)641-5700
Blanca Ceron	9704 103rd Ave	Ozone Park	NY	11417	(718)322-6649
Jorge Pijuan	97-04 103rd Ave	Ozone Park	NY	11417	(718)848-7064
Silvano Frattissi	97-04 103rd Ave	Ozone Park	NY	11417	(718)641-8326
Ocean Pharmacy Inc	9705 101st Ave	Ozone Park	NY	11416	(718)843-4600
Sunny Bissoondial	9705 101st Ave	Ozone Park	NY	11416	(718)323-1631
Denis Couture	97-05 101st Ave	Ozone Park	NY	11416	(718)641-5925
Jaime Sanchez	97-05 101st Ave	Ozone Park	NY	11416	(718)641-0187
Arturo Spinelli	9705 103rd Ave	Ozone Park	NY	11417	(718)323-0072
D Ohara	9705 103rd Ave	Ozone Park	NY	11417	(718)641-4213
Esmeralda Lopez	9705 103rd Ave	Ozone Park	NY	11417	(718)323-8197
Krystyna Rutkowska	9705 103rd Ave	Ozone Park	NY	11417	(718)529-3988
N Rios	9705 103rd Ave	Ozone Park	NY	11417	(718)845-3079
Osman Lupi	9705 103rd Ave	Ozone Park	NY	11417	(718)848-9356
Roman Wasielewski	9705 103rd Ave	Ozone Park	NY	11417	(718)641-2242
A Bartash	97-05 103rd Ave	Ozone Park	NY	11417	(718)843-4425
Bozenna Jablonska	97-05 103rd Ave	Ozone Park	NY	11417	(718)835-2024
Joseph Peck	97-05 103rd Ave	Ozone Park	NY	11417	(718)835-2207
M V Dunne	97-05 103rd Ave	Ozone Park	NY	11417	(718)845-5322
M Ward	97-05 103rd Ave	Ozone Park	NY	11417	(718)845-8130
Marek Kiryluk	97-05 103rd Ave	Ozone Park	NY	11417	(718)843-5019
Maria Ramos	97-05 103rd Ave	Ozone Park	NY	11417	(718)848-5247
Patrick Mc-Guigan	97-05 103rd Ave	Ozone Park	NY	11417	(718)848-4756
Venancio Oliva	97-05 103rd Ave	Ozone Park	NY	11417	(718)843-2399
Wladyslaw Ferenc	97-05 103rd Ave	Ozone Park	NY	11417	(718)323-1753
Deco Destinations	9706 101st Ave	Ozone Park	NY	11416	(718)738-7400
Alina B Kowalik	97-06 103rd Ave	Ozone Park	NY	11417	(718)845-4655
Marek Bronkiewcz	97-06 103rd Ave	Ozone Park	NY	11417	(718)738-8034
Waldemar Dubiel	97-06 103rd Ave	Ozone Park	NY	11417	(718)641-8456
Resident	9707 Liberty Ave	Ozone Park	NY	11417	
Absolute Auto Brokerage Inc	9708 101st Ave	Ozone Park	NY	11416	(718)641-3030
Carters Jv Jewelry	9708 101st Ave	Ozone Park	NY	11416	(718)845-4500
Frank Chmielewski	97-08 103rd Ave	Ozone Park	NY	11417	(718)843-0699
Bumatay Joseph T MD	9709 101st Ave	Ozone Park	NY	11416	(718)641-5555
Little Neck Radiology Pc	9709 101st Ave	Ozone Park	NY	11416	(718)659-9163
Soni Sharad MD	9709 101st Ave	Ozone Park	NY	11416	(718)641-5555
New Ozone Park Liquor Store	9710 101st Ave	Ozone Park	NY	11416	(718)845-2833
Zheng Y Wu	97-10 101st Ave	Ozone Park	NY	11416	(718)848-1228
Fleshing Pain Managemnt	9711 101st Ave	Ozone Park	NY	11416	(718)529-5575
Kim Woo-Sup MD	9711 101st Ave	Ozone Park	NY	11416	(718)845-6000
Lee David H MD	9711 101st Ave	Ozone Park	NY	11416	(718)845-6000
Ozone Park Medical	9711 101st Ave	Ozone Park	NY	11416	(718)845-6000

Attachment 4
Local Resident/Business

Name	Street	Community	State	Zip Code	Phone Number
Almando Romero	9711 103rd Ave	Ozone Park	NY	11417	(718)641-6608
O Singh	97-11 103rd Ave	Ozone Park	NY	11417	(718)843-3062
Sharon Persaud	97-11 103rd Ave	Ozone Park	NY	11417	(718)323-6646
Totaram Ramkalawan	97-11 103rd Ave	Ozone Park	NY	11417	(718)738-3059
El Viejo Yayo Restaurant	9712 101st Ave	Ozone Park	NY	11416	(718)322-3920
Madelines Gift Shoppe	9712 101st Ave	Ozone Park	NY	11416	(718)845-3580
Rene Valdez	9712 101st Ave	Ozone Park	NY	11416	(718)323-9597
Joseph Pelo	97-12 103rd Ave	Ozone Park	NY	11417	(718)835-7085
Asher Management Inc	9713 101st Ave	Ozone Park	NY	11416	(718)845-9269
Savitir Bhagwant	9713 103rd Ave	Ozone Park	NY	11417	(718)835-1005
Deochand Tandu	97-13 103rd Ave	Ozone Park	NY	11417	(718)323-5771
M Tandu	97-13 103rd Ave	Ozone Park	NY	11417	(718)845-8878
M & T Mortgage Corp	9714 101st Ave	Ozone Park	NY	11416	(718)845-2300
Feet First Foot Care	9715 101st Ave	Ozone Park	NY	11416	(718)848-5700
Mohmmad Shafi	97-15 101st Ave	Ozone Park	NY	11416	(718)641-4834
X L Hair Salon	9716 101st Ave	Ozone Park	NY	11416	(718)843-3348
Hugo Hernandez	97-16 101st Ave	Ozone Park	NY	11416	(718)848-1665
Javier Oballe	97-16 101st Ave	Ozone Park	NY	11416	(718)843-3857
Gabriel Bertolini	97-16 103rd Ave	Ozone Park	NY	11417	(718)845-5122
Hanover Transcription Svc	9717 101st Ave	Ozone Park	NY	11416	(718)322-5413
Fred De-Vito	97-17 103rd Ave	Ozone Park	NY	11417	(718)738-0512
Giuseppe Zollo	97-17 103rd Ave	Ozone Park	NY	11417	(718)845-9405
Guiuseppe Ferrara	97-17 103rd Ave	Ozone Park	NY	11417	(718)738-4717
Lori Landolfi	97-17 103rd Ave	Ozone Park	NY	11417	(718)848-5918
Resident	9718 101st Ave	Ozone Park	NY	11416	
Khwaja Yeaser	9718 103rd Ave	Ozone Park	NY	11417	(718)641-4460
Mahfuza Choudhury	9718 103rd Ave	Ozone Park	NY	11417	(718)845-8988
Mario Ramos	9718 103rd Ave	Ozone Park	NY	11417	(718)526-8517
Samuel J Pandian	9718 103rd Ave	Ozone Park	NY	11417	(718)843-3564
Avs Inc	9719 101st Ave	Ozone Park	NY	11416	(718)845-7911
Mario Navarrete	9720 101st Ave	Ozone Park	NY	11416	(718)738-4336
Nicks Hardware City Inc	9720 101st Ave	Ozone Park	NY	11416	(718)845-1600
Process Server Plus Inc	9720 101st Ave #A	Ozone Park	NY	11416	(718)845-5523
Giusseppe Grippi	97-20 103rd Ave	Ozone Park	NY	11417	(718)845-8027
Judy Seemungal	9720 Liberty Ave	Ozone Park	NY	11417	(718)738-3088
Neena Barran	9720 Liberty Ave	Ozone Park	NY	11417	(718)641-4639
Enile Degannes	97-20 Liberty Ave	Ozone Park	NY	11417	(718)641-6077
Resident	9745 103rd Ave	Ozone Park	NY	11417	
Jeremias Florist	9801 101st Ave	Ozone Park	NY	11416	(718)845-3250
Charles Dejesus	98-01 101st Ave	Ozone Park	NY	11416	(718)738-6795
A 1 A Locksmiths Of Ozone Park	9802 101st Ave	Ozone Park	NY	11416	(718)807-2700
A A Plus Plumbing 24 Hrs	9802 101st Ave	Ozone Park	NY	11416	(718)807-2670
Fantasia Nails Inc	9802 101st Ave	Ozone Park	NY	11416	(718)738-2625
Ronald Roman	9802 103rd Ave	Ozone Park	NY	11417	(718)529-6814
Bibi R Jahur	98-02 103rd Ave	Ozone Park	NY	11417	(718)835-0476
M Mohamed	98-02 103rd Ave	Ozone Park	NY	11417	(718)322-2346
Mohamed Kassim	98-02 103rd Ave	Ozone Park	NY	11417	(718)529-9533
Patrick Landveld	98-02 103rd Ave	Ozone Park	NY	11417	(718)848-9708
Mordechay Mataev	9803 101st Ave	Ozone Park	NY	11416	(718)845-1740
R Kaykov	9803 101st Ave	Ozone Park	NY	11416	(718)322-8181
Rueben Kaykov	9803 101st Ave	Ozone Park	NY	11416	(718)322-7126

Attachment 4
Local Resident/Business

Name	Street	Community	State	Zip Code	Phone Number
Jill Frandsen	9803 103rd Ave	Ozone Park	NY	11417	(718)529-3565
Victor Chichotky	98-03 103rd Ave	Ozone Park	NY	11417	(718)738-1072
Resident	9804 101st Ave	Ozone Park	NY	11416	
Juan Duran	9804 103rd Ave	Ozone Park	NY	11417	(718)529-0694
R J Park	9804 103rd Ave	Ozone Park	NY	11417	(718)323-7964
101 Cafe	9805 101st Ave	Ozone Park	NY	11416	(718)848-2233
Louis J Orlando	98-05 103rd Ave	Ozone Park	NY	11417	(718)845-5846
Eagle Tax Planning & Advisory	9807 101st Ave	Ozone Park	NY	11416	(718)659-2811
Resident	9807 Liberty Ave	Ozone Park	NY	11417	
Ozone Grocery	9808 101st Ave	Ozone Park	NY	11416	(718)843-8873
Sky Tech	9809 101st Ave	Ozone Park	NY	11416	(718)925-8888
Wedding Exsentions	9809 101st Ave	Ozone Park	NY	11416	(718)835-4021
K-B Distributors	9810 101st Ave	Ozone Park	NY	11416	(718)848-6887
Chile Kumariewilson	98-10 103rd Ave	Ozone Park	NY	11417	(718)835-8202
American Postal Workers Union	9811 101st Ave	Ozone Park	NY	11416	(718)845-8113
Cono Disalvio	98-11 103rd Ave	Ozone Park	NY	11417	(718)529-3662
Michael Franzese	98-11 103rd Ave	Ozone Park	NY	11417	(718)845-3732
Pasquale Capasso	98-12 103rd Ave	Ozone Park	NY	11417	(718)835-0909
I Morales	9815 101st Ave	Ozone Park	NY	11416	(718)323-0529
Juan Sanchez	98-15 101st Ave	Ozone Park	NY	11416	(718)641-1450
Mary Friedel	98-15 101st Ave	Ozone Park	NY	11416	(718)641-6441
Cfs Investment Svc Inc	9816 101st Ave	Ozone Park	NY	11416	(718)835-0747
New York Community Bank	9816 101st Ave	Ozone Park	NY	11416	(718)845-0427
Paul Trinchese Iron Works Inc	9816 103rd Ave	Ozone Park	NY	11417	(718)848-1954
Studio 101 Nails	9817-A 101st Ave	Ozone Park	NY	11416	(718)738-8705
C-Tec Electric Corp	98-19 103rd Ave	Ozone Park	NY	11416	
Luc Acosta	98-21 101st Ave	Ozone Park	NY	11416	(718)843-8089
Resident	9906 101st Ave	Ozone Park	NY	11416	