REMEDIAL INVESTIGATION/REMEDIAL ALTERNATIVES ANALYSIS WORK PLAN

211 FRANKLIN STREET
OLEAN, NEW YORK 14760

NYSDEC SITE NUMBER PENDING

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1.0 INTRODUCTION

This Remedial Investigation/Remedial Alternatives Analysis (RI/RAA) Work Plan (the Work Plan) was prepared by Day Environmental, Inc. (DAY) for an approximate 5.79 acre parcel located at 211 Franklin Street, City of Olean, County of Cattaraugus, New York (Site). A Project Locus Map is provided as Figure 1. The RI/RAA will be implemented under the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), assuming that the Site is accepted into the BCP by the NYSDEC. The Work Plan was prepared based on knowledge of the Site conditions provided in the BCP Application, a Phase I Environmental Site Assessment (Phase I ESA) prepared by DAY dated November 1, 2013, site-specific subsurface conditions at the Site as documented in a Preliminary Phase II Environmental Site Investigation (Phase II ESA) prepared by DAY dated October 2013, and applicable NYSDEC guidance documents including, but not limited to, *DER-10*, *Technical Guidance for Site Investigation and Remediation* dated May 2010 (DER-10).

The Work Plan summarizes the known environmental conditions that exist at the Site based upon currently available information, presents the investigation approach, quality control procedures, and scope of work for the completion of the Remedial Investigation (RI). In addition, a site-specific Health and Safety Plan (HASP) including a Community Air Monitoring Plan (CAMP), and a Quality Assurance Project Plan (QAPP), are included as in the Work Plan as Appendices A and B, respectively. Implementation of the work described in the Work Plan will result in greater understanding of the environmental impacts to the surface soil, subsurface soil, underground utilities, soil vapor, and groundwater associated with the historic use of the Site, and impacts from adjacent properties (if any). The findings of the RI will assist in determination of appropriate remedial measures to address the identified environmental impacts. In addition, the Work Plan presents a summary of the scope of work to be conducted as an Interim Remedial Measures (IRM). Completion of a Remedial Alternatives Analysis (RAA) evaluation and report is also included as part of the scope of work presented in the Work Plan.

1.1 Proposed Future Use of Site

The Site is zoned for industrial use and is located in within the boundaries of the New York State Department of State (NYSDOS) Brownfield Opportunity Area (BOA) known as the Northwest Quadrant. It is anticipated that the Site will continue to be used for industrial activities in the future, and may also be used for commercial purposes. Based on the continued use for industrial activities with possible commercial use, the urban setting of the Site, and NYSDEC requirements, soil sample analytical results will be compared to NYSDEC Part 375 Soil Cleanup Objectives (SCO) for: 1) Unrestricted Use; 2) Restricted Commercial Use; and 3) the Protection of Groundwater.

1.2 Objectives

The RI objectives are listed below.

- Define the nature and extent of on-site contamination.
- Identify contaminant source areas.
- Evaluate a range of remedial alternatives, including remedial activities completed as an IRM, to enable the preparation of a Remedial Action Work Plan (RAWP).

- Produce data of sufficient quantity and quality for remedial decision-making.
- Identify and characterize soil contamination, which may be acting as contaminant source areas. Delineate the areal and vertical extent of soil contamination, which may be leaching to and impacting groundwater quality at the Site.
- Evaluate and scope potential IRMs, which could be utilized to potentially remediate/mitigate contaminated source areas present in the subsurface.
- Evaluate and characterize the extent and magnitude of the overburden groundwater contamination at the Site.
- Describe the volume, concentration, persistence, mobility, state, and other significant characteristics of the on-site contamination.
- Evaluate the presence or potential for soil vapor to impact receptors within the office portion of the building at the Site.
- Determine the extent to which natural or anthropogenic barriers currently contain or impact migration or mobility of the contamination.
- Define the extent to which the contaminants have migrated on the Site or are expected to migrate and whether future migration may pose a threat to human health or the environment.
- Perform an exposure assessment to identify potential routes of exposure, populations and environmental receptors at risk.
- Define hydrogeological factors (e.g., soil permeability, depth to saturated zone, hydrologic gradients, hydraulic conductivity, and proximity to a drinking water aquifer, flood plain or wetland).
- Describe groundwater characteristics and current and potential groundwater use, including the identification of private wells and public water supply wells in the area.
- Identify surface water classifications and existing use designations in vicinity of the Site.
- Describe the property's contribution to an air, land, water, biota, or bioaccumulation contamination problem.
- Determine the extent to which contamination levels pose an unacceptable risk to public health and/or the environment.

The goal of the RI is to obtain sufficient information to evaluate remedial alternatives, and ultimately recommend and select a remedial alternative that is protective of public health and the environment as part of the RAA.

The objectives of the RAA for this project are to identify evaluate and select a remedy or alternative remedies to address the contamination identified by the RI in accordance with the provision of Chapter 4 of DER-10. This includes:

1. Identifying remedial goals.
2. Identifying Remedial Action Objectives (RAO) for the protection of public health and the environment.
3. Evaluating baseline considerations associated with: protection of public health and the environment; addressing sources of contamination; bulk storage tank and containment vessels; and groundwater protection and control measures.
4. Evaluating other considerations associated with remedial alternatives to address the contamination on the Site to the extent applicable, such as the potential for soil vapor intrusion, and impacts on adjacent properties.

5. Evaluating the need for a cover system, such as a soil cover, if contamination is present in exposed surface soil.
6. Evaluating the alternatives in relation to threshold criteria and primary balancing criteria listed in Section 4.2 of DER-10.

1.3 Applicable Project Standards, Criteria and Guidance

Applicable standards, criteria and guidance (SCG) values that will be used for this project are outlined below:

- ☐ Appropriate SCO and other guidance as set forth in 6 NYCRR Part 375-3 Brownfield Cleanup Program dated December 14, 2006.
- ☐ Appropriate Soil Cleanup Levels (SCL) and other guidance as set forth in NYSDEC Policy CP-51/Soil Cleanup Guidance dated October 21, 2010.
- ☐ Guidelines referenced in the NYSDEC document titled "DER-10 Technical Guidance for Site Investigation and Remediation", May 2010.
- ☐ Appropriate water quality standards and guidance values (WQS/GV) as set forth in NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) document titled "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations", June 1998 and amended by a January 1999 Errata Sheet, an April 2000 Addendum and a June 2004 Addendum.
- ☐ City of Olean Sewer Use Permit Effluent Standards.

2.0 BACKGROUND AND PREVIOUS INVESTIGATIONS

This section presents a brief discussion of the setting/uses of the Site and the surrounding area. In addition, an overview of the environmental studies completed to date at the Site and the findings of these studies with respect to subsurface conditions and contaminant types/distribution are presented in this section.

2.1 Background

The Site is located in an industrial-use urban area in the Northwest Quadrant district of the City of Olean, Cattaraugus County, New York and is within the NYSDOS BOA boundaries. The Site is bound to the north by Franklin Street followed by a parking lot, athletic field, and undeveloped land, to the east by vacant residential properties followed by a residential neighborhood, to the south by a railroad ROW with a residential neighborhood beyond, and to the west by a railroad ROW with industrial properties beyond. The approximate 5.79 acre Site is developed with an approximate 280,000-square foot, two-story industrial building with a partial basement. A Project Locus Map is provided as Figure 1.

Based on information obtained from Sanborn Fire Insurance (Sanborn) Maps, historic records, and historic telephone directories from the City of Olean, industrial activities have been conducted on the Site since at least 1882 and include the following:

- ❑ The Olean Chemical Company was located on the western portion of the Site between at least 1882 until around 1898, and operations included the manufacturing and storage of muriatic, sulphuric, mixed acids and ammonia. A 1894 Sanborn map depicts various buildings, acid tanks, coal/coke storage structures, sulphur and soda storage structures, and acid pipelines at this facility. An oil house is depicted on an earlier Sanborn map, dated 1886, in the approximate location of one of the acid tanks depicted on the 1894 Sanborn Map. Multiple railroad spur lines that connect the Olean Chemical Company buildings to railroad lines adjacent to the south and west are also depicted on the Site. The Olean Chemical Company was partially destroyed by fire sometime around 1898.

- ❑ A glass bottle manufacturing facility was constructed on the Olean Chemical Co. property (i.e., the western portion of the Site) in the about 1906. The facility was destroyed after a fire and explosion the following year.

- ❑ Olean Metal Cabinet Works was constructed on the western portion of the Site sometime around 1932 and the facility operated until around 1934. As depicted on a 1932 Sanborn map, the building contained office space, carting (shipping) area, a factory floor, a spray painting area, a coal room, a boiler room and storage.

- ❑ The Daystrom Corporation occupied the building on the western portion of the Site sometime after 1934, subsequently expanded the building, and operated until at least 1961, manufacturing metal furniture and metal wares. Daystrom Corporation conducted painting, polishing, and plating operations in the central portion of the building, and a boiler room was located in the northwest portion of the building. In addition, historic documentation indicates that a 10,000-gallon tank, a press room building, a waste paper shed, and two un-named buildings were removed in order to construct an addition on the south side of the main building. Daystrom Corporation constructed another addition on the eastern side the building at the Site sometime between 1943 and 1949, and this addition was constructed over the Spruce Street ROW and a portion of the West Connell Avenue ROW.

- Hysol, a Division of the Dexter Corporation occupied the Site sometime after 1966, and operated until at least 1996, manufacturing plastics and epoxy resins. As depicted on a Sanborn map dated 1969, painting operations were completed in the central and southern portions of the building, and raw materials (including solvents) were stored in the southern portion of the building. A boiler room is also depicted in the southern portion of the building.
- The Henkel Corporation occupied the Site sometime after 1996, and operated until 2011, manufacturing adhesive and sealants. Reportedly, solvents were stored/used at the facility, and raw material resins and 'off-spec' product waste were stored in tanks located in the southern and northwestern portion of the building, respectively. Heating oil for the facility was stored in underground storage tanks. Based on information included in a Phase I ESA completed at the Site in 2013 (refer to Section 2.2), wastes generated by Henkel Corporation included:
    - Flammable liquids (MIBK, propylene glycol monoethyl ether, toluene, xylene, cyclohexane);
    - Hazardous waste liquids and solids (acetone, MIBK, MIBK rags);
    - resin mixtures;
    - aerosols;
    - paint related materials;
    - Corrosive liquid (triethanolamine);
    - Mercury;
    - Caustic alkali liquids (sodium hydroxide/triethanolamine);
    - Amines (benzyl dimethylamine);
    - aluminum powder; and
    - Methanol mixture.
- SolEpoxy, Inc. has occupied the building at the Site since 2010, and currently manufactures epoxy resins for use by others to manufacture electric components at off-site locations.

2.2 Previous Environmental Studies

The previous environmental assessments and studies completed at the Site are summarized below.

Phase I Environmental Site Assessments (Phase I ESAs)

Environmental Resources Management (ERM) prepared a Phase I ESA report dated May 2007 for the Site and select adjacent properties (i.e., including 202 Franklin Street, 119 Franklin Street, and 211 Franklin Street) comprising a total of approximately 13.5 acres. Recognized environmental conditions (RECs), pertaining to the Site, that were identified in the 2007 Phase I ESA include:

- ❑ "The site has been historically used for industrial manufacturing activities since prior to 1886. Historical uses of the subject property included bulk acid and soda storage…electroplating operations associated with metal furniture production…and other manufacturing activities."

- ❑ "An approximate 500-acre area covering eleven current and former industrial properties, including the subject property, has been named by the City of Olean and the State of New York as a Brownfields Opportunity Area (BOA)…the BOA initiative includes creation of a statewide groundwater database to assist communities in evaluating groundwater issues related to the cleanup of contaminated properties…No soil or groundwater sampling has been performed to characterize site conditions on the subject property."

In addition, the 2007 Phase I ESA report identified that rinse water used for cleaning reactor vessels and tanks contained a flammable solvent and that this rinse water was discharged to the sewer system for an undocumented period of time prior to 2005.

DAY completed a Phase I ESA in 2013 that included the Site and select adjacent properties that covered approximately 14.28 acres (i.e., 202 Franklin Street, 119 Franklin Street, 211 Franklin Street, and 120 West Connell Street).

The 2013 Phase I ESA report identified that the Site has been used for historical industrial purposes including bulk acid manufacturing and soda storage, glass bottle production, metal furniture manufacturing; and the manufacturing of formulated resins, molding powders, coating powders for the electronic components industry. Multiple railroad spurs were also identified crossing the Site. RECs pertaining to the Site, that were identified in the 2013 Phase I ESA report include:

- ❑ Historical industrial manufacturing activities were conducted at the Site since at least 1886, and some of the chemicals, hazardous substances and waste products used/generated during these operations included:

    - Acids and fuels stored and manufactured at the Olean Chemical Company;
    - materials/wastes from glass manufacturing;
    - electroplating and painting materials and wastes from metal furniture manufacturing;
    - materials and wastes generated during resins/coatings manufacturing (solvents [MIBK, acetone, etc.]), raw materials containing metals [arsenic, chromium, mercury, etc.]); and
    - petroleum products, coal, and ash associated with power plants/boilers fueling operations at these facilities.

- ☐ Railroad spurs were present in various areas of the Site, and railroad ballast material may be present beneath portions of the (Site) building.

- ☐ Potential releases from the following current/former tanks/tank systems (i.e., including the associated piping, fill ports, vents, dispensers, etc.) can not be ruled out with the available information).

    - A gasoline underground storage tank (UST) located near the northwest corner of building, identified in a 1949 Sanborn historical map.
    - A 10,000-gallon No. 2 fuel oil/diesel UST, which was reportedly removed in the late 1980s.
    - A 10,000-gallon No. 2 fuel oil/diesel UST, installed in 1987, which has been empty and out-of-service for about 2 ½ years. [Note: this UST is reportedly present in the same location as the removed fuel oil UST that was removed in the late 1980s; see above.]
    - Two aboveground 5,000-gallon storage tanks located in the southern portion of the building. These tanks are currently empty, but previously contained resin. The tanks are surrounded by concrete containment walls, which are close to the northern exterior building wall. The concrete appeared to be darkly stained at the time of the Phase I ESA site visit.
    - Two 10,000-gallon storage tanks, which are each located in a concrete vault/basement beneath the south/central portion of the building. These tanks are currently empty, but formerly contained resin and castor oil. The ages of these tanks are unknown. It is also not known whether different materials may have been stored in these tanks in the past.
    - A 30,000-gallon waste resin UST formerly located beneath the northwestern portion of the building. According to a 2007 Phase I ESA report, this tank was used for disposal of waste resin and resin sample bottles. In 1988, it is reported that this UST was filled with liquid resin to fill void space, allowed to harden, cut up, and disposed off site as non-regulated waste. No analytical laboratory data is available to confirm that environmental media were not impacted by this UST. Samples of water collected from the vault housing the UST contained detectable levels of zinc, mercury and phthalates that were speculated, but not confirmed, to be associated with historic metal furniture manufacturing and electroplating operations.
    - In addition, at the time of the Phase I ESA site visit, a dark, hardened material was observed on the ground surface on the south side of the building in the vicinity of the location of current and former interior storage tanks and the associated fill ports. These tanks formerly stored materials that were used by previous owners/occupants during large-scale formulated liquid resin production.

- ☐ Several apparent basement or vault areas are present beneath the central/southern portions of the building. These basements/vaults could not be entered during the Phase I ESA site visit because they are confined spaces, accessible only through manholes/manways. These basement/vault areas are not included on the facility plans or Sanborn maps. Therefore, the size and configuration of the basement/vaults could not be determined (i.e., it is not known whether the basement/vaults are interconnected, or whether additional basement/vault areas may be present). Two of the basement/vaults contain storage tanks (described above), and at the time of the Phase I ESA site visit two of the basements/vaults contained about 1.5 feet of standing water. These basements/vaults are historical building features and the former uses are not known. The potential for hazardous substance/petroleum products/waste storage or disposal into these subsurface basements/vaults can not be ruled out with the available information.

- ☐ Concrete floor patches, suggesting the former presence of floor drains, trench drains, sumps etc., are located in portions of the building, particularly in the southwestern portion of the building. During the Phase I ESA site visit, floor staining was observed in these areas. (A facility representative interviewed as part of the Phase I ESA indicated that) 90% of the facility's floor drains were closed/sealed in the 1970s.) Former operations at the facility, which may have discharged hazardous materials/petroleum products to drains, and the discharge point(s) of former drains, are not specially known.

  A trench drain is located in the current flammables storage room located near the northwestern corner of the building. According to a facility representative interviewed as part of the Phase I ESA, this drain is designed to contain spills in this room. There is a valve within this drain to prevent spills from flowing to the end of the drain, which, if open, would discharge to the ground outside of the building wall. Given the unknown condition/functionality of the valve that would prevent exterior spillage, and given unknown historical practices, potential exterior spillage via the trench drain can not be ruled out.

- ☐ The historical use of the adjoining and nearby properties revealed a long history of industrial use of the area. The most significant historical use of the area was an oil refinery, which extended to the northeast, north, northwest, west and southwest of the Site. Numerous oil storage tanks, processing equipment and pipelines were located on the refinery complex. Other industries, which were located in the vicinity of the Site, and which may have used, stored and disposed of hazardous/petroleum products/wastes included: Acme Glass, Seaman Container Manufacturing, Wheeling Corrugating Co, and Empire Mills.

  The NYSDEC spills database identified four spills at off-site properties, including: the adjoining property to the west/northwest ("Former Socony Vacuum" site); the adjoining property to the west/northwest ("Offsite Scott Rotary Seal BCP Site"); and two properties located approximately 0.25 miles north ("MJ Painting Contractor" site and "Offsite Homer Street BCP Site"). These four spills were attributed to the historic presence of an oil refinery operated by a predecessor to ExxonMobil. Off-site contaminant migration, potentially toward the assessed property, was identified at each of these spill sites.

  An approximate 500-acre area [in the vicinity of the Site] has been designated as a Brownfield Opportunity Area (BOA). This designation suggests recognition that environmental contamination may be present based on historical industrial uses. Additionally, this designation indicates that certain community organizations and municipalities may be eligible for funding to complete revitalization plans and implementation strategies for areas or communities affected by the presence of brownfield sites, and site assessments for strategic brownfield sites.

Preliminary Phase II Environmental Site Assessment (Phase II ESA)

DAY completed a Preliminary Phase II ESA at the Site and select adjacent properties in 2013 (i.e., 202 Franklin Street, 119 Franklin Street, 211 Franklin Street, and 120 West Connell Street). The findings of the Preliminary Phase II ESA are summarized in a report dated October 17, 2013.

The portion of the Preliminary Phase II ESA performed on the Site consisted of the advancement of five test borings (designated TB-02 through TB-05 and TB-07), the installation of four overburden groundwater monitoring wells (designated MW-B through MW-E) in four of the test borings, and the collection/analysis of soil and groundwater samples from these locations. Copies of laboratory data summary tables, test boring logs, and a well construction diagram from the Preliminary Phase II ESA report are included in Appendix C. The locations of the test borings/monitoring wells installed during the Preliminary Phase II ESA are depicted on the Site Plan presented as Figure 2. The Phase II ESA report documented the presence of petroleum related volatile organic compounds (VOCs), acetone, and metals in saturated soil samples and groundwater collected from the Site. The findings of the Phase II ESA included:

- ❑ Evidence of apparent contamination (i.e., petroleum-type odors and elevated photoionization detector [PID] readings) was encountered within the saturated soil in test borings TB-02 and TB-04.
- ❑ Soil samples collected from below the top of the apparent ground water table in test borings TB-02 and TB-04 contained non-target VOC compounds (i.e., tentatively identified compounds, TICs) at concentrations of 155.2 mg/Kg (or ppm) and 95.1 ppm (respectively) and non-target SVOC TICs at concentrations of 14.44 ppm and 56.6 ppm, respectively. Groundwater samples collected from these locations (i.e., MW-B and MW-D, respectively) contained non-target VOC TICs at concentrations of 0.0602 and 615.2 mg/L or ppm, respectively.
- ❑ The concentration of the VOC tert-butylbenzene in the groundwater sample collected from MW-B (3,130 ug/l or ppb) exceeds the Class GA standard of 5 ppb. In addition, the concentration of acetone in the groundwater sample collected from MW-B (i.e., 4,260 ppb) exceeds the Class GA guidance value of 50 ppb.
- ❑ A groundwater sample collected from monitoring well MW-B contained concentrations of the metals arsenic, barium, beryllium, chromium, copper, iron, magnesium, manganese, sodium, nickel, lead, thallium, and zinc that exceeded applicable groundwater standards/guidance values established by the NYSDEC.
- ❑ A groundwater sample collected from monitoring well MW-D contained detectable concentrations of sec-butylbenzene (1.05 ug/l) and tert-butylbenzene (1.90 ug/l), but the levels reported were below the applicable Class GA standard of 5 ug/l. The groundwater sample collected from MW-D contained a non-target VOC TICs concentration of 60.2 ug/l.

3.0 PHYSICAL CONDITIONS OF THE SITE AND SURROUNDING AREA

The physical conditions of the Site and surrounding area regarding the overburden, bedrock and groundwater conditions are discussed in this section.

3.1 Overburden

Based on the results of the Preliminary Phase II ESA, soil at the Site consists of fill material that extends from the surface to depths between approximately 2 feet (ft.) near the southern boundary of the Site to approximately 11 ft. below a portion of the building at the Site. This fill generally consists of reworked native soil (sand and gravel), with intermixed brick, concrete, ash, and coal fragments in locations. Native soil below the fill consists of varying proportions of fine to coarse sand and gravel (with larger aggregate suspected to be present) that extends to depths of at least 33 ft. below ground surface (bgs).

3.2 Bedrock

The test borings completed as part of the Preliminary Phase II ESA (i.e., advanced to a maximum depth of 33 ft. bgs) did not encounter bedrock. The Ellicott member of the Chadakoin Formation is anticipated to be the uppermost bedrock at the Site. The Ellicott Member is an inter-bedded soft gray shale and siltstone.

3.3 Hydrogeology

The Site and the vicinity are generally level, with the exception of the elevated Interstate I-86 roadway (i.e., approximately 20 ft. higher in elevation that the Site) that is located north of the Site. Beyond I-86 to the northwest the ground surface rises steeply with elevations more than 400 feet higher than the Site. Figure 1 (Project Locus Map) presents a portion of the topographic quadrangle map that includes the Site and surrounding areas.

There are no surface water bodies on or adjoining the Site. Depending on location, surface water generated during precipitation and/or snowmelt events appears to flow off the Site to the north, toward storm water catch basins located along Franklin Street which enter the City storm sewer system, and to the south/southeast discharging onto the ground surface. Two Mile Creek is located approximately 1,250 ft. north of the Site and Olean Creek is located approximately 2,400 ft. east of the Site. No state or federally listed wetlands are located within a half-mile radius of the Site.

The uppermost water-bearing unit encountered at the Site during the Preliminary Phase II ESA was within an unconfined sand and gravel layer and the depth to groundwater, ranged between about 20 ft. bgs and 26 ft. bgs. At the time of the Preliminary Phase II ESA, groundwater flow in the uppermost water-bearing unit was toward the east-southeast, towards Olean Creek.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

The preliminary conceptual site model presented in this section identifies and describes: (1) the known or potential sources of contamination; (2) the types of contaminants and affected media; 3) release mechanisms and potential migration pathways; and 4) actual/potential human health and environmental receptors. This preliminary conceptual site model was used as the basis for the studies described herein. The data collected during the RI will be used to refine this model as the project progresses and assist in evaluating remedial options for the Site.

The Site is currently developed with an approximate 280,000-square foot, two-story industrial building with a partial basement. Industrial activities were conducted at the Site by various entities since at least 1882. Some of the chemicals, hazardous substances and waste products used/generated during the historic use of the Site include: materials and waste products associated with Olean Chemical Company (e.g., acids, sulfur waste, coal/coke associated with a heating plant); plating and paint waste associated with operations conducted during the manufacturing of metal furniture and cabinets by Olean Metal Cabinet Works and Daystrom Industries and residual petroleum products associated with a gasoline tank and fuel oil tanks operated by these companies; and liquid resins and waste solvents used during epoxy manufacturing operations conducted by Hysol, a division of the Dexter Corporation and the Henkel Corporation. Railroad spur lines that serviced the manufacturing facilities were formerly located on the Site, and apparent railroad ballast including cinders and ash may remain in portions of the Site where these rail lines were previously located.

Copies of select Sanborn Maps overlain onto a current Site Plan are presented on the following figures to depict historic conditions at the Site.

- ☐ Figure 3: Site Plan showing approximate locations of former buildings, former railroad spur lines, and former street right-of-ways in 1894 (Olean Chemical Company)
- ☐ Figure 4: Site Plan showing the approximate building footprint, former railroad spur lines and former street right-of-ways in 1932 (Olean Cabinet)
- ☐ Figure 5: Site Plan showing the approximate building footprint and former facility layout in 1943 (Daystrom Corporation)
- ☐ Figure 6: Site Plan showing the approximate building footprint and former railroad spur lines in 1969 (Hysol Corporation)
- ☐ Figure 7: Site Plan showing the former facility layout and former waste management units identified as part of a 1997 RCRA Facility Assessment
- ☐ Figure 8: Site Plan showing the approximate current locations of drains and select underground utilities

In addition to operations conducted on the Site, industrial activities including an oil refinery, oil production/storage operations, and railroad lines are/were located in proximity of the Site.

4.1 Subsurface Conditions

Based upon the test borings advanced on the Site as part of the Preliminary Phase II ESA, fill material extending from the ground surface (or below concrete slabs) extends to depths up to 11 ft. bgs. This fill material typically consists of reworked soil comprised primarily of sand and gravel intermixed in some locations with brick fragments, concrete fragments, hardened epoxy resin and coal fragments. Indigenous soil below the fill consists of a mixture of sand, silt and gravel that generally becomes coarser with depth, and this material extends to depths of more than 33 ft. bgs (i.e., the deepest test boring advanced on the Site during the Preliminary Phase II ESA). The depth to bedrock underlying the Site is not known. Groundwater was measured in the monitoring wells installed at the Site as part of the Preliminary Phase II ESA at a depths ranging between 20.2 ft. bgs and 26.3 ft. bgs on September 25, 2013. Groundwater flow in the uppermost groundwater-bearing zone underlying the Site was determined during the Preliminary Phase II ESA to be generally to the southeast.

4.2 Known or Suspected On-Site Sources of Contamination

This conceptual site model is based on historic documentation regarding usage of the Site, the findings of the previous studies conducted at the Site including the Preliminary Phase II ESA conducted in October 2013, and applicable information obtained during studies conducted on nearby properties. Based on the above, known or suspected on-site sources of contamination and current information on extent of contamination are listed below in this section.

Petroleum Contamination

The two western-most test borings advanced at the Site during the Preliminary Phase II ESA encountered evidence of petroleum impact beginning at depths of approximately 18 ft. bgs and 26 ft. bgs where chemical/petroleum odors were observed, and PID readings in excess of 100 ppm were measured above soil samples. Groundwater samples collected from the monitoring wells installed within these test borings had a petroleum sheen and TPH similar to #2 fuel oil, ligroin (e.g., mineral spirits, petroleum naptha, etc.) and/or other oil, various petroleum-related constituents including a concentration of tert-Butylbenzene that exceeded TOGS 1.1.1 drinking water criteria.

In addition, although testing has not yet been completed, it is possible that petroleum contamination associated with former manufacturing operations conducted at the Site may be present in the subsurface. Specifically, residual petroleum products from the former heating systems used to fuel the buildings and residual gasoline from underground storage tanks (USTs) may be present within the subsurface of the Site.

Volatile Organic Compounds

In addition to petroleum-related VOCs, other VOCs associated with tank and equipment cleaning operations previously conducted at the Site (e.g., acetone, MIBK, etc.), and paints/varnishes used during the manufacturing operations conducted by Olean Metal Cabinet Works and Daystrom Industries could be present within the subsurface. VOCs, if present, may also migrate via the soil gas.

Former Railroad Lines

The ballast within the railroad spur lines that formerly traversed the Site may have contained coal, ash and other materials that contained elevated concentrations of SVOCs and heavy metals. In addition, leakage from the trains could have resulted in VOC impact to subsurface media. It is also possible that oil containing polychlorinated biphenyls (PCBs) could have been discharged onto the railroad ballast.

Discharges to Sewers

Several closed/abandoned drains are located within the building at the Site. These abandoned drains include sanitary sewer lines that were located within the ROW for the portions of Spruce Street and West Connell Street that were closed/abandoned when the building was expanded and constructed over the former roads. In addition, other closed and active catch basins that discharge to the sanitary and storm sewer are located within the building. It is possible that waste materials were discharged into these drains in the past. [Note: Reportedly rinse water from the cleaning of equipment that contained flammable solvents was discharged into the sanitary sewer system prior to 2005.]

4.3 Potential Release Mechanisms and Contaminant Migration Pathways

Potential release mechanisms and contaminant migration pathways away from known or suspected source areas may have included one or more of the following:

- ❑ Volatilization directly from the ground surface into the air;
- ❑ Volatilization from impacted soil and/or groundwater into the soil vapor that collects beneath the floor slab of the building at the Site and potentially discharges into the indoor air;
- ❑ Surficial flow across exterior surfaces, possibly enhanced by precipitation and snow melt events;
- ❑ Direct contact with fill material exposed at the ground surface that contains metals, Semi-volatile organic compounds (SVOCs), PCBs and/or other constituents;
- ❑ Preferential subsurface migration within subsurface utilities or their bedding materials could occur along active and abandoned structures depending on the depth and extent of the impact;
- ❑ Migration horizontally and vertically through the overburden soil, fill, bedrock, or groundwater; and/or;
- ❑ Migration along impermeable subsurface layers.

4.4 Potential Human Receptors and Environmental Receptors

Most of the Site is covered with a 280,000-square foot, two-story building with isolated parking and landscape areas on the north side of the building and gravel/fill covered areas on the western and southern sides of the building (i.e., generally in proximity of loading docks and access roads adjacent to the railroad tracks). Access to the exterior portion of the Site is not restricted by fencing, thus direct contact to exposed waste materials is possible. In addition, there is a potential that off-site migration of contaminants could impact environmental and/or human receptors via the groundwater and/or through the soil vapor. Active and closed utilities at the Site, may serve as preferential pathways for contaminants that may have been discharged into the sewer system or are flowing along the bedding of the utility lines. Contaminants from the Site could also migrate via groundwater, surface flows, and/or soil vapor.

Based on review of Cattaraugus County mapping information, site reconnaissance and the Phase I ESA completed for the Site, the following churches/schools are located within one-half mile of the Site.

School	Address	Relative Location
New Life Christian School	102 West Forest Avenue	~0.5 miles southeast
St. John's Roman Catholic Church/Religious Education Facility	921 North Union Street	~0.4 miles southeast
St. Joseph's Roman Catholic/Church Society of Olean NY	225 North 4th Street	~0.25 miles east/southeast

An athletic field is located adjacent to the Site (i.e., across Franklin Street) to the northeast and residential properties are located adjacent to the athletic field to the east and to the east and southeast. Residential properties are located within a 0.5-mile radius of the Site to east and southeast.

Other potentially sensitive environmental receptors that were evaluated during development of this RI/RAA Work Plan include Two Mile Creek located approximately 1,250 ft. to the north/northwest (hydraulically upgradient) and Olean Creek located approximately 2,400 ft. to the east (hydraulically downgradient) and east of the Site. There are no State wetlands or records of potable water supply wells within one-half mile of the Site based on a review of available information.

4.5 Nearby Known Off-Site Contamination Sources

There are several known contamination sites located within one-half mile of the Site, which are regulated by the NYSDEC. These sites include the Rotary Seals NYSDEC Brownfield Cleanup Program (BCP) site (BCP Site #C905036) located adjacent to the Site to the west and the Former Socony Vacuum site (NYSDEC Spill No. 0550226) located adjacent to the Site to the northwest. Information regarding these facilities was obtained from the NYSDEC, and the contaminants identified primarily included residual petroleum and petroleum-related constituents dissolved within the groundwater.

Based on the location of NYSDEC Spill Site No. 0550226, it is possible that contamination from this spill site migrates onto the Site.

5.0 SCOPE OF WORK

This section presents the scope of work to meet the project objectives presented in Section 1.2 of the Work Plan. In general, this work will be completed in accordance with provisions and guidance outlined in the NYSDEC document titled *DER-10 Technical Guidance for Site Investigation and Remediation* dated May 2010, and the scope of work will be adjusted as necessary based upon regular communication with the NYSDEC.

The site-specific HASP attached as Appendix A outlines the policies and procedures to protect workers and the public from potential environmental hazards during activities that have the potential to disturb contaminated materials. The HASP includes a CAMP that is required for intrusive activities at the Site during this project, and also an Emergency Contingency Plan (ECP) should unanticipated emergencies or Site conditions be realized.

The QAPP included in Appendix B describes the procedures to be used to provide for the integrity of the field data and analytical laboratory data to be collected. The QAPP includes specific information pertaining to the handling of samples, analytical methods to be used, Quality Assurance/Quality Control (QA/QC) procedures to be followed, analytical laboratory reporting limits, documentation procedures, project organization, decontamination procedures, sampling procedures, and a sampling and analysis plan. As described in the QAPP, analytical laboratory results will be provided in an EQUIS database format in accordance with the Electronic Data Deliverable (EDD) requirements of the NYSDEC.

5.1 Remedial Investigation

The RI will include a detailed evaluation of the nature and extent of contamination at the Site. The RI will include a review of existing records of utilities on and adjacent to the Site, screening level soil vapor testing with analytical laboratory analyses, advancement of test borings, soil sampling with analytical laboratory analyses, overburden monitoring well installation, groundwater sampling with off-site analytical laboratory analyses, hydraulic conductivity testing of the overburden and bedrock aquifers, investigation derived waste (IDW) management, data evaluation and report preparation. A summary of the analytical laboratory-testing program anticipated for this RI is provided as Table 1 of the QAPP included as Appendix B. The NYSDEC shall be notified at least seven days in advance of any field activities so that it can arrange to have a representative on-site, if desired.

5.1.1 Basement/Vault Assessment

Discrete basement areas (i.e., basements/vaults) are located beneath the central and southern portions of the building at the Site. The size and configuration of these basement/vaults are not currently known (i.e., it is not known whether the basement/vaults are interconnected, or whether additional basement/vault areas may be present). Contained storage tanks and standing water were identified in the basements/vaults observed during previous studies (refer to Section 2.2). In addition, a basement in the north/central portion was historically used for paint/chemical storage and contained a storage tank used for waste chemical storage.

An assessment of the basements/vaults will be conducted to evaluate their integrity, extent and content, as well as the potential for subsurface impacts from past/current uses of these areas. This assessment will include:

- Determination of the approximate dimensions and construction materials of each basement/vault identified;

- Evaluation of the integrity of floors, walls, and containment structures (dikes, secondary containment around storage tanks, etc.) pertaining to the potential for releases to the subsurface;

- Identification of drains, sumps, etc., present within the vaults (if any); and

- Completion of an inventory to determine the dimensions, integrity, and contents of storage tanks, drums or other chemical containers encountered. A sample of the contents of each tank identified will be collected using the procedures outlined in Section 3.12 of the QAPP (Appendix B) and submitted under chain-of-custody control to Spectrum Analytical, Inc. (Spectrum) of Warwick, Rhode Island. Spectrum is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified analytical laboratory (ELAP ID LAI00329). Each tank contents sample will be tested for the following parameters:
    - Target Compound List (TCL) VOCs plus TICs;
    - TCL SVOCs plus TICs;
    - TCL PCBs;
    - TCL pesticides;
    - Target Analyte List (TAL) metals; and,
    - Cyanide.

Vault areas determined to be confined spaces under 29 CFR 1910.146 will be assessed using remote survey/sampling equipment, or entered using the procedures and requirements for confined space entry as listed in Section 3.13 of the QAPP (Appendix B).

5.1.2 Geophysical Survey

The history of the Site indicates that USTs, or other buried structures, may have existed in exterior portions of the Site. To evaluate the potential presence of USTs and other buried anomalies, an EM-61 geophysical survey will be conducted over the exterior portions of the Site using approximate 3-foot line spacing. A report will be prepared that includes a map showing magnetic anomalies that may indicate the presence of sumps, tanks or other potentially significant buried metallic objects.

Utilities, where present in the areas covered by the EM-61 survey, will also be mapped to the extent possible using the geophysical survey data. A Global Positioning System (GPS) meter will be used to locate grid boundaries, as well as the visible sources of anomalous geophysical readings such as drain grates, fences, vertical piping, reinforced concrete, fill areas and other findings. Precise mapping of these Site features will allow more complete screening of the surveyed areas and help to eliminate “noise” to the extent possible.

The results of the geophysical study, including the locations of potential subsurface anomalies such as UST locations, will be geo-referenced and incorporated into the Global Information System (GIS) database. The results will be used to assist in determining the locations of subsequent subsurface investigations, including overburden test boring locations, and monitoring well installation locations.

In the event anomalies indicative of USTs, or other potentially environmentally significant structures, are identified during the geophysical survey, test pits may be required to evaluate the source of these anomalies. The NYSDEC will be contacted to discuss such work, and an addendum work plan will be prepared, as necessary.

5.1.3 Soil Vapor Screening

A screening level evaluation of the soil vapor beneath the building at the Site is proposed as part of the scope of investigation for this project. The purpose of the soil vapor screening is to: 1) determine whether actions are needed to address exposures to volatile chemical contamination related to soil vapor intrusion; 2) identify possible contaminant source areas below the building footprint; and 3) to assess the extent (if any) of contaminant migration along buried utilities located below the building footprint.

It is anticipated that the soil vapor screening will be conducted using passive soil gas samplers (PSGS) obtained from Beacon Environmental Services, Inc. (Beacon), or equivalent. Currently it is anticipated that 20 PSGS will be installed below the floor surfaces in the approximate locations depicted in Figure 9. As shown on Figure 9, the PSGS will be located below the facility office/support areas, production areas, and warehouse/maintenance areas, and in proximity to buried utilities identified on Figure 8.

The PSGS will be installed and collected in accordance with the sampling procedures outlined in Section 3.4 of the QAPP (Appendix B). Upon retrieval, the PSGS will be shipped under chain-of-custody procedures to Beacon (or an equivalent testing company) and analyzed for select parameters, including but not limited to:

- 1,1,1,2-tetrachloroethane;
- 1,1,1-trichloroethane;
- 1,1,2-trichloroethane;
- 1,1,2-trichlorotrifluoroethane;
- 1,2,4-trimethylbenzene;
- 1,3,5-trimethylbenzene;
- 4-methyl-2-pentanone (MIBK);
- acetone;
- benzene;
- cis-1,2-dichloroethene;
- cyclohexane;
- ethylbenzene;
- hexane;
- methylene Chloride;
- naphthalene;
- o-xylene;
- p & m-xylene;
- tert-butylbenzene;
- tetrachloroethenene;
- tetrahydrofuran;
- toluene;
- trichloroethene; and
- vinyl chloride

5.1.4 Utility Assessment

Identifying potential preferred contamination migration pathways is a significant objective of the RI, and understanding active and former utility infrastructure is critical for identifying potential preferred contamination pathways. Publicly available and facility utility records will be obtained, reviewed and verified with field observations in order to identify utilities on-site and immediately off-site, including buried sewer systems (e.g., storm, sanitary or combined), electric lines, natural gas lines, water delivery lines, etc.

Buried utilities currently identified at the Site include a 24-inch diameter sewer system and a parallel 10-inch diameter sewer system (refer to Figure 8). As shown, segments of the parallel sewers are located under the building at the Site, within the former Spruce Street and West Connell Street right-of-ways (ROW). Several PSGS (refer to Section 5.1.3) will be placed in proximity to the storm sewer and sanitary sewer main lines within the former Spruce Street and West Connell Street ROWs, and in proximity to lateral storm and sanitary sewer piping in select locations within the building footprint, in order to assist in the evaluation of the potential for preferred contamination migration pathways along these utilities.

If the results of the soil vapor screening (and/or subsequent subsurface testing conducted during the RI) indicate potential contaminant source area(s) in proximity to the storm or sanitary sewer system, an evaluation of the integrity of the piping in the vicinity of the potential source area will be required. The specific method for evaluation will be discussed with the NYSDEC prior to implementation, but these methods may include: dye testing, remote video examination of the sewer lines, and/or additional testing using PSGS to further delineate soil vapor impacts in the area. Shallow test borings/probes may also be advanced in the potential source area for the purpose of assessing impacts to utility bedding.

5.1.5 Surface Soil Samples

In order to characterize the limited surface soil exposed at the Site, surface soil samples will be collected from seven of the test boring/monitoring well locations depicted on Figure 6 (i.e., TB-101, TB-106, TB-108, TB-114, TB-120, MW-J and MW-M), and described on Table 1 *Summary of Proposed Remedial Investigation Test Locations*. The sample locations may be adjusted in the field with NYSDEC concurrence to nearby areas if those areas appear stained, devoid of vegetation and/or exhibit other characteristics that indicate the presence of contamination.

The surface soil samples will be collected prior to the advancement of the test borings/monitoring wells from a depth of 0 to 6 inches below the ground surface, or the vegetative cover (if present). Initially, vegetation (if present) will be removed with a dedicated disposable trowel and placed to the side of the test location. The trowel will then be used to collect the surface soil sample from the 0 to 6 inch depth interval. Portions of the samples will be placed directly into laboratory-supplied glassware for subsequent analysis. To the extent practicable based on visual and olfactory observations, the portions placed in laboratory-supplied glassware will consist of the most contaminated section of the sample. Other portions of the samples will be placed in Ziploc®-type plastic baggies that will subsequently be field screened with a PID in accordance with the provisions of the QAPP located in Appendix B. The laboratory containers and baggies for each sample location will be labeled and placed in a cooler maintained at or below 4°C.

The surface soil samples will be submitted for analytical laboratory analyses using the procedures listed in the QAPP presented in Appendix B. The samples will be submitted under chain-of-custody control to Spectrum. Each surface soil sample will be analyzed for the following suite of test parameters (refer to Table 1 of the QAPP):

- TCL VOCs plus TICs;
- TCL SVOCs plus TICs;
- TCL Pesticides;
- Cyanide
- TCL PCBs; and
- TAL Metals.

Note: Surface soil samples submitted for VOC testing will be collected using United States Environmental Protection Agency (USEPA) Method 5035 protocols (refer to the QAPP included in Appendix B).

5.1.6 Test Borings

Based upon historic documentation of industrial activities conducted at the Site, which are summarized on Figure 3 through Figure 7, and the presence of buried utility lines that may provide preferential pathways for contaminant migration (Figure 8), twenty-five (25) test borings (designated TB-101 through TB-125) are currently proposed in the locations depicted on Figure 9. The rationale for the advancement of test borings TB-101 through TB-125 is summarized on Table 1 *Summary of Proposed Remedial Investigation Test Locations*. The final number, locations, and depth of the test borings may be modified based on the information obtained during the initial tasks of the RI (i.e., Section 5.1.1 through Section 5.1.4), and access restrictions.

A 40-hour OSHA trained subcontractor will be retained to provide drilling equipment and an operator to advance the test borings and collect representative samples for observation and subsequent testing. This subcontractor will call in a utility stakeout prior to start of intrusive work.

Due to space and height restrictions, it is anticipated that select test borings advanced inside the building footprint (i.e., TB-102, TB-104, TB-109 through TB-111, TB-116, TB-117, TB-119, and TB-123 through TB-125) will be completed using a direct-push drill-rig capable of advancing a 2.25-inch diameter macro core sampler to an approximate depth of 12 ft. below the floor at which point equipment refusal is anticipated due to the granular nature of the subsurface materials. [Note: It is also anticipated that exterior test borings TB-106, TB-115, and TB-120 will be advanced to approximate depths of 12 ft. bgs., since these borings are being advanced to assess shallow subsurface soil conditions adjacent to the facility loading docks and nearby test borings/monitoring wells will be advanced into the uppermost groundwater bearing zone underlying the Site.] However, if impacted materials are identified at or near anticipated boring completion depths and/or if a monitoring well is required at a particular location, a drill-rig capable of advancing 2.25-inch inner diameter (ID) Hollow Stem Augers (HSA) will be utilized, if possible depending on clearance. [Note: It is anticipated that, test borings that will be completed as monitoring wells will be advanced to depths of approximately 30 ft. to 35 ft. bgs.]

It is anticipated that the remainder of the test borings completed at interior and exterior locations will be advanced using a rotary drill-rig capable of advancing minimum 4.25-inch ID HSA, through approximately 30 ft. to 35 ft. of overburden materials (i.e., at least 10 ft. below the top of the observed first water-bearing zone).

In addition to the test borings identified on Figure 9, supplemental test borings may be advanced to further evaluate known and suspected areas of concern and to fill any data gaps that may be identified during field activities. The NYSDEC will be consulted as to the need and specifications for such additional test borings, prior to their advancement.

During drilling, continuous samples will be collected from the ground surface to depths of up to 12 ft. bgs using direct-push sampling equipment to collect Macro-Core samples in consecutive 4-foot intervals and/or continuous split spoon samples will be collected via Standard Penetration Test (SPT) ahead of the hollow stem augers. Depending on the subsurface conditions encountered, samples below 12 ft. bgs will typically be collected at 5-foot intervals. In the event field evidence of contamination is detected within the soil samples collected at 5-foot intervals, continuous samples will be collected to define the vertical extent of impact. If SPT refusal is encountered, the HSA will be used to advance the borings, and sampling will resume (i.e., assuming auger refusal is not encountered). The soil samples collected will be logged and screened with a PID in the field by a DAY representative. Select soil samples from the test borings will be collected for potential analytical laboratory analyses to confirm the field observation findings.

If field observations and/or elevated PID readings suggest the presence of DNAPL or LNAPL, the DAY representative will perform a shake test on an aliquot of the corresponding soil sample with hydrophobic dye using the procedure outline in Section 5.1.4. If DNAPL is encountered, representatives of the NYSDEC will be consulted to discuss options to prevent investigation induced vertical migration of DNAPL.

Prior to use and between test boring locations, re-usable drilling equipment will be decontaminated. Water generated from the equipment decontamination activities will be containerized as Investigation Derived Waste (IDW) for later disposal. Procedures for managing IDW are provided in Section 5.1.8.

The soil samples collected for analytical laboratory testing will be selected using the following criteria.

- Samples will be tested to confirm evidence of field contamination (elevated PID readings, staining, odors, present of NAPL, etc.) to evaluate samples with the greatest evidence of apparent contamination.

- Samples will be collected from approximately one to two feet below areas of apparent environmental impact for possible testing to assess the vertical extent and nature of the contamination.
- Samples will be collected adjacent to subsurface structures of environmental concern such as abandoned utilities or other preferential pathways for contaminant migration.
- Samples will be collected at the bedrock/overburden interface (if encountered).
- Samples will be collected approximately one foot above the encountered water table.

Currently it is anticipated that one sample (i.e., in addition to the surface soil samples described in Section 5.1.5) will be collected from each test boring and submitted to Spectrum for laboratory analyses using the procedures listed in the QAPP. [Note: To satisfy the criteria listed above, additional samples may require testing. If such testing is required, the NYSDEC will be contacted to review the proposed samples and test parameters.]

Ten (10) of the soil samples collected from the test borings will be analyzed for the following suite of test parameters (refer to Table 1 of the QAPP):

- TCL VOCs plus TICs;
- TCL SVOCs plus TICs;
- TCL Pesticides;
- Cyanide;
- TCL PCBs; and
- TAL Metals.

Fifteen (15) of the samples collected form the test borings will be analyzed for the following suite of test parameters (refer to Table 1 of the QAPP):

- TCL VOCs plus TICs;
- TCL SVOCs plus TICs; and
- TAL Metals.

Note: Soil samples collected from the test borings submitted for VOC testing will be collected using United States Environmental Protection Agency (USEPA) Method 5035 protocols (refer to the QAPP included in Appendix B).

5.1.7 Groundwater Investigation

A groundwater evaluation is proposed as part of the scope of investigation for this project. The purpose of the groundwater evaluation is to evaluate groundwater quality at the Site, evaluate potential off-site impacts migrating onto the Site, evaluate suspected preferential migration pathways along buried utilities, evaluate potential off-site migration of site contaminants, and evaluate the vertical and lateral extents of known and suspected contamination in groundwater.

In addition to the monitoring wells installed as part of the Preliminary Phase II ESA (i.e., designated MW-B, MW-C, MW-D and MW-E), eight (8) additional overburden monitoring wells (i.e., designated MW-F through MW-M) are proposed as part of this RI. The existing and proposed monitoring well locations are shown on Figure 9.

Monitoring Well Installation

The monitoring wells will be installed utilizing a one-inch or two-inch inside diameter, Schedule 40 PVC casing and screen materials. A schematic overburden well construction diagram is shown on Figure 10. The well screen will consist of a 10-foot section of No. 10 slot screen PVC and will be attached to a solid PVC riser casing with a PVC cap that will extend from the top of the screened section to the ground surface. The actual length of the well screen may vary due to the encountered field conditions.

The annulus around the well screen will be filled with a washed and graded silica sand pack that will be placed to at least two feet above the top of the screen interval. A minimum two-foot thick bentonite seal will be placed above the sand pack and hydrated with potable water. Following hydration of the bentonite, the remaining annulus will be filled with cement/bentonite grout consisting of approximately 96% Portland type 1 (or similar) cement to 4% granular bentonite mixture, and water. The cement/bentonite grout will be tremied into the well annulus to approximately one foot below grade. A curb box or steel protective casing with locking cap will be placed over each well and cemented in-place.

Well Development

At least two days following installation, the monitoring wells will be developed in accordance with the protocol outlined in the QAPP.

Groundwater Sampling

Two groundwater sampling rounds will be completed during this RI. During the initial round, conducted approximately two weeks after the development of monitoring wells MW-F through MW-M, groundwater samples will be collected from monitoring wells MW-B through MW-M (i.e., a total of 12 wells). To assist in meeting the desired project schedule, the second round of groundwater sampling will be collected approximately three months after the initial groundwater sampling round.

At least the first round of groundwater samples will be collected utilizing low-flow purging and sampling procedures. With input from the NYSDEC, a decision will be made whether low-flow sampling is required during the second round and/or if all twelve monitoring wells will require sampling during the second sampling event. Low-flow and conventional groundwater sampling procedures are outlined in the QAPP.

The groundwater samples collected during the first groundwater sampling round will be analyzed for the following suite of parameters:

- TCL VOCs plus TICs;
- TCL SVOCs plus Tics;
- TCL PCBs;
- TCL pesticides;

- TAL Metals; and,
- Cyanide.

Following a review of the data collected during the initial monitoring event, the NYSDEC will be contacted to determine if the parameter list identified above can be modified. For purposes of this Work Plan it is assumed that during the second sampling event each of the monitoring wells will be tested for the parameters.

- TCL VOCs plus TICs; and
- TCL SVOCs plus TICs.

The field parameters of pH, temperature, turbidity, DO and ORP will be measured during each groundwater sampling event using a Horiba Model U-22 water quality meter, or similar (refer to the QAPP in Appendix B).

Prior to use and between monitoring wells, the portable bladder pump and other reusable (non-disposable) groundwater sampling equipment will be decontaminated. Water generated from the well sampling and equipment decontamination activities will be containerized as IDW for later disposal. Procedures for managing IDW are provided in Section 5.1.8.

Surveying and Groundwater Potentiometric Surface Evaluation

A licensed surveyor will measure the locations and elevations of each new monitoring well and the four existing monitoring wells at the Site. During each sampling event, static groundwater measurements will be collected from each monitoring well using an electronic static water level meter or an oil/water interface meter. Static water-level measurements will also be obtained during other portions of the RI, such as during the slug testing activities described below. Groundwater elevations will be calculated for the two groundwater sampling events, and corresponding potentiometric groundwater contour maps will be prepared illustrating the approximate groundwater elevations and groundwater flow direction(s) for each water-bearing unit. The survey information and groundwater elevations will also be imported into the GIS database for the Site.

Physical Characterization

The hydraulic conductivity of the water-bearing units at the Site will be calculated using in-situ slug testing techniques from selected monitoring wells. Each slug test will be conducted by instantaneously changing the water level in a monitoring well by the introduction, and subsequent removal, of a non-reactive solid and sealed PVC pipe, “the slug”, and measuring the aquifer’s response to the changing water-level over time. Slug tests will be conducted by both inserting and removing the slug. Removal of the slug will be conducted only after the well has receded to 98% of the original water level. The slug test procedures are described in Bouwer, H., 1989. The Bouwer and Rice slug test--an update, Groundwater, vol. 27, no. 3, pp. 304-309 and the original Bouwer, H and R.C. Rice 1976 article in the Water Resources Research Journal. Slug test data will be imported to specialized software such as SuperSlug to calculate hydraulic conductivity, and if appropriate the transmissivity. The hydraulic conductivity data will also be used to evaluate the local groundwater velocity combined with potentiometric data gathered at the Site.

Slug tests will be conducted in three of the monitoring wells installed at the Site following completion of the first round of groundwater sampling. The location and water-bearing units of the slug tests will be determined based on an evaluation of the RI data obtained to date. Based on the extent of groundwater impacts to the overburden, the number of slug tests conducted in each water-bearing unit may change.

5.1.8 Investigation Derived Wastes Management and Disposal

It is anticipated that solid and liquid study-derived wastes will be generated during the RI. IDW will be managed in general accordance with the applicable provisions set forth of DER-10 Section 3.3(e). The anticipated proposed method for handling, characterization and disposal of IDW is described below.

Potentially contaminated liquid wastes will likely include: decontamination water, drilling water, well development water, and purge water. The handling of the contaminated liquids is further discussed below. Storage of liquid IDW will be generally collected in 55-gallon drums, which will be stored on the Site in a secure location. Liquids that are grossly contaminated or suspected to contain NAPL may be placed in separate drums and labeled accordingly. Management of liquid IDW following completion of the first round of groundwater sampling may be modified following review of the RI results. It is anticipated that liquid IDW will be discharged to the City of Olean sanitary sewer system under a sewer use permit. Obtaining a sewer use permit may require sampling the IDW for the parameters of concern. Sampling of IDW necessary to obtain a sewer use permit will be incorporated into the RI/RAA Report. A copy of the sewer use permit will be provided to the NYSDEC prior to any discharge to the sanitary sewer system. Drummed liquid IDW that is grossly contaminated or suspected to contain NAPL will also be characterized using the investigation test results and other sampling data as necessary to dispose or treat the material in accordance with the applicable rules and regulations.

Potentially contaminated solid wastes will likely include disposable sampling equipment and personal protective equipment (PPE), soil samples that were collected but not selected for analytical laboratory testing, and soil cuttings from rotary drilling operations that exhibit field evidence of potential impact. The handling of contaminated solid wastes is further discussed below. It is anticipated that the solid IDW will be placed in a 55-gallon drum. As an exception, solids that are grossly contaminated or suspected to contain NAPL may be placed in separate drums and labeled accordingly. The IDW solids will be characterized and disposed of off-site in accordance with the applicable rules and regulations. If based on a review of the RI results that re-use of the IDW is possible, the NYSDEC will be notified of the proposed re-use of IDW for approval prior to implementation.

5.1.9 Analytical Laboratory Quality Assurance/Quality Control

The QA/QC program to be implemented by Spectrum for this project is described in the QAPP.

A NYSDEC approved data validator (currently anticipated to be Environmental Data Validation, Inc., see QAPP) will independently prepare a Data Usability Summary Report (DUSR) in accordance with the provisions set forth in Appendix 2B of the DER-10. The findings of the DUSR(s) will be incorporated in analytical laboratory tables that will be included in the RI and other associated reports as applicable. Further information is provided in the QAPP.

5.2 Interim Remedial Measures

An IRM that involves the removal of one 10,000-gallon fiberglass UST and potentially petroleum-impacted soil located adjacent to the southern edge of the building at the Site will be completed in conjunction with the RI. The approximate location of the 10,000-gallon UST is depicted on Figure 2. The 10,000 gallon UST was installed in 1987 and previously contained fuel oil, but is currently out of service.

This IRM will be conducted in accordance with provisions outlined in Section 5.5 of DER-10 and with the NYDEC guidance document, *Permanent Closure of Petroleum Tanks dated January 20* 1987 and modified July 19, 1998 and December 3, 2003, and the City of Olean requirements. The IRM is intended to mitigate a possible source area in a timely manner prior to development of a remedy for the remainder of the Site. If a spill is discovered during the IRM work described below, the NYDEC will be notified via the Spill Hotline (1-800-457-7362) within two hours of discovery.

5.2.1 NYSDEC Notification and UST Preparation

The NYSDEC will be notified within 30 days prior to permanent closure of the UST and the required forms will be submitted to the PBS project manager. The City of Olean will also be notified, as required. A tank removal contractor will be retained to open the UST, remove residual fuel oil to the extent possible, drain and flush product supply and return piping, and subsequently pump out remaining liquids from the bottom of the tank. Liquids generated during the UST preparation will be containerized in 55-gallon drums or pumped directly into a vacuum truck for characterization, treatment, or disposal at a regulated facility.

5.2.1 Tank Excavation and Removal

The UST will be exposed using an excavator, and product and vent piping will be disconnected from the UST and removed. The piping will be inspected for evidence of holes, cracks, corrosion, etc. and photographed. A heavier than air inert gas such as nitrogen or dry ice will be introduced into the UST in order to displace petroleum vapors until such time as the concentration of flammable vapors are 10-20% of the Lower Explosive Limit (LEL) as indicated by CGI or an explosion meter.

Using an excavator, soil/fill material around the perimeter of the UST will be removed in sufficient quantity so at to allow the tank to be removed from the sub surface, and these soils will be observed by a technician for evidence of petroleum impact and screened with a PID. Soil that exhibits visible or olfactory evidence (i.e., staining, petroleum type odors, free product, etc.) of petroleum impact, or produces readings greater than 25 parts per million (ppm) in the ambient air when screened with a PID will be segregated and stockpiled on two layers of 8-mil thick poly sheeting. The impacted material will be covered with 8-mil thick poly sheeting subsequent to the completion of excavation activities associated with the tank removal.

The UST will be removed from the ground using an excavator, and inspected for evidence of holes, cracks, corrosion, etc. and photographed prior to being cut open for cleaning. Liquids generated during tank cleaning activities will be containerized in 55-gallon drums or pumped directly into a vacuum truck for characterization, treatment, or disposal at a regulated facility. Once residual solids and liquids have been removed from the UST interior and containerized, the tank will be loaded onto a flatbed truck and transported off the Site by a licensed waste transporter.

5.2.2 Subsurface Examination and Sampling

Based on the preliminary conceptual site model (refer to Section 4.1) the first water-bearing unit at the Site is anticipated to be between approximately 20 feet and 25 feet bgs. Therefore, it is not anticipated that groundwater will be encountered in the UST excavation.

Subsequent to the removal of the UST from the subsurface, fill/soil material that comprises the excavation floor and sidewalls will be examined for evidence of impact from petroleum (e.g., petroleum odor, staining, free product, etc.) Confirmatory sampling will be conducted in accordance with the procedures outlined in Section 3.11 of the QAPP included in Appendix B. Samples of fill/soil will be collected using the excavator bucket from the excavation floor and sidewalls along transects spaced approximately 5 feet apart and subsequently screened with a PID.

If no evidence of impact is observed in the samples collected from the excavation, or if readings do not exceed 25 ppm in the ambient air above the fill/soil samples when screened with a PID, discrete center line confirmatory soil/fill samples will be collected from the bottom of the excavation at a frequency of 1 sample for every 5 linear feet of tank. It is anticipated that the total length of the UST will be between 15 and 30 feet, resulting in 3 to 6 bottom samples, respectively. Each sample will be submitted to Spectrum and tested for NYSDEC CP-51 List VOCs using USEPA Method 8260 and NYSDEC CP-51 List SVOCs using USEPA Method 8270.

If evidence of petroleum impact to fill/soil material is observed in the fill/soil sample collected, of if readings exceed 25 ppm in the ambient air above the fill/soil samples when screened with a PID, further excavation will be conducted until the impacted material has been removed, or excavation is no longer feasible (e.g. further excavation would undermine the building foundation or expose buried utilities). Impacted fill/soil will be stockpiled on two layers of 8-mil thick poly sheeting. The impacted material will be covered with 8-mil thick poly sheeting subsequent to the completion of excavation activates associated with the tank removal. Confirmatory soil samples will be collected at a frequency of four (4) sidewall samples and one (1) bottom sample for each fifteen (15) linear ft. of trench and biased towards locations suspected of greatest residual petroleum impact. Each sample will be tested for NYSDEC CP-51 List VOCs using USEPA Method 8260 and NYSDEC CP-51 List SVOCs using USEPA Method 8270.

5.2.3 Backfill and Disposal

Upon completion of excavation activities, fill/soil that does not exhibit evidence of petroleum impact or produce readings greater than 25 parts per million (ppm) in the ambient air when screened with a PID will be used to backfill the UST excavation. The remainder of the excavation will be backfilled with imported aggregate material obtained from a DOT approved source.

Samples of the impacted fill/soil stockpiled at the Site (if any) will be tested for waste characterization, loaded into NYCRR Part 360 Permitted trucks and transported to a regulated landfill for disposal.

5.2.4 IRM Reporting

Within four weeks of completion of the IRM activities described above and the receipt of analytical laboratory test results, an IRM report will be submitted to the NYSDEC that describes the actions completed as part of the IRM and includes pertinent information including field observations/measurements; copies of representative photographs; a diagram depicting the approximate UST orientation in the resulting excavation and the approximate locations of confirmatory samples; disposal documentation for the UST and cleaning fluids; summary tables comparing test results to applicable regulatory limits; and a summary of the findings/conclusions of the work performed.

5.2.5 Additional Interim Remedial Measures

Based on the findings of the work described in Section 5.1, additional IRMs work may be identified. Additional IRMs, if approved by the NYSDEC, will be conducted in accordance with IRM Work Plans that will be separate and stand-alone documents. The IRM results may be used to modify the preliminary conceptual site model and the RI investigation depending on the timing and findings of the IRM.

6.0 REMEDIAL INVESTIGATION/REMEDIAL ALTERNATIVES ANALYSIS REPORT

The RI/RAA report will be prepared in accordance with provisions set forth in DER-10. The RI/RAA report will present the findings and outcome of the RI, the results of the IRM(s) completed, and an analysis and recommendation of remedial alternatives. An executive summary will be included in the RI/RAA report.

The RI portion of the report will include, but is not limited to, the following components:

- Technical overview and details on the investigative work performed;
- A description of the physical characteristics of the Site, including soil/fill types, hydrogeological characteristics, proximity to a drinking water aquifer, absence of surface water, floodplains, and wetlands for this specific Site, etc.;
- Identification of the nature and extent of contamination, including identification of known or suspected sources of contamination;
- A discussion on contaminant fate and transport, including potential routes of migration, contaminant persistence, and documented contaminant migration as well factors that affect contaminant migration;
- A qualitative human health exposure assessment, and completion of a Fish and Wildlife Resources Impact Analysis (FWRIA) Decision Key;
- A Summary and Conclusions section, including identification of data limitations or recommendations for future work;
- Identifications of recommended RAOs;
- Appropriate figures including a project locus map, site plan depicting Site features, sample location figures and results of various testing (e.g., geophysical survey results, contaminants of concern (if any) detected in soil, groundwater or other media, including isopleth maps), overburden potentiometric groundwater contour maps, extent of NAPL if appropriate, etc.;
- Stratigraphic cross-sections prepared using information and data obtained during the investigation;
- Identification of SCG values that pertain to the Site;
- Data tables including: a table(s) providing specifics on each sample tested (e.g., sample designation, location, date, depth interval, test parameters, UTM NAD 83 coordinates), summary tables comparing detected constituents to appropriate regulatory SCG values; a table summarizing the nature and extent of constituents detected at the Site; and tables for other various investigation-related data or information). The analytical laboratory results for soil samples tested will be compared to appropriate NYSDEC Part 375 SCOs. The analytical laboratory results for groundwater samples will be compared to NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 groundwater standards and guidance values;
- Analytical laboratory reports and associated QA/QC evaluation (e.g., DUSRs);

- Field logs and data, including test boring logs, and well construction diagrams, well development logs, well sampling logs, hydraulic conductivity testing data, PID readings from soil screening and CAMP monitoring;
- Photographs;
- Conclusions and recommendations regarding the extent of the areas of concern, identification of any unacceptable exposure pathways, and recommendations of future work (e.g. none, additional investigation, or an evaluation of remedial alternatives);
- An updated conceptual site model; and
- Other information as deemed appropriate.

To the extent required by the NYSDEC at the time of report submission, analytical laboratory data generated as part of the RI will be submitted to the NYSDEC in the appropriate EDD format.

The RAA portion of the report will discuss potential remediation options for addressing impacts documented in the RI portion of the report. A detailed evaluation will be conducted for each remedial alternative taking into consideration factors identified in DER-10. Evaluation criteria include, but are not limited to:

- Overall protection of human health and the environment, including potential exposures;
- Compliance with SCG values;
- Long-term effectiveness and permanence;
- Short-term effectiveness;
- Reduction of toxicity, mobility and/or volume;
- Implementability;
- Current use and reasonably anticipated future use of the Site;
- Community acceptance, and
- Cost.

The RAA will identify general response actions including an estimate of the volumes/areas of contaminated media. General response actions include categories such as treatment, containment, excavation, extraction, disposal, institutional controls, engineering controls, or various combinations. Cumulative data will be used as the project progresses to modify general response actions as deemed appropriate. Where presumptive remedies are available to address an area of contaminated media, they will be strongly considered; however, innovative technologies will also be considered. Applicable general response actions will be developed on a medium-specific basis, similar to the development of RAOs. For each medium addressed, the volumes or areas to be remediated will be identified and characterized with respect to requirements for protectiveness, taking into account the chemical and physical characterization. During this step, technologies that are not suitable for the Site will be eliminated from further consideration.

Technology types for each general response action associated with an impacted media will be screened for appropriateness. Technology types may include chemical treatment, enhanced biodegradation, capping, thermal destruction, dewatering, etc. The technologies that appear feasible and capable of meeting the Standards, Criteria and Guidance goals will be used in development of remedial alternatives for the Site. The technologies will then be assembled into media-specific or site-wide remedial alternatives. The following components of each alternative will be discussed: size and configuration of processes; anticipated remediation duration; spatial requirements; disposal options; permit requirements; and beneficial or adverse impacts on fish and wildlife.

A no-action alternative and a pre-disposal alternative will also be developed and evaluated for the Site. Other alternatives will be developed that take into consideration: current use and anticipated future use of the Site, additional removal of source areas beyond that already addressed by the IRMs; and contaminant containment. The remedial alternatives will then be compared to the evaluation criteria and a comparative analysis will be completed. Based on the remedial alternative analysis, a remedial alternative for the Site will be recommended, which will include a discussion on the reasons for selection. The criteria of community acceptance will be evaluated upon completion of the public comment period.

The RI/RAA Report will be submitted to the NYSDEC for their review and comment. Following review and comment from the NYSDEC, the RI/RAA Report will be finalized, stamped and signed by a currently-registered New York State licensed Professional Engineer (P.E.) prior to approval by the NYSDEC. Based on the findings of the RI/RAA Report, the NYSDEC will prepare a Proposed Remedial Action Plan (PRAP) summarizing the proposed remedy for the Site. The final RI/RAA Report will include an electronic copy in the appropriate PDF format required by the NYSDEC.

7.0 REPORTING SCHEDULE

The RI will proceed immediately following NYSDEC approval of this Work Plan. A detailed schedule for each phase of the RI/RAA project is included as Appendix D.

8.0 ACRONYMS

ASP	Analytical Services Protocol
BCP	Brownfield Cleanup Program
bgs	Below the Ground Surface
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Plan
DAY	Day Environmental, Inc.
DO	Dissolved Oxygen
DNAPL	Dense Non-Aqueous Phase Liquid
DUSR	Data Usability Summary Report
ECP	Emergency Contingency Plan
EDD	Electronic Data Deliverable
EDV	Environmental Data Validation, Inc.
ELAP	Environmental Laboratory Approval Program
EM	Electromagnetic
ERM	Environmental Resources Management
FWRIA	Fish and Wildlife Resources Impact Analysis
GIS	Geographic Information System
GPS	Global Positioning System
HASP	Health And Safety Plan
HSA	Hollow Stem Augers
IDW	Investigation Derived Waste
IRM	Interim Remedial Measure
mg/kg	Milligram per Kilogram, or parts per million
LNAPL	Light Non-Aqueous Phase Liquid
NAPL	Non-Aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOS	New York State Department of State
NYSDOT	New York State Department of Transportation
OSHA	Occupational Health and Safety Administration
ORP	Oxidation Reduction Potential
PCBs	Polychlorinated Biphenyls
PDF	Portable Document Format
P.E.	Professional Engineer
Phase I ESA	Phase I Environmental Site Assessment
Phase II ESA	Phase II Environmental Site Assessment
PID	Photoionization Detector
PPB	Parts Per Billion
PPE	Personal Protective Equipment
PPM	Parts Per Million
PRAP	Proposed Remedial Action Plan
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective

ACRONYMS (continued)

RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
RI/RAA	Remedial Investigation/Remedial Alternatives Analysis
ROW	Right of Way
SCG	Standard, Criteria and Guidance
SCL	Soil Cleanup Levels
SCO	Soil Cleanup Objective
SOP	Standard Operating Procedure
Spectrum	Spectrum Analytical, Inc.
SPT	Standard Penetration Test
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TIC	Tentatively Identified Compound
TOC	Total Organic Carbon
TOGs	Technical and Operational Guidance Series
TPH	Total Petroleum Hydrocarbons
Ug/l	Microgram per Liter
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WQS/GV	Water Quality Standards and Guidance Values

TABLE

Table 1

211 Franklin Street
Olean, New York
RI/RAA Work Plan

Summary of Proposed Remedial Investigation Test Locations

Test Designation	Test Type	Rationale for Sample Locations
SV-01	Soil Vapor	Screening level soil vapor sample below flammable storage area/former boiler room as depicted in a Sanborn Map dated 1932
SV-02	Soil Vapor	Screening level soil vapor sample below the main office area, in the vicinity of a sanitary sewer line
SV-03	Soil Vapor	Screening level soil vapor sample below the main office area, in the vicinity of a storm sewer line
SV-04	Soil Vapor	Screening level soil vapor sample below the cafeteria, in the vicinity of a sanitary sewer line
SV-05	Soil Vapor	Screening level soil vapor sample below the Quality Control Lab, in the vicinity of multiple utility lines
SV-06	Soil Vapor	Screening level soil vapor sample near building edge, in the vicinity of multiple utility lines
SV-07	Soil Vapor	Screening level soil vapor sample below a production area, in the vicinity of multiple utility lines
SV-08	Soil Vapor	Screening level soil vapor sample near building edge, for site-wide coverage
SV-09	Soil Vapor	Screening level soil vapor sample below a production area, in the vicinity of multiple utility lines
SV-10	Soil Vapor	Screening level soil vapor sample below a production area, in the vicinity of multiple utility lines
SV-11	Soil Vapor	Screening level soil vapor sample below a production area, in the vicinity of multiple utility lines
SV-12	Soil Vapor	Screening level soil vapor sample below a production area, in the vicinity of a storm sewer line
SV-13	Soil Vapor	Screening level soil vapor sample below a production area, in the vicinity of the former plating area as depicted in the Daystrom facility plan dated 1943
SV-14	Soil Vapor	Screening level soil vapor sample below the mezzanine area, in the vicinity of the former spray painting area as depicted in the Daystrom facility plan dated 1943
SV-15	Soil Vapor	Screening level soil vapor sample below the shipping area, for site-wide coverage
SV-16	Soil Vapor	Screening level soil vapor sample below the maintenance department area, in the vicinity of a storm sewer line
SV-17	Soil Vapor	Screening level soil vapor sample below former polishing areas depicted in the Daystrom facility plan dated 1943, in the vicinity of multiple utility lines
SV-18	Soil Vapor	Screening level soil vapor sample below former solvent waste areas as depicted in the 1997 RCRA inspection figure, in the vicinity of a sanitary sewer line
SV-19	Soil Vapor	Screening level soil vapor sample below the warehouse area, in the vicinity of multiple utility lines
SV-20	Soil Vapor	Screening level soil vapor sample below the pilot plant area, for site-wide coverage
TB-101	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former boiler room as depicted in a Sanborn Map dated 1932 and a former gasoline tank as depicted in a Sanborn Map dated 1949 and to collect a sample to characterize surface soil/fill at the Site
TB-102	Test Boring	Observe subsurface conditions and collect soil/fill samples from the area of the former 'off-spec' storage tank as depicted in the 1997 RCRA inspection figure
TB-103	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former acid bottling area as depicted in a Sanborn Map dated 1886, 1894
TB-104	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former paint/lacquer storage area as depicted in the Daystrom facility plan dated 1943
TB-105	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former coal/coke storage building area as depicted in Sanborn Maps dated 1886, 1894 and assess impact from adjacent BCP site to the west
TB-106	Test Boring	Observe subsurface conditions and collect soil/fill samples from the unpaved driveway below the current loading dock and to collect a sample to characterize surface soil/fill at Site
TB-107	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former paint drying area as depicted in the Daystrom facility plan dated 1943
TB-108	Test Boring	Observe subsurface conditions and collect soil/fill samples adjacent to the current maintenance department, BCP Site, and railroad, and to collect a sample to characterize surface soil/fill at the Site
TB-109	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former spray painting area as depicted in the Daystrom facility plan dated 1943
TB-110	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former acid tank and oil house area as depicted in Sanborn Maps dated 1886, 1894
TB-111	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former plating area as depicted in the Daystrom facility plan dated 1943
TB-112	Test Boring	Observe subsurface conditions and collect soil/fill samples from the railroad spur line footprint as depicted in Sanborn Map dated 1894 and impacts from former street ROW
TB-113	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former polishing area as depicted in the Daystrom facility plan dated 1943
TB-114	Test Boring	Observe subsurface conditions and collect soil/fill samples from the unpaved driveway below the current loading dock and to collect a sample to characterize surface soil/fill at the Site
TB-115	Test Boring	Observe subsurface conditions and collect soil/fill samples from the unpaved driveway below the current loading dock and assess impact from adjacent BCP site to the west

Table 1

211 Franklin Street
Olean, New York
RI/RAA Work Plan

Summary of Proposed Remedial Investigation Test Locations

TB-116	Test Boring	Observe subsurface conditions and collect soil/fill samples from the area of the former solvent reclamation unit as depicted in the 1997 RCRA inspection figure
TB-117	Test Boring	Observe subsurface conditions and collect soil/fill samples from the area of the former solvent distillation unit as depicted in the 1997 RCRA inspection figure
TB-118	Test Boring	Observe subsurface conditions and collect soil/fill samples from the former 10,000-gallon tank area as depicted in the Daystrom facility plan dated 1943
TB-119	Test Boring	Observe subsurface conditions and collect soil/fill samples from the area of the former resin underground storage tanks as depicted in the 1997 RCRA inspection figure
TB-120	Test Boring	Observe subsurface conditions and collect soil/fill samples from the unpaved driveway below the current loading dock and to collect a sample to characterize surface soil/fill at the Site
TB-121	Test Boring	Observe subsurface conditions and collect soil/fill samples from the railroad spur line footprint as depicted in Sanborn Map dated 1932
TB-122	Test Boring	Observe subsurface conditions and collect soil/fill samples for Site coverage
TB-123	Test Boring	Observe subsurface conditions and collect soil/fill samples for Site coverage
TB-124	Test Boring	Observe subsurface conditions and collect soil/fill samples for Site coverage
TB-125	Test Boring	Observe subsurface conditions and collect soil/fill samples for Site coverage
MW-F	Monitoring Well	Observe saturated soil conditions and overburden groundwater conditions on the presumed hydraulic up gradient edge of the Site, soil/fill conditions from the unpaved driveway below the current loading dock, and delineate petroleum impacted groundwater plume identified in Phase II ESA
MW-G	Monitoring Well	Observe saturated soil conditions and overburden groundwater conditions and delineate petroleum impacted groundwater plume identified in Phase II ESA
MW-H	Monitoring Well	Observe saturated soil conditions and overburden groundwater conditions in painting area in depicted in 1932 Sanborn Map, plating area depicted in the Daystrom facility plan dated 1943, and delineate petroleum impacted groundwater plume identified in Phase II ESA
MW-I	Monitoring Well	Observe saturated soil conditions and overburden groundwater conditions and delineate petroleum impacted groundwater plume identified in Phase II ESA
MW-J	Monitoring Well	Observe saturated soil conditions and overburden groundwater conditions in the area of former waste solvent area as depicted in the 1997 RCRA inspection figure, delineate petroleum impacted groundwater plume identified in Phase II ESA, and to collect a sample to characterize surface soil/fill at the Site
MW-K	Monitoring Well	Observe saturated soil conditions and overburden groundwater conditions on the presumed hydraulic up gradient edge of the Site
MW-L	Monitoring Well	Observe saturated soil conditions and overburden groundwater conditions on the presumed hydraulic down gradient edge of the Site
MW-M	Monitoring Well	Observe saturated soil conditions and overburden groundwater conditions on the presumed hydraulic up gradient edge of the Site and to collect a sample to characterize surface soil/fill at the Site

Note: Depending on conditions encountered at the Site at the time of drilling, select test borings may be converted to monitoring wells.

FIGURES

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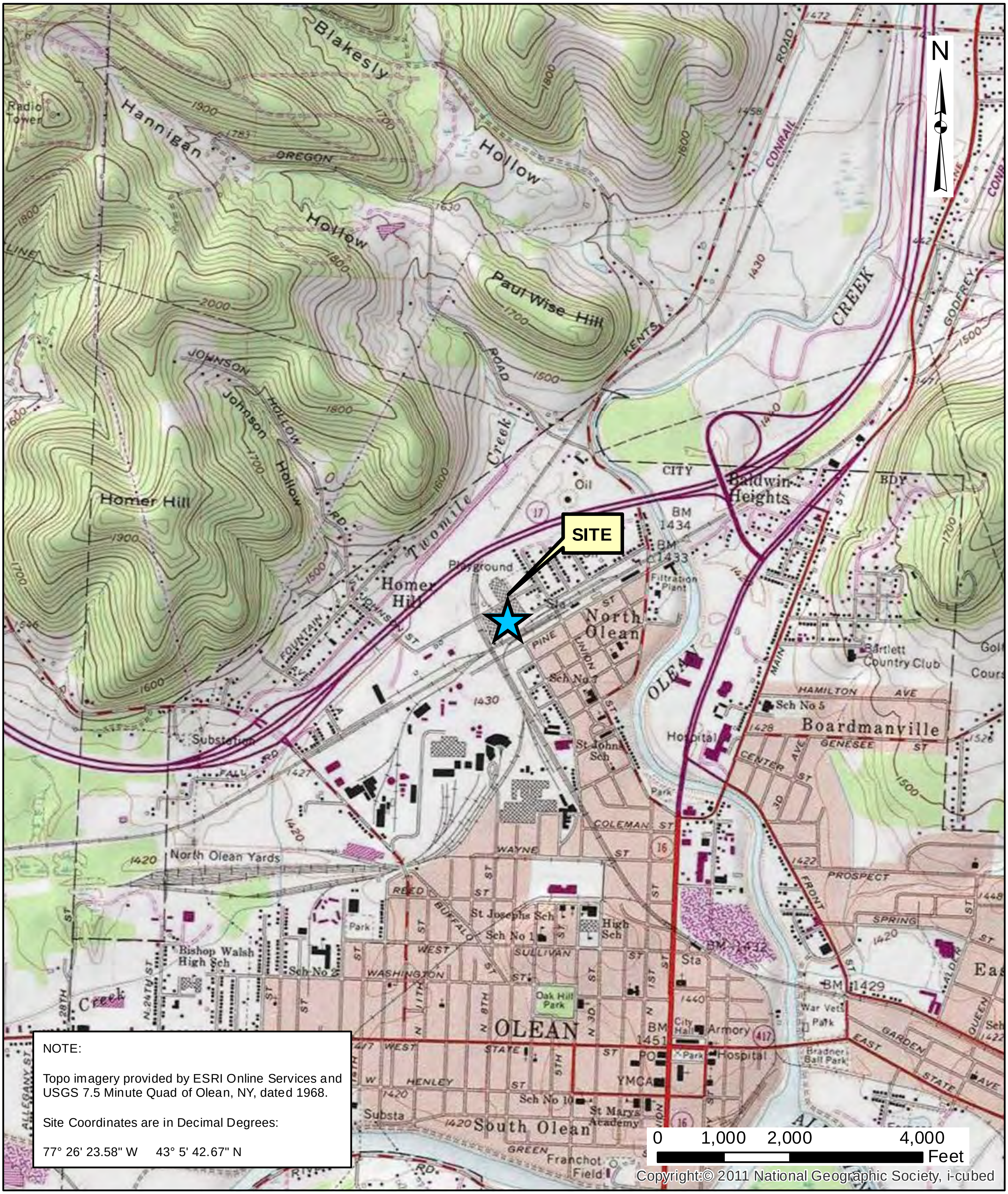


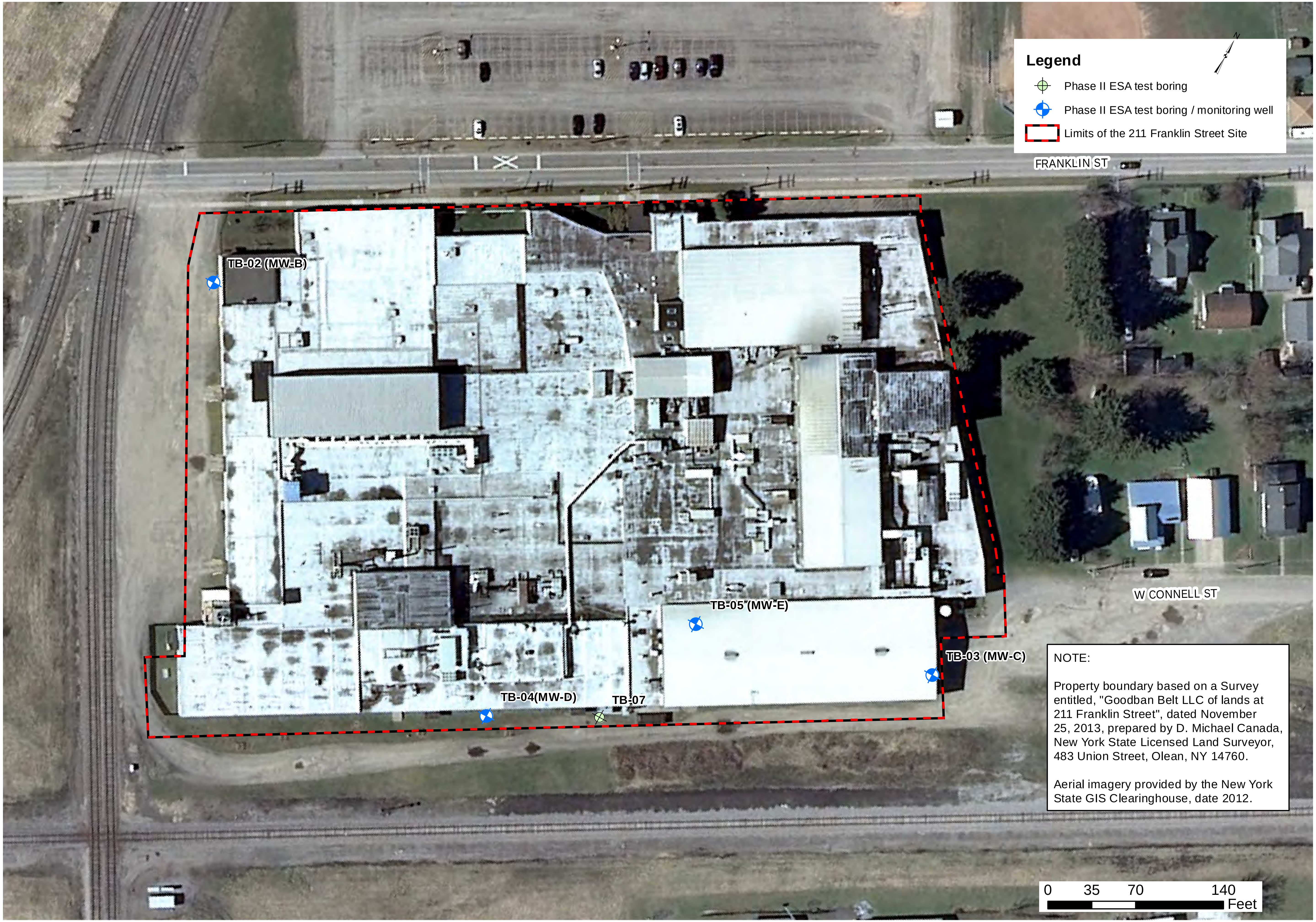
NOTE:

Topo imagery provided by ESRI Online Services and USGS 7.5 Minute Quad of Olean, NY, dated 1968.

Site Coordinates are in Decimal Degrees:

77° 26' 23.58" W 43° 5' 42.67" N

Date 11-5-2013	day **DAY ENVIRONMENTAL, INC.** **Environmental Consultants** **Rochester, New York 14606** **New York, New York 10170**	Project Title 211 FRANKLIN STREET OLEAN, NEW YORK RI/RAA WORK PLAN	Project No. 4884S-13 FIGURE 1
Drawn By CAH		Drawing Title Project Locus Map	
Scale AS NOTED			



Legend

- ⌖ Phase II ESA test boring
- ● Phase II ESA test boring / monitoring well
- 🟥 Limits of the 211 Franklin Street Site

NOTE:

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

DATE	11-2013
DATE DRAWN	11-2013
DATE ISSUED	11-26-2013
DESIGNED BY	RLK
DRAWN BY	CPS
SCALE	AS NOTED

day ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

RI/RAA WORK PLAN

Drawing Title
Site Plan with Preliminary Phase II ESA Test Locations

Project No.
4884S-13

FIGURE 2

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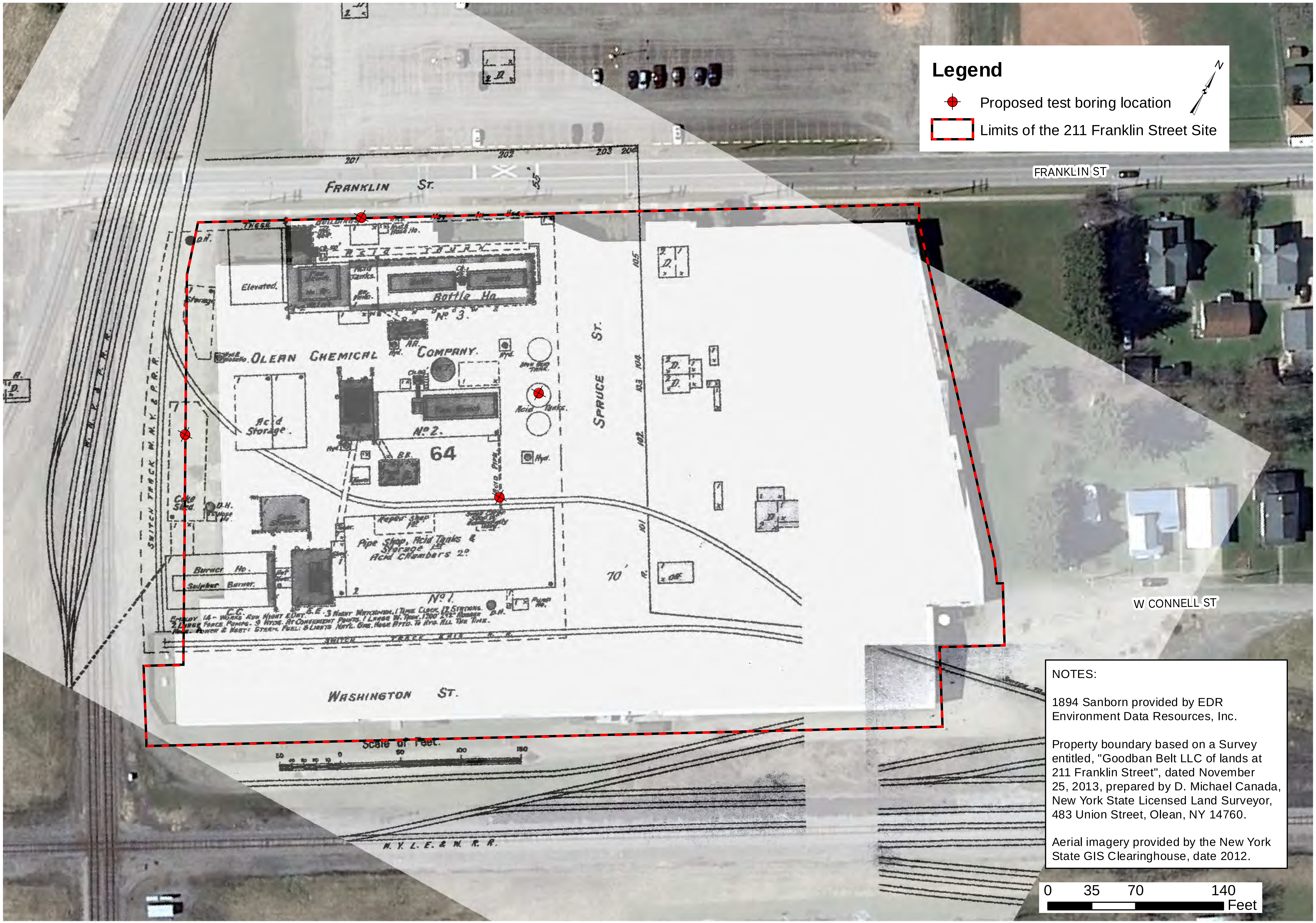

Legend

● Proposed test boring location

🟥 Limits of the 211 Franklin Street Site

NOTES:

1894 Sanborn provided by EDR Environment Data Resources, Inc.

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

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DATE 11-2013
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DATE DRAWN 11-2013
SCALE AS NOTED
DATE ISSUED 11-26-2013

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

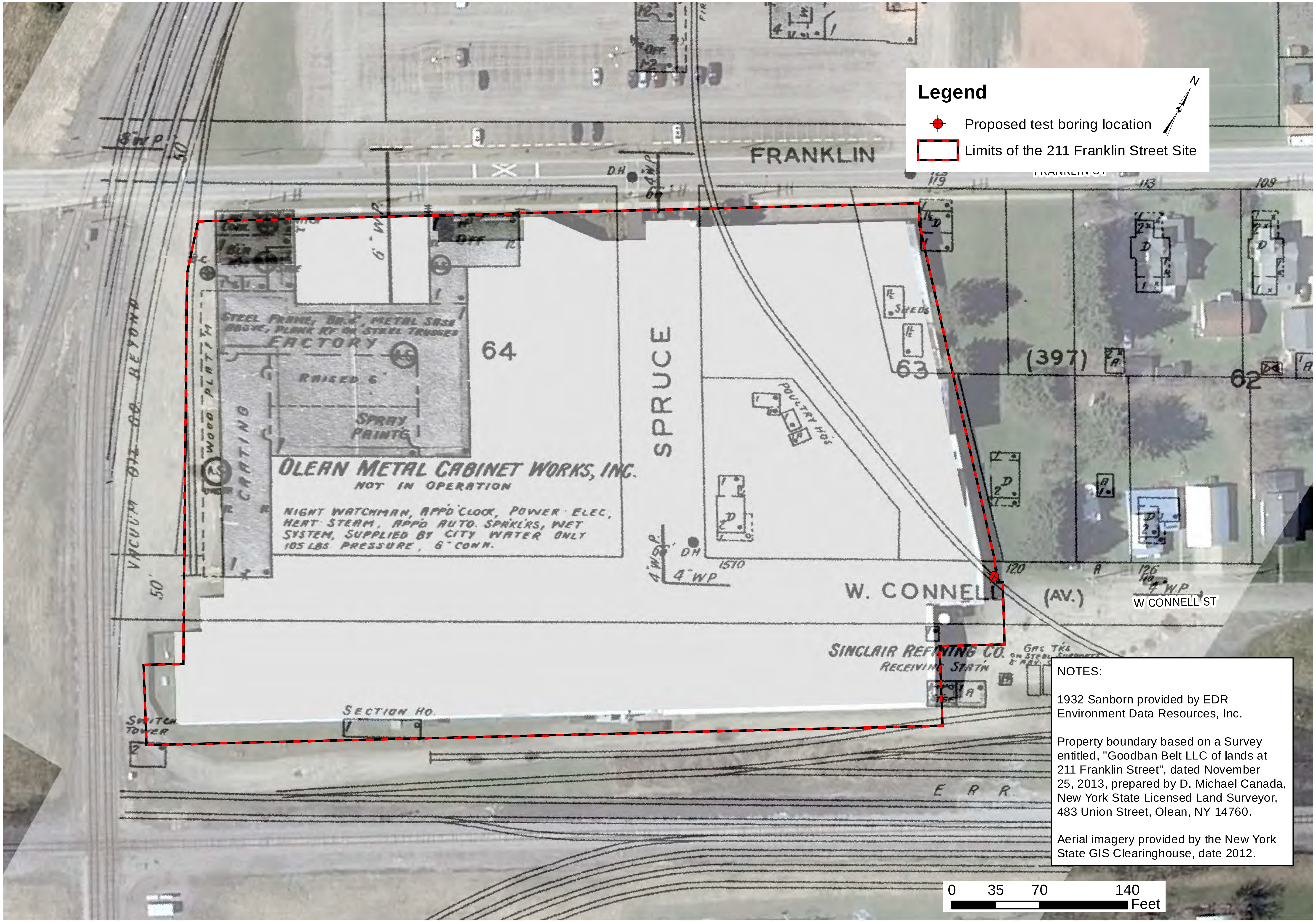
RI/RAA WORK PLAN

Drawing Title
Site Plan showing the Approximate Locations of Former Buildings, Former Railroad Spur Lines, and Former Street ROWs in 1894 (Olean Chemical Co.)

Project No.
4884S-13

FIGURE 3

Last Date Saved: 02 Dec 2013 Document Path: \\Smelt-win7pc\GIS\GIS Mapping\4884S-13Solepo\211Franklin\4884S - 16 - 1897Sanborn.mxd



Legend

🟥 Proposed test boring location

▭ Limits of the 211 Franklin Street Site

N

NOTES:

1932 Sanborn provided by EDR Environment Data Resources, Inc.

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

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DESIGNED BY RLK	DATE 11-2013
DRAWN BY CPS	DATE DRAWN 11-2013
SCALE AS NOTED	DATE ISSUED 11-26-2013

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

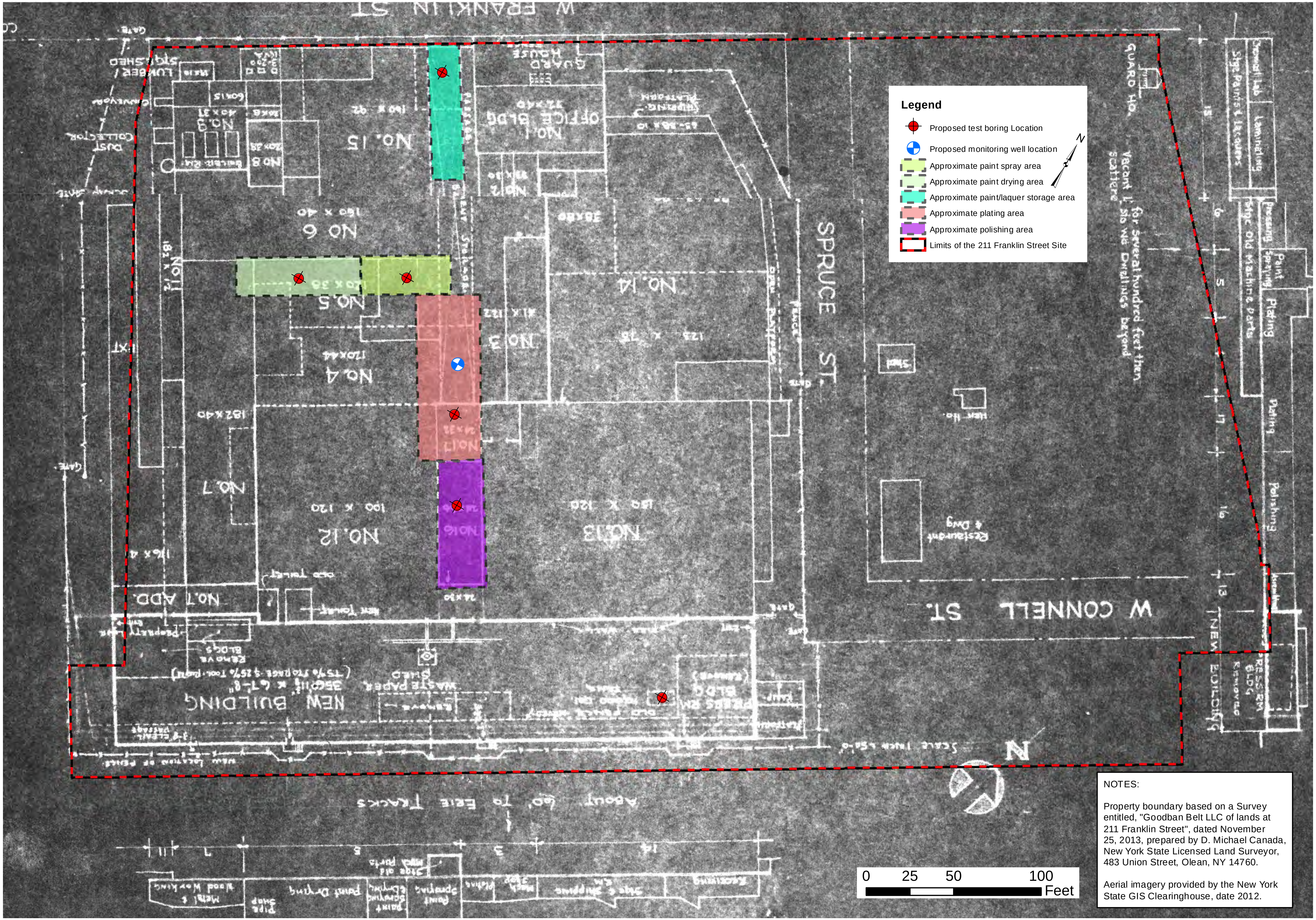
RI/RAA WORK PLAN

Drawing Title
Site Plan showing the Approximate Building Footprint, Former Railroad Spur Lines, and Former Street ROWs in 1932 (Olean Metal Cabinet)

Project No.
4884S-13

FIGURE 4

Last Date Saved: 02 Dec 2013   Document Path: \\Smelt-win7pc\GIS\GIS Mapping\4884S-13Sdepo\211Franklin\4884S - 17 - 1932Sanborn.mxd



NOTES:

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

DESIGNED BY	DATE
RLK	11-2013
DRAWN BY	DATE DRAWN
CPS	11-2013
SCALE	DATE ISSUED
AS NOTED	11-26-2013

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

RI/RAA WORK PLAN

Drawing Title
Site Plan showing the Approximate Building Footprint and Former Facility Layout in 1943 (Daystrom Corp.)

Project No.
4884S-13

FIGURE 5

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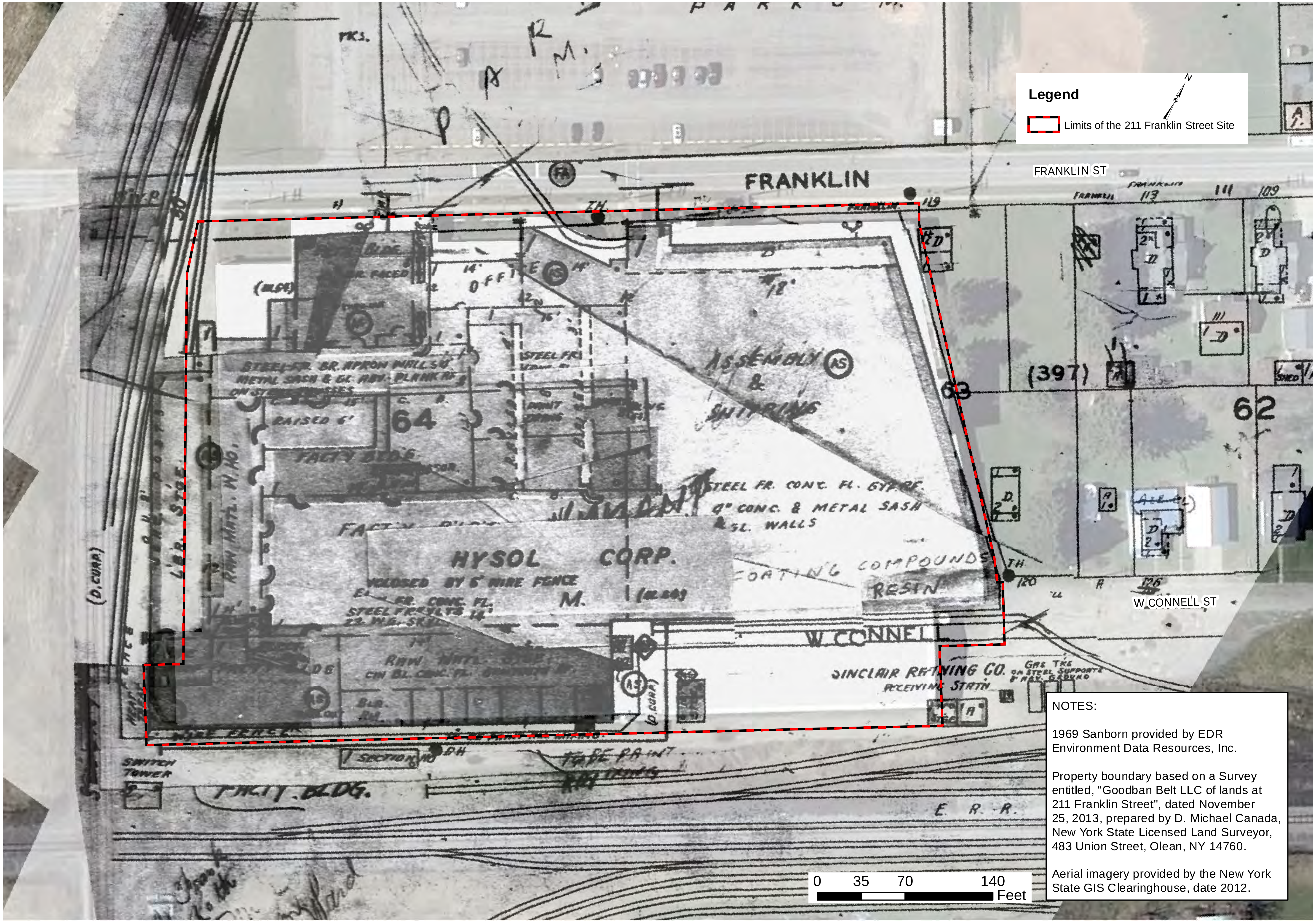

Legend

🟥 Limits of the 211 Franklin Street Site

NOTES:

1969 Sanborn provided by EDR Environment Data Resources, Inc.

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

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RLK	11-2013
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CPS	11-2013
SCALE	DATE ISSUED
AS NOTED	11-26-2013

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

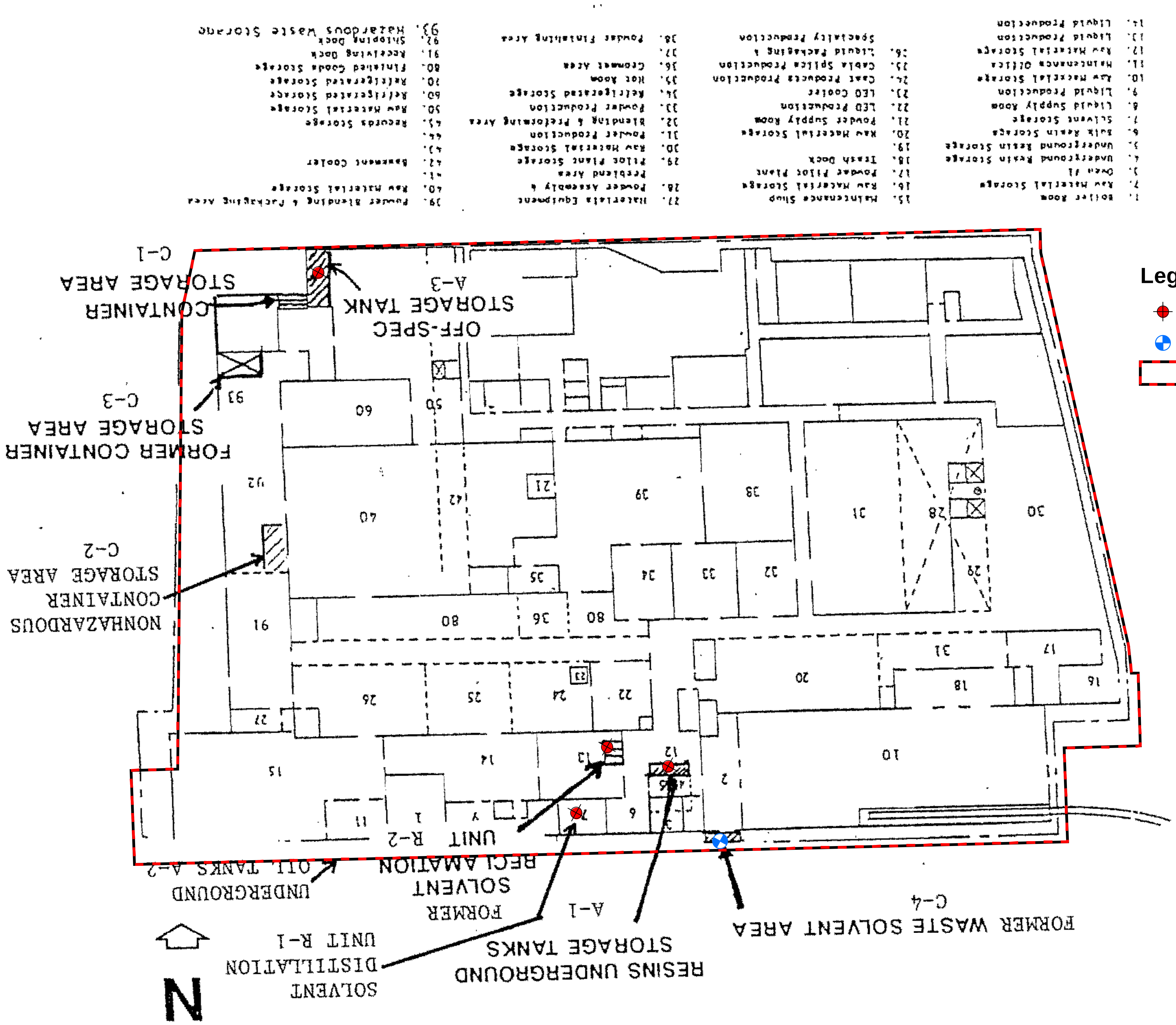
Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

RI/RAA WORK PLAN

Drawing Title
Site Plan showing the Approximate Building Footprint and, Former Railroad Spur Lines in 1969 (Hysol Corp.)

Project No.
4884S-13

FIGURE 6



Legend

- ⊕ Proposed test boring location
- ◕ Proposed monitoring well location
- ▭ Limits of the 211 Franklin Street Site

NOTES:

NYSDEC Facility Assesment Report completed by Dexter Electronic Materials Division, dated November 10, 1997

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

DATE 11-2013
DESIGNED BY RLK
DATE DRAWN 11-2013
DRAWN BY CPS
DATE ISSUED 11-26-2013
SCALE AS NOTED

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

RI/RAA WORK PLAN

Drawing Title
Site Plan showing the Former Facility Layout and Former SolidWaste ManagementUnits identified as part of a 1997 RCRA Facility Assessment.

Project No.
4884S-13

FIGURE 7

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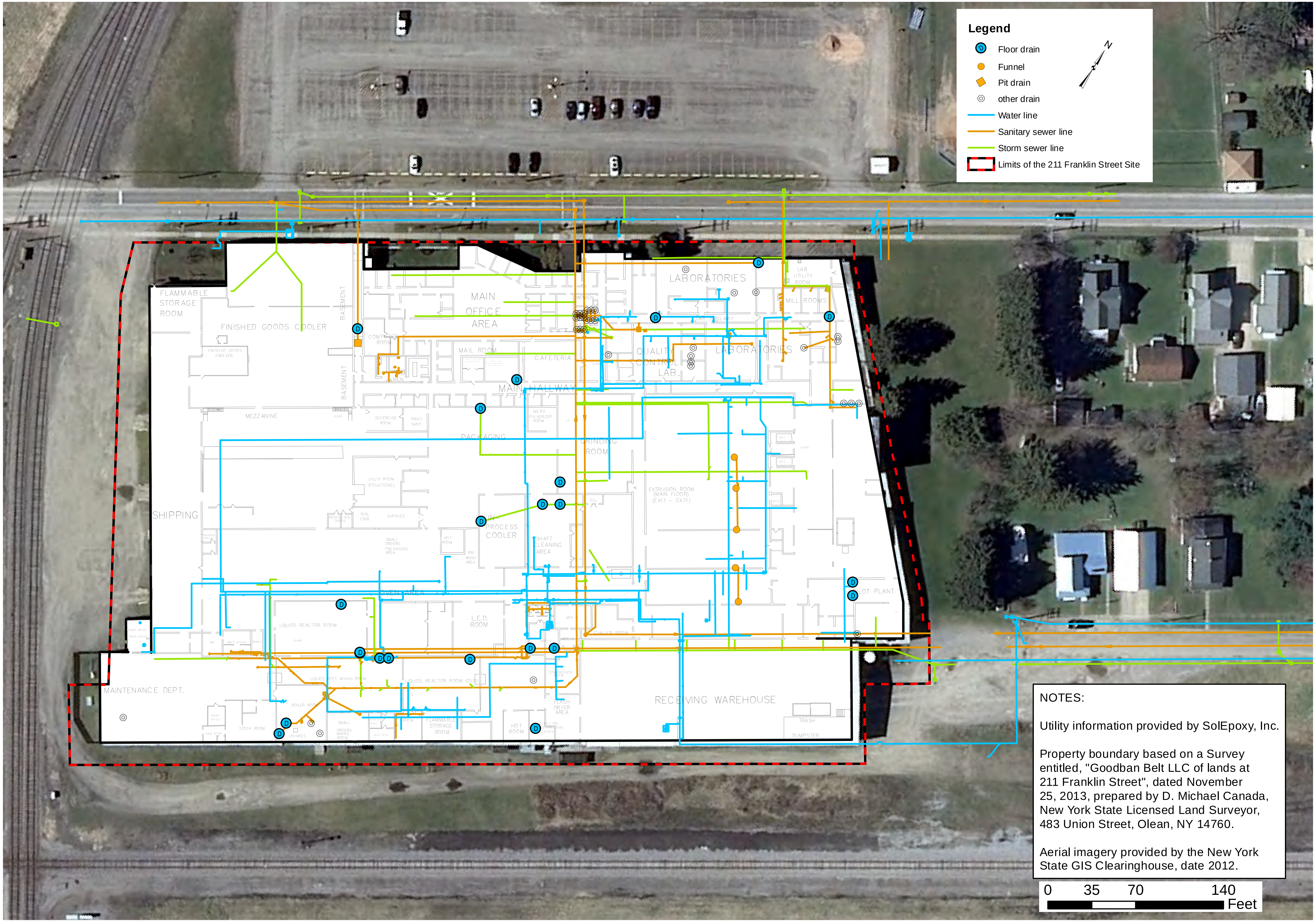
Last Date Saved: 02 Dec 2013



NOTES:

Utility information provided by SolEpoxy, Inc.

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

DATE	11-2013
DESIGNED BY	RLK
DATE DRAWN	11-2013
DRAWN BY	CPS
DATE ISSUED	11-26-2013
SCALE	AS NOTED

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

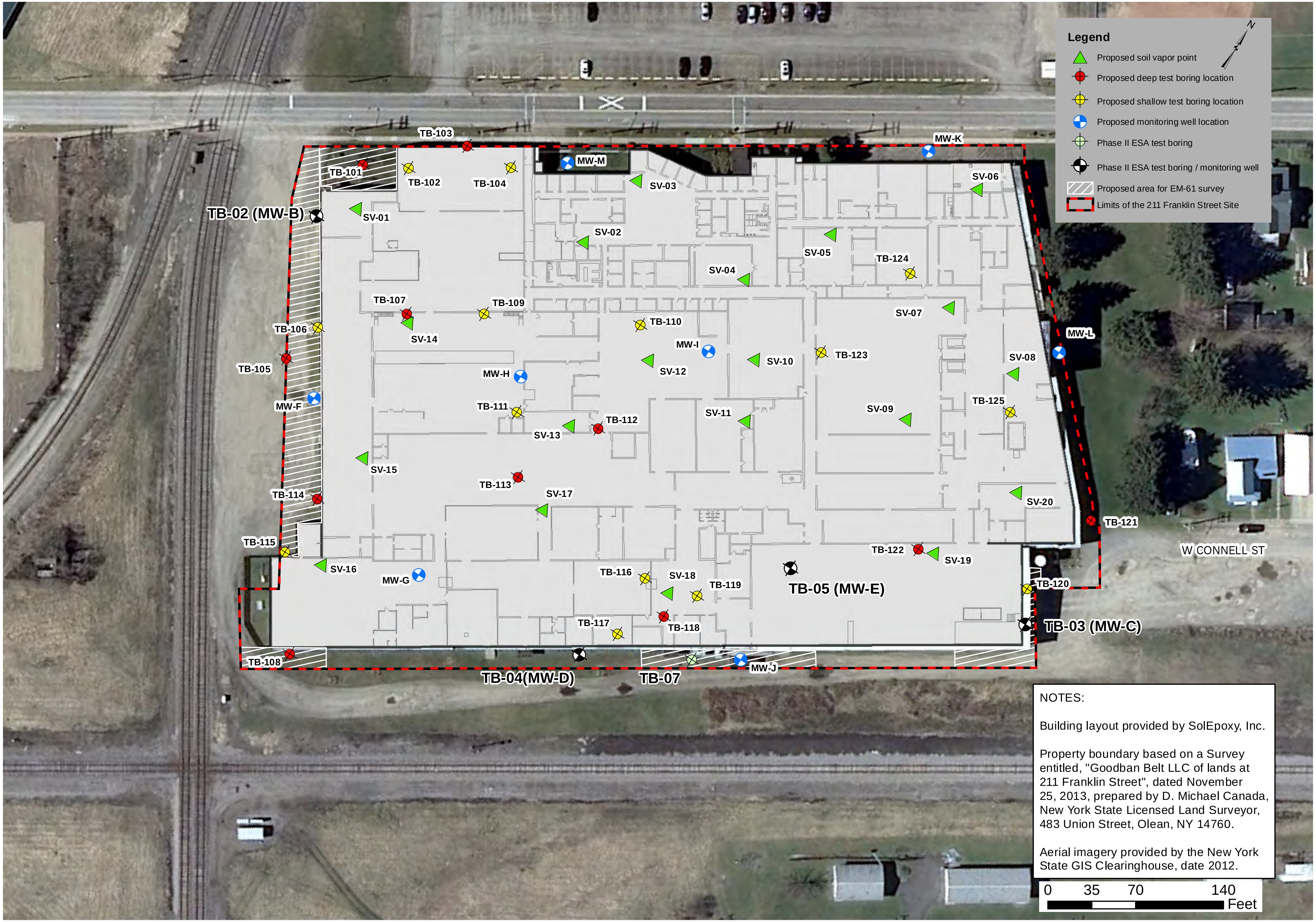
RI/RAA WORK PLAN

Drawing Title
Site Plan showing the Approximate Current Locations of Drains and Select Underground Utilities

Project No.
4884S-13

FIGURE 8

Last Date Saved: 02 Dec 2013 Document Path: \\Smelt-win7pc\GIS\GIS Mapping\4884S-13Solepo\211Franklin\4884S - 21 - Utilities.mxd



Legend

- ▲ Proposed soil vapor point
- ● Proposed deep test boring location
- ● Proposed shallow test boring location
- ● Proposed monitoring well location
- ⊕ Phase II ESA test boring
- ⊕ Phase II ESA test boring / monitoring well
- ▨ Proposed area for EM-61 survey
- ▭ Limits of the 211 Franklin Street Site

NOTES:

Building layout provided by SolEpoxy, Inc.

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

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SCALE AS NOTED	DATE ISSUED 11-26-2013

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Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

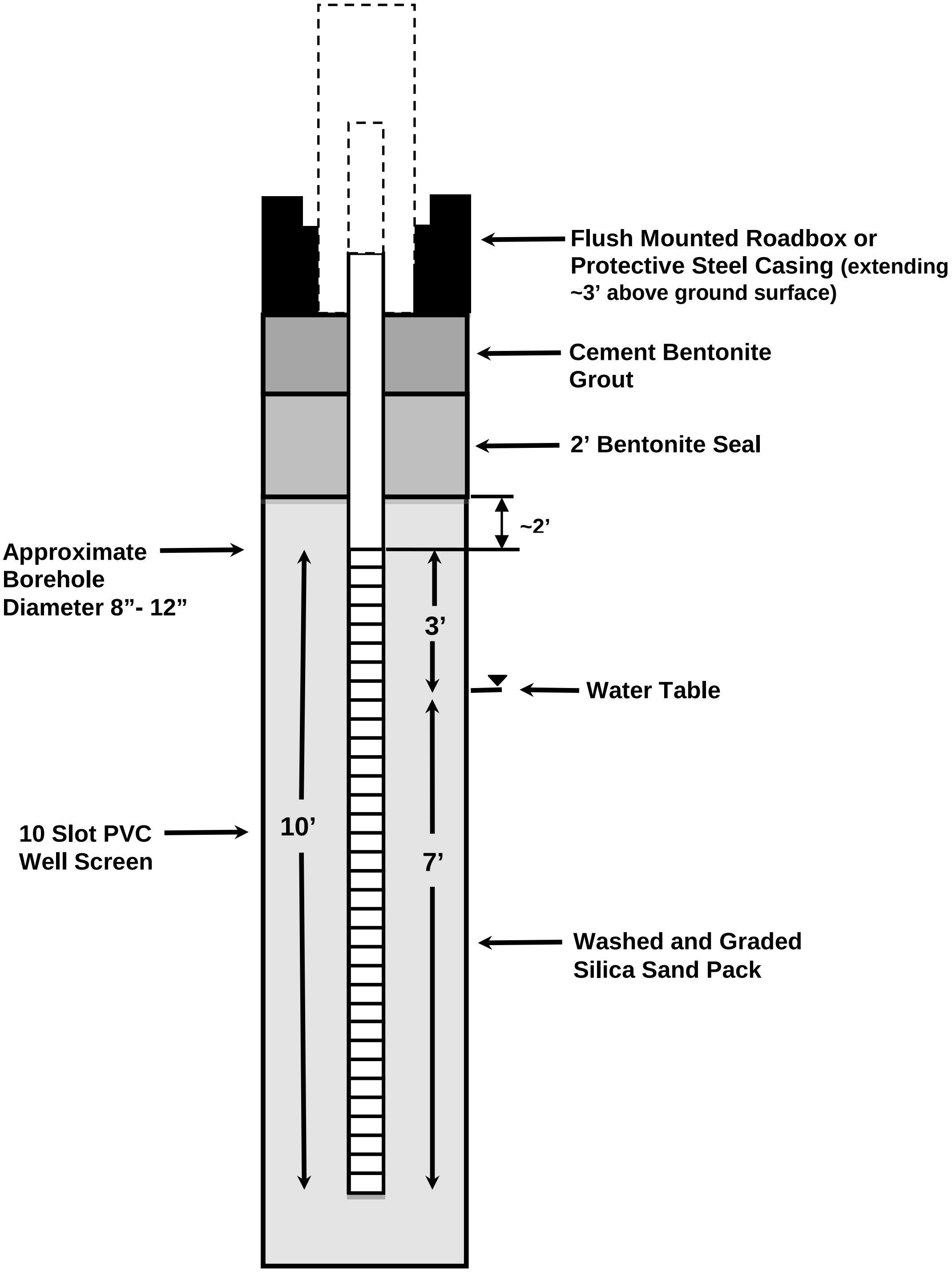
RI/RAA WORK PLAN

Drawing Title
Site Plan Showing Proposed Remedial Investigation Test Locations

Project No.
4884S-13

FIGURE 9

Last Date Saved: 02 Dec 2013 Document Path: \\Smelt-win7pc\GIS\GIS Mapping\4884S-13Solepo\211Franklin\4884S - 23 - Proposed BCP RI Test Locations.mxd



NOT TO SCALE

CAH0682/4884S-13

DATE **11/26/2013**	day **DAY ENVIRONMENTAL, INC.** ENVIRONMENTAL CONSULTANTS ROCHESTER, NEW YORK 1406 NEW YORK, NEW YORK 10016-0701	PROJECT TITLE **211 FRANKLIN STREET** **OLEAN, NEW YORK** **RI / RAA WORK PLAN**	PROJECT NO. **4884S-13**
DRAWN BY **CAH**			**FIGURE 10**
SCALE **Not to Scale**		DRAWING TITLE **Schematic Overburden Well Design**	

APPENDIX A

Health and Safety Plan

HEALTH AND SAFETY PLAN

REMEDIAL INVESTIGATION
211 FRANKLIN STEET
OLEAN, NEW YORK

BCP SITE NUMBER PENDING

Prepared by: Day Environmental, Inc.
1563 Lyell Avenue
Rochester, New York 14606

Project No.: 4884S-13

Date: December 2013

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

Day Environmental, Inc. (DAY) prepared this Health and Safety Plan (HASP) to outline policies and procedures to protect workers and the public from potential environmental hazards during the Remedial Investigation described in the Remedial Investigation/Remedial Alternatives Analysis (RI/RAA) Work Plan to be conducted at the property addressed 211 Franklin Street, City of Olean, County of Cattaraugus, New York (the Site). Figure 1 depicts the general location of the Site.

Although the HASP focuses on the specific work activities planned for the Site, it must remain flexible due to the nature of this work. Conditions may change and unforeseen situations can arise that require deviations from the original HASP.

1.1 SITE HISTORY/OVERVIEW

The Site is located in an industrial-use area in the City of Olean, Cattaraugus County, New York. The Site is bounded to the north by Franklin Street with vacant land, a parking lot and playground/baseball field beyond, to the east by vacant land and residential housing beyond, to the south by railroad lines and West Pine Street beyond, and to the west by railroad lines and industrial use properties beyond. The Site is improved with a building that operates as a manufacturing facility for resins, epoxies and related materials. Specific information regarding current structures is provided below.

☐ 211 Franklin Street (SBL #94.040-1-21): An approximate 5.54-acre parcel of land, improved with an approximate 280,000-square foot, two-story industrial building with a partial basement.

Recognized environmental conditions (RECs) for the Site, as identified in a Phase I Environmental Site Assessment (Phase I ESA) completed by DAY in 2013, are listed below.

☐ Historical industrial usage of the Site, including:
  - o Industrial manufacturing activities at the Site since at least 1886;
  - o Use of chemical and petroleum storage tanks;
  - o Use of basements and subsurface vaults for possible chemical waste storage or disposal; and
  - o Drain discharges that could contain waste materials generated during past manufacturing operations.

☐ Potential contaminant migration from off site sources.

A preliminary Phase II Environmental Site Assessment (Phase II ESA) was conducted at the Site by DAY to initially evaluate the identified RECs. The findings of the October 17, 2013 Phase II ESA relative to the Site are summarized below.

☐ Field evidence of petroleum-like odors and elevated PID readings was encountered in two of the test borings completed at the Site. Specifically, a maximum PID reading of 701 parts per million (ppm) was measured above samples collected from test boring

TB-02 (located along the western edge of the manufacturing facility) at a depth of about 26 feet below ground surface (bgs) and a maximum PID reading of 279 ppm was measured above samples collected from test boring TB-04 (located along the southern edge of the manufacturing facility) at a depth of about 29 feet bgs.

☐ Detectable concentrations of methylcyclohexane and tert-butylbenzene were reported in a soil sample collected from TB-02, at a depth of 24 feet bgs. The concentration of tert-butylbenzene did not exceed the Unrestricted Use SCO. [Note: The NYSDEC has not published an Unrestricted Use SCO for methylcyclohexane at this time.]

☐ Potential elevated concentrations of total tentatively identified volatile organic compounds (TICs) were detected in the soil sample collected from TB-02 at a depth of about 24 feet bgs. and within a soil sample collected from TB-04 at a depth of about 30 feet bgs.

☐ Several target list SVOCs (i.e., primarily polyaromatic hydrocarbons, PAHs) were detected in soil samples collected from test borings TB-02, TB-04 and TB-07 (located along the southern edge of the manufacturing facility) at depths of 24, 30 and 3 feet bgs, respectively. The concentrations detected did not exceed their respective Unrestricted Use SCO.

☐ Polychlorinated biphenyls (PCBs) were not detected in the one soil sample from test boring TB-02 that was analyzed.

☐ Cyanide was not detected at a concentration higher than the laboratory detection limit in the one soil sample from test boring TB-02 that was analyzed.

☐ Monitoring wells MW-B through MW-E contained detectable concentrations of one or more target list VOCs. The concentration of tert-butylbenzene in MW-B exceeded the Class GA standard and the concentration of acetone in MW-B exceeded the Class GA guidance value. The concentrations of the other target list VOCs detected in the groundwater samples from MW-B through MW-E did not exceed their respective Class GA standards or guidance values.

☐ SVOCs bis(2-ethylhexyl)phthalate and di-n-butyl phthalate were detected in the groundwater sample collected from MW-E, but the concentrations do not exceed their respective Class GA standards.

☐ TAL metals were detected in a groundwater sample collected from MW-B with the following metals exceeding their respective Class GA standards or guidance values: arsenic, barium, beryllium, chromium, copper, iron, magnesium, manganese, sodium, nickel, lead, thallium, and zinc. The concentrations of the following TAL metals, detected in groundwater sample collected from MW-D, exceeded their respective Class GA standards or guidance values: chromium, iron, magnesium, manganese, sodium, and lead.

☐ Total Petroleum Hydrocarbons were detected in the samples collected from MW-B (283 mg/l) and MW-D (7.3 mg/l). No regulatory guidance values have been established for TPH.

1.2 PLANNED ACTIVITIES COVERED BY HASP

This HASP is intended to be used during the RI/RAA for the on-site environmental activities. Currently, identified activities include:

☐ Site Preparation Activities;
☐ Geophysical Survey;
☐ Passive Soil Gas Studies;
☐ Underground Utility Assessment;
☐ Completion of Soil Borings and Sample Collection;
☐ Monitoring Well Installation and Sampling;
☐ Underground Petroleum Storage Tank Removal;
☐ Basement/Vault Assessment that may include Confined Space Entry; and,
☐ Investigation of Derived Waste Management;

This HASP can be modified to cover other site activities as deemed appropriate. The owner of the property, its contractors, and other site workers will be responsible for the development and/or implementation of health and safety provisions associated with site activities.

2.0 KEY PERSONNEL AND MANAGEMENT

The Project Manager (PM) and Site Safety Officer (SSO) are responsible for formulating health and safety requirements, and implementing the HASP.

2.1 PROJECT MANAGER

The PM has the overall responsibility for the project and will coordinate with the SSO to ensure that the goals of the project are attained in a manner consistent with the HASP requirements.

2.2 SITE SAFETY OFFICER

The SSO has responsibility for administering the HASP relative to site activities, and will be in the field while activities are in progress. The SSO's operational responsibilities will be monitoring, including personal and environmental monitoring, ensuring personal protective equipment (PPE) maintenance, and identification of protection levels. The air monitoring data obtained by the SSO will be available for review by regulatory agencies and other on-site personnel.

2.3 EMPLOYEE SAFETY RESPONSIBILITY

Each employee is responsible for personal safety as well as safety of others in the area. The employee will use the equipment provided in a safe and responsible manner as directed by the SSO.

2.4 KEY SAFETY PERSONNEL

The following individuals are anticipated to share responsibility for health and safety of DAY representatives at the Site.

DAY Project Manager	Raymond Kampff
DAY Site Safety Officer	William Batiste, Charles Hampton, or Zachary Tennies

3.0 SAFETY RESPONSIBILITY

Contractors, consultants, state or local agencies, or other parties, and their employees, involved with this project will be responsible for their own safety while on-site. Their employees will be required to understand the information contained in this HSAP, and must follow the recommendations that are made in this document. As an alternative, contractors, consultants, state or local agencies, or other parties, and their employees, involved with this project can utilize their own health and safety plan for this project as long as it is found acceptable to the New York State Department of Health (NYSDOH) and /or the Cattaraugus County Health Department (CCHD).

4.0 JOB HAZARD ANALYSIS

There are many hazards associated with environmental work on a site, and this HASP discusses some of the anticipated hazards for this Site. The hazards listed below deal specifically with those hazards associated with the management of potentially contaminated media (e.g. soil, fill, etc.).

4.1 CHEMICAL HAZARDS

Chemical substances can enter the unprotected body by inhalation, skin absorption, ingestion, or injection (i.e., a puncture wound, etc.). A contaminant can cause damage to the point of contact or can act systemically, causing a toxic effect at a part of the body distant from the point of initial contact.

A list of selected constituents that have been detected at the Site that were measured during the Phase II ESA at concentrations that exceed soil or groundwater standards, criteria and guidance (SCG) values are presented below. This list also presents the Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs), National Institute for Occupational Safety and Health (NIOSH) recommended exposure limits (RELs), and NIOSH immediately dangerous to life or health (IDLH) levels.

CONSTITUENT	OSHA PEL	NIOSH PEL	IDLH
tert-butylbenzene	NA	NA	NA
Acetone	2400 mg/m^3	590 mg/m^3	2500 ppm
Arsenic	0.01 mg/m^3	0.002 mg/m^3	5 mg/m^3
Barium	0.5 mg/m^3	0.5 mg/m^3	50 mg/m^3
Beryllium	0.002 mg/m^3	0.0005 mg/m^3	4 mg/m^3
Chromium	1 mg/m^3	0.5 mg/m^3	250 mg/m^3
Copper	1 mg/m^3	1 mg/m^3	100 mg/m^3
Iron[1]	10 mg/m^3	5 mg/m^3	2500 mg/m^3
Magnesium	15 mg/m^3	NA	750 mg/m^3
Manganese	5 mg/m^3	1 mg/m^3	500 mg/m^3
Sodium	NA	NA	NA
Nickel	1 mg/m^3	0.015 mg/m^3	10 mg/m^3
Lead	0.05 mg/m^3	0.05 mg/m^3	100 mg/m^3
Thallium	0.1 mg/m^3	0.1 mg/m^3	15 mg/m^3
Zinc	5 mg/m^3	5 mg/m^3	500 mg/m^3

NA = Not Available

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[1] Iron Oxide dust and fume (as Fe)

The potential routes of exposure for these analytes and chemicals include inhalation, ingestion, skin absorption and/or skin/eye contact. The potential for exposure through any one of these routes will depend on the activity conducted. The most likely routes of exposure for these activities that are performed during environmental activities at the Site include inhalation and skin/eye contact.

4.2 Physical Hazards

There are physical hazards associated with this project, which might compound the chemical hazards. Hazard identification, training, adherence to the planned environmental measures, and careful housekeeping can prevent many problems or accidents arising from physical hazards. Potential physical hazards associated with this project and suggested preventative measures include:

☐ Slip/Trip/Fall Hazards – Some areas may have wet or frozen surfaces that will greatly increase the possibility of inadvertent slips. Caution must be exercised when using steps and stairs due to slippery surfaces in conjunction with the fall hazard. Good housekeeping practices are essential to minimize the trip hazards.

☐ Small Quantity Flammable Liquids – Small quantities of flammable liquids will be stored in “safety” cans and labeled according to contents.

☐ Electrical Hazards – Electrical devices and equipment shall be de-energized prior to working near them. All extension cords will be kept out of water, protected from crushing, and observed regularly to ensure structural integrity. Temporary electrical circuits will be protected with ground fault circuit interrupters. Only qualified electricians are authorized to work on electrical circuits. Heavy equipment (e.g., excavator, backhoe, drill rig) shall not be operated within 10 feet of high voltage lines, unless proper protection form the high voltage lines is provided by the appropriate utility company.

☐ Noise – Work around large equipment often creates excessive noise. The effects of noise can include:

  - Workers being startled, annoyed, or distracted.
  - Physical damage to the ear resulting in pain, or temporary and or/permanent hearing loss.
  - Communication interference that may increase potential hazards due to the inability to warn of danger and proper safety precautions to be taken.

  Proper hearing protection will be worn as deemed necessary. In general, feasible administrative or engineering controls shall be utilized when on-site personnel are subjected to noise exceeding an 8-hour time weighted average (TWA) sound level of 90 decibels on the A-weighted scale (dBA). In addition, whenever employee noise exposures equal or exceed an 8-hour TWA sound level of 85 dBA, employers shall administer a continuing, effective hearing conservation program as described in the OSHA Regulation 29 Code of Federal Rules (CFR) Part 1910.95.

- ☐ Heavy Equipment – Each morning before start-up, heavy equipment will be checked to ensure safety equipment and devices are operational and ready for immediate use.
- ☐ Subsurface and Overhead Hazards – Before any excavation activity, efforts will be made to determine whether underground utilities and potential overhead hazards will be encountered. Underground utility clearance must be obtained prior to subsurface work.
- ☐ Excavation and Trenching Hazards – Excavations and trenches (i.e., test pits and removal of underground storage tanks) required during the course of this project will be completed in accordance with the requirements of 29 CFR 196 Part P (OSHA Excavations Regulation). As shown in 29 CFR 196.652(a)(1)(ii), excavations that are greater than 5 feet in depth require an adequate protective system prior to entry by qualified personnel. The SSO will be responsible for identifying excavations that require protective systems and their implementation. Adequate protective systems will be designed and implemented as required in Part P of the applicable regulation.

  Qualified personnel should remain at least 3 feet from edge of sidewalls of excavation and should view excavation from end walls to avoid cave-in. Samples from excavation should be collected using remote methods such as with an excavator bucket.

4.2 ENVIRONMENTAL HAZARDS

Environmental factors such as weather, wild animals, insects, snakes and irritant plants can pose a hazard when performing outdoor tasks. The SSO shall make reasonable efforts to alleviate these hazards should they arise.

4.3.1 Heat Stress

The combination of warm ambient temperature and protective clothing increases the potential for heat stress. In particular,

- ☐ Heat rash
- ☐ Heat cramps
- ☐ Heat exhaustion
- ☐ Heat stroke

Site workers will be encouraged to increase consumption of water or electrolyte-containing beverages such as Gatorade® when the potential for heat stress exists. In addition, workers are encouraged to take rests whenever they feel any adverse effects that may be heat-related. The frequency of breaks may need to be increased upon worker recommendation to the SSO.

4.3.2 Exposure to Cold

With outdoor work in the winter months, the potential exists for hypothermia and frostbite. Protective clothing greatly reduces the possibility of hypothermia in workers. However, personnel will be instructed to wear warm clothing and to stop work to obtain more clothing if they become too cold. Employees will also be advised to change into dry clothes if their clothing becomes wet from perspiration or from exposure to precipitation.

5.0 SITE CONTROLS

To prevent migration of contamination caused through tracking by personnel or equipment, work areas, and personal protective equipment staging/decontamination areas will be specified prior to beginning operations.

5.1 SITE ZONES

In the area where contaminated materials present the potential for worker exposure (work zone), personnel entering the area must wear the mandated level of protection for the area. A "transition zone" shall be established where personnel can begin and complete personal and equipment decontamination procedures. This can reduce potential off-site migration of contaminated media. Contaminated equipment or clothing will not be allowed outside the transition zone (e.g., on clean portions of the Site) unless properly containerized for disposal. Operational support facilities will be located outside the transition zone (i.e., in a "support zone"), and normal work clothing and support equipment are appropriate in this area. If possible, the support zone should be located upwind of the work zone and transition zone.

5.2 GENERAL

The following items will be requirements to protect the health and safety of workers during implementation of activities that disturb contaminated material.

- ☐ Eating, drinking, chewing gum or tobacco, smoking, or any practice that increased the probability of hand to mouth transfer and ingestion of contamination shall not occur in the work zone and/or transition zone during disturbance of contaminated material.
- ☐ Personnel admitted in the work zone shall be properly trained in health and safety techniques and equipment usage.
- ☐ No personnel shall be admitted in the work zone without the proper safety equipment.
- ☐ Proper decontamination procedures shall be followed before leaving the Site.

6.0 PROTECTIVE EQUIPMENT

This section addresses the various levels of PPE, which are or may be required at this job site. Personnel entering the work zone and transition zone shall be trained in the use of the anticipated PPE to be utilized.

6.1 ANTICIPATED PROTECTION LEVELS

The following table summarizes the protection levels (refer to Section 6.2) anticipated for tasks to be implemented during this project.

TASK	PROTECTION LEVEL	COMMENTS/MODIFICATIONS
Site mobilization	D	
Site preparation	D	
Intrusive work	C/Modified D/D	Based on air monitoring, and SSO discretion.
Decontamination Area	Modified D/D	
Site breakdown and demobilization	D	

It is anticipated that work conducted as part of this project will be performed in Level D or modified Level D PPE. If conditions are encountered that require Level A or Level B PPE, the work will immediately be stopped. The appropriate government agencies (e.g., City, NYSDEC, NYSDOH, CCHD, etc.) will be notified and the proper health and safety measures will be implemented (e.g., develop and implement engineering controls, upgrade in PPE, etc.). If conditions are encountered that require Level C PPE, the work will be temporarily suspended and the work site will be evaluated to limit exposure prior to implementing Level C PPE.

6.2 PROTECTION LEVEL DESCRIPTIONS

This section lists the minimum requirements for each protection level. Modifications to these requirements can be made upon approval of the SSO. If Level A, Level B, and/or Level C PPE is required, Site personnel that enter the work zone and/or transition zone must be properly trained and certified in the use of those levels of PPE.

6.2.1 Level D

Level D consists of the following:

- ☐ Safety glasses
- ☐ Hard hat when working with heavy equipment
- ☐ Steel-toed or composite-toed work boots
- ☐ Protective gloves during sampling or handling of potentially contaminated media

☐ Work clothing as prescribed by weather

6.2.2 Modified Level D

Modified Level D consists of the following:

☐ Safety glasses with side shields
☐ Hard hat when working with heavy equipment
☐ Steel-toed or composite-toed work boots
☐ Protective gloves during sampling or handling of potentially contaminated media
☐ Outer protective wear, such as Tyvek coverall [Tyveks (Sarans) and polyvinyl chloride (PVC) acid gear will be required when workers have a potential to be exposed to impacted liquids or impacted particulates].

6.2.3 Level C

Level C consists of the following:

☐ Air-purifying respirator with appropriate cartridges
☐ Outer protective wear, such as Tyvek coverall [Tyveks (Sarans) and PVC acid gear will be required when workers have a potential to be exposed to impacted liquids or particulates].
☐ Hard hat when working with heavy equipment
☐ Steel-toed or composite-toed work boots
☐ Nitrile, neoprene, or PVC overboots, if appropriate
☐ Nitrile, neoprene, or PVC gloves, if appropriate
☐ Face shield (when projectiles or splashes pose a hazard)

6.2.4 Level B

Level B protection consists of the items required for Level C protection with the exception that an air-supplied respirator is used in place of the air-purifying respirator. Level B PPE is not anticipated to be required during this project. If the need for level B PPE becomes evident, activities in the affected area will be stopped until conditions are further evaluated, and any necessary modifications to the HASP have been approved by the PM and SSO. Subsequently, the appropriate safety measures (including Level B PPE) must be implemented prior to commencing site activities.

6.2.5 Level A

Level A protection consists of the items required for Level B protection with the addition of a fully-encapsulating, vapor-proof suit capable of maintaining positive pressure. Level A PPE is not anticipated to be required during this project. If the need for level A PPE becomes evident, activities in the affected area will be stopped until conditions are further evaluated, and any necessary modifications to the HASP have been approved by the PM and SSO. Subsequently, the appropriate safety measures (including Level A PPE) must be implemented prior to commencing site activities.

6.3 RESPIRATORY PROTECTION

Any respirator used will meet the requirements of the OSHA 29 CFR 1910.134. Both the respirator and cartridges specified shall be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910). Air purifying respirators shall not be worn if contaminant levels exceed designated use concentrations. The workers will wear respirators with approval for: organic vapors less than 1,000 ppm; and dusts, fumes and mists with a TWA less than 0.05 milligrams per cubic meter (mg/m^3).

No personnel who have facial hair, which interferes with respirator sealing surface, will be permitted to wear a respirator and will not be permitted to work in areas requiring respirator use.

Only workers who have been certified by a physician as being physically capable of respirator usage shall be issued a respirator. Personnel unable to pass a respiratory fit test or without medical clearance for respirator use will not be permitted to enter or work in areas that require respirator protection.

7.0 DECONTAMINATION PROCEDURES

This section describes the procedures necessary to ensure that both personnel and equipment are free from contamination when they leave the work site.

7.1 PERSONNEL DECONTAMINATION

Personnel involved with activities that involve disturbing contaminated media will follow the decontamination procedures described herein to ensure that material which workers may have contacted in the work zone and/or transition zone does not result in personal exposure and is not spread to clean areas of the Site. This sequence describes the general decontamination procedure. The specific stages can vary depending on the Site, the task, and the protection level, etc.

1. Leave work zone and go to transition zone
2. Remove soil/debris from boots and gloves
3. Remove boots
4. Remove gloves
5. Remove Tyvek suit and discard, if applicable
6. Remove and wash respirator, if applicable
7. Go to support zone

7.2 EQUIPMENT DECONTAMINATION

Decontamination procedures for equipment are presented as Section 4.0 of the Quality Assurance Project Plan (QAPP).

7.3 DISPOSAL

Disposable clothing will be disposed in accordance with applicable regulations. Liquids (e.g., decontamination water, etc.) or solids (e.g., soil) generated by remedial activities will be disposed in accordance with applicable regulations.

8.0 AIR MONITORING

During activities that have the potential to disturb contaminated soil, fill material, or groundwater, air monitoring will be conducted in order to determine airborne particulate and contamination levels. This ensures that respiratory protection is adequate to protect personnel against the chemicals that are encountered and that chemical contaminants are not migrating off-site. Additional air monitoring may be conducted at the discretion of the SSO. Readings will be recorded and be available for review.

The following chart describes the direct reading instrumentation that will be utilized and appropriate action levels.

Monitoring Device	Action Level	Response/Level of PPE
PID Volatile Organic Compound Meter	< 1 ppm in breathing zone, sustained 5 minutes	Level D
	1-25 ppm in breathing zone, sustained 5 minutes	Cease work, implement measures to reduce air emissions when the work is performed, etc. If levels can not be brought below 1 ppm in the breathing zone, then upgrade PPE to Level C
	26-250 ppm in breathing zone, sustained 5 minutes	Level B, Stop work, evaluate the use of engineering controls, etc.
	>250 ppm in breathing zone	Level A, Stop work, evaluate the use of engineering controls, etc.
RTAM Particulate Meter	< 100 µg/m^3 over an integrated period not to exceed 15 minutes.	Continue working
	> 100 µg/m^3	Cease work, implement dust suppression, change in way work performed, etc. If levels can not be brought below 150 µg/m^3, then upgrade PPE to Level C

8.1 PARTICULATE MONITORING

During activities where contaminated materials (e.g., soil, fill, etc.) may be disturbed, air monitoring will include real-time monitoring for particulates using a real-time aerosol monitor (RTAM) particulate meter at the perimeter of the work zone in accordance with the Final DER-10 Technical Guidance for Site Investigation and Remediation dated May 2010. DER-10 uses an action level of 100 µg/m3 (0.10 mg/m3) over background conditions for an integrated period not to exceed 15 minutes. If the action level is exceeded, or if visible dust is encountered, then work shall be discontinued until corrective actions are implemented. Corrective actions may include dust suppression, change in the way work is performed, and/or upgrade of personal protective equipment.

8.2 VOLATILE ORGANIC COMPOUND MONITORING

During activities where contaminated materials may be disturbed, a photoionization detector (PID) will be used to monitor total VOCs in the ambient air. The PID will prove useful as a direct reading instrument to aid in determining if current respiratory protection is adequate or needs to be upgraded. The SSO will take measurements before operations begin in an area to determine the amount of VOCs naturally occurring in the air. This is referred to as a background level. Levels of VOCs will periodically be measured in the air at active work sites, and at the transition zone when levels are detected above background in the work zone.

8.3 COMMUNITY AIR MONITORING PLAN

During activities that have the potential to disturb contaminated soil, fill material, or groundwater, this Community Air Monitoring Plan (CAMP) will be implemented. The CAMP includes real-time monitoring for VOCs and particulates (i.e., dust) at the downwind perimeter of each designated work area when activities with the potential to release VOCs or dust are in progress at the Site. This CAMP is based on the NYSDOH Generic CAMP included as Appendix 1A of the NYSDEC document titled *"DER-10, Technical Guidance for Site Investigation and Remediation"* dated May 2010. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences/businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of project activities.

Exterior Investigations

The most significant nearby receptor for exterior work is the residential housing located along North Union Street to the east of the Site. Due to proximity of the houses, at least one of the CAMP stations will be placed between the area of intrusive activities and the receptor. In addition, one CAMP monitoring station will be placed on the downwind Site perimeter, and the upwind Site perimeter will be periodically monitored to obtain background levels. [Note: The specific locations will be determined based upon wind conditions at the time of fieldwork.] A Site Plan depicting potential exterior CAMP station locations is provided on Figure 2.

Interior Investigations

During intrusive work within interior locations, VOCs, particulates and oxygen and carbon monoxide levels will be monitored using temporary monitoring stations at the perimeter of the work zone. Stations will be placed at the discretion of the SSO to best evaluate potential contamination leaving the work zone or building. No exterior CAMP monitoring will be completed concurrent with interior work.

The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air. Reliance on the CAMP should not preclude simple, common sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Continuous monitoring will be conducted during ground intrusive activities involving potentially contaminated soil, fill material or groundwater. Ground intrusive activities include, but are not limited to, test pitting or trenching, advancement/installation of test borings or monitoring wells, etc.

Periodic monitoring for VOCs will be conducted during non-intrusive activities involving potentially contaminated soil, fill material or groundwater where deemed appropriate (e.g., during collection of soil samples or groundwater samples, etc.).

8.3.1 VOC Monitoring, Response Levels, and Actions

VOCs must be monitored at the downwind perimeter of the immediate work area (i.e., the work zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- ☐ If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 ppm above background for the 15-minute average, work activities must be temporarily halted and monitoring must be continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- ☐ If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source or vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less (but in no case less than 20 feet), is below 5 ppm over background for the 15-minute average.

- ☐ If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

The 15-minute readings must be recorded and made available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

8.3.2 Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind perimeter of the work zone at temporary particulate monitoring stations. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during work activities.

☐ If the downwind PM-10 particulate level is 100 micrograms per cubic meter (µg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 µg/m3 above the upwind level and provided that no visible dust is migrating from the work area.

☐ If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 µg/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 µg/m3 of the upwind level and in preventing visible dust migration.

Readings will be recorded and made available for review.

8.4 CARBON MONOXIDE AND OXYGEN MONITORING PLAN

Carbon monoxide (CO) and oxygen (O) concentrations will be monitored continuously during activities completed indoors which require the use of equipment that produces exhaust fumes. The monitoring will be completed using a RAE QRAE II unit, or similar, set up at temporary monitoring stations at the perimeters of the work zone and/or in proximity of potential receptors. Concentrations of CO greater than 50 ppm will require discontinuing the work, installation of venting systems or implementing of other engineering controls, and continued monitoring. Areas where concentrations of CO are in exceedance of 100 ppm shall be evacuated immediately. OSHA does not have a PEL for O however, minimum acceptable breathing air contains at least 19.5% O. Concentrations of O below the minimum acceptable value for breathing air will require discontinuing the work, installation of venting systems or implementing of other engineering controls, and continued monitoring. Work will continue only when concentrations are within the acceptable ranges.

Readings will be recorded and made available for review.

9.0 CONFINED SPACE ENTRY PROCEDURES

As part of the work to be performed during this project, entry into vaulted basements located along the southern edge of the manufacturing facility may be required. Entry into these spaces likely falls under the definition of confined space entry as defined in 29 CFR 1910.146. Entry procedures into confined spaces will be completed in accordance with the requirements of 29 CFR 1910.146 (OSHA Permit-Required Confined Space Regulation). Only properly trained individuals shall be allowed to participate in confined space entries.

As shown in 29 CFR 1910.146, a "Confined Space" is defined as:

1. A space "large enough and so configured that an employee can bodily enter and perform assigned work";
2. A space that "has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, and pits)"; and
3. A space "not designed for continuous employee occupancy".

As shown in 29 CFR 1910.146, a "Permit-Required Confined Space" is defined as:

1. A space that "contains or has a potential to contain a hazardous atmosphere";
2. A space that "contains a material that has the potential for engulfing an entrant";
3. A space that "has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section"; or
4. A space that "contains any other recognized serious safety and health hazards".

Permit-required confined space entry procedures do not need to be implemented if the four characteristics defining a permit-required confined space are eliminated (e.g., shore excavation walls, vent air in the confined space, etc.). Based on prior observation of the vaulted basements it is unlikely that these spaces will be classified as permit-required confined spaces. The SSO will be responsible for identifying permit-required confined spaces prior to anyone entering them.

10.0 EMERGENCY CONTINGENCY PLAN

This section presents the emergency contingency plan (ECP) describing the procedures to be performed in the event of an emergency (e.g., fire, spill, tank/drum release, etc.). To provide first-line assistance to field personnel in the case of illness or injury, the following items will be made immediately available on the Site:

- ☐ First-aid kit;
- ☐ Portable emergency eye wash; and
- ☐ Supply of clean water.

10.1 EMERGENCY TELEPHONE NUMBERS

The following telephone numbers are listed in case there is an emergency at the Site:

Fire/Police Department:	911
Poison Control Center:	(800) 222-1222
NYSDEC	
Region 9: Environmental Remediation	(716) 851-7220
Spill Hotline	(800) 457-7362
NYSDOH	
Public Health Duty Officer	(866) 881-2809
CCHD	
24 Hour Hotline	(716) 373-8010
SOL EPOXY	
Mark Wendel	(716) 378-8546
DAY ENVIRONMENTAL, INC.	
Raymond Kampff	(585) 454-0210 x108
NEAREST HOSPITAL:	Olean General Hospital 515 Main Street, Olean, NY 14760 (716) 373-2600 (Main) (716) 375-2675 (Emergency Department)
Directions to the Hospital:	Head northeast on Franklin Street toward North Union Street for approximately 0.1 miles. Turn right on N. Union Street and proceed approximately 0.8 miles. Continue onto Main Street and travel approximately 0.1 miles, then turn left into Olean General Hospital. (Figure 1).

10.2 EVACUATION

During activities involving potential disturbance of contaminated soil, fill material, or groundwater, a log of each individual entering and leaving the Site will be kept for emergency accounting practices. Although unlikely, it is possible that a site emergency could require evacuating personnel from the Site. If required, the SSO will give the appropriate signal for site evacuation (i.e., hand signals, alarms, etc.).

All personnel shall exit the Site and shall congregate in an area designated by the SSO. The SSO shall ensure that all personnel are accounted for. If someone is missing, the SSO will alert emergency personnel. The appropriate government agencies will be notified as soon as possible regarding the evacuation, and any necessary measures that may be required to mitigate the reason for the evacuation.

10.3 MEDICAL EMERGENCY

In the event of a medical emergency involving illness or injury to one of the on-site personnel, Emergency Medical Services (EMS) and the appropriate government agencies should be notified immediately. The area in which the injury or illness occurred shall not be entered until the cause of the illness or injury is known. The nature of injury or illness shall be assessed. If the victim appears to be critically injured, administer first aid and/or cardio-pulmonary resuscitation (CPR) as needed. If appropriate, instantaneous real-time air monitoring shall be done in accordance with air monitoring outlined in Section 8.0 of this HASP.

10.4 CONTAMINATION EMERGENCY

It is unlikely that a contamination emergency will occur; however, if such an emergency does occur, the specific work area shall be shut down and immediately secured. If an emergency rescue is needed, notify Police, Fire Department and EMS units immediately. Advise them of the situation and request and expedient response. The appropriate government agencies shall be notified immediately. The area in which the contamination occurred shall not be entered until the arrival of trained personnel who are properly equipped with the appropriate PPE and monitoring instrumentation as outlined in Section 8.0 of this HASP.

10.5 FIRE EMERGENCY

In the event of a fire on-site, all non-essential site personnel shall be evacuated to a safe, secure area. The Fire Department will be notified immediately, and advised of the situation and the identification of any hazardous materials involved. The appropriate government agencies shall be notified as soon as possible.

The four classes of fire along with their constituents are as follows:

Class A:	Wood, cloth, paper, rubber, many plastics, and ordinary combustible materials.

Class B: Flammable liquids, gases and greases.

Class C: Energized electrical equipment.

Class D: Combustible metals such as magnesium, titanium, sodium, potassium.

Small fires on-site may be actively extinguished; however, extreme care shall be taken while in this operation. Approaches to the fire shall be done from the upwind side if possible. Distance from on-site personnel to the fire shall be close enough to ensure proper application of the extinguishing material but far enough away to ensure that the personnel are safe. The proper extinguisher shall be utilized for the Class(es) of fire present on the site. If possible, the fuel source shall be cut off or separated from the fire. Care must be taken when performing operations involving the shut-off of valves and manifolds, if present.

Examples of proper extinguishing agent as follows:

Class A: Water
Water with 1% AFFF Foam (Wet Water)
Water with 6% AFFF or Fluorprotein Foam
ABC Dry Chemical

Class B: ABC Dry Chemical
Purple K
Carbon Dioxide
Water with 6% AFFF Foam

Class C: ABC Dry Chemical
Carbon Dioxide

Class D: Metal-X Dry Powder

No attempt shall be made against large fires these shall be handled by the Fire Department.

10.6 SPILL OR AIR RELEASE

In the event of a spill or air release of hazardous materials on-site, the specific area of the spill or release shall be shut down and immediately secured. The area in which the spill or release occurred shall not be entered until the cause can be determined and site safety can be evaluated. Non-essential site personnel shall be evacuated to a safe and secure area. The appropriate government agencies shall be notified as soon as possible. The spilled or released material shall be immediately indentified and appropriate containment measures shall be implemented, if possible. Real-time air monitoring shall be implemented as outlined in Section 8.0 of this HASP. If the materials are unknown, Level

B protection is mandatory. If warranted, samples of the materials shall be acquired to facilitate identification.

10.7 LOCATING CONTAINERIZED WASTE AND/OR UNDERGROUND STORAGE TANKS

In the event that unanticipated containerized waster (e.g., drums) and/or USTs are located during remedial activities, the work will be stopped in the specific area until site safety can be evaluated and addressed. Non-essential Site personnel shall not work in the immediate area until conditions including possible exposure hazards are addressed. The appropriate government agencies shall be notified as soon as possible. The SSO shall monitor the area as outlined in Section 8.0 of this HASP.

Prior to any handling, unanticipated containers will be visually assessed by the SSO to gain as much information as possible about their contents. As a precautionary measure, personnel shall assume that unlabelled containers and/or tanks contain hazardous materials until their contents are characterized. To the extent possible based upon the nature of the containers encountered, actions may be taken to stabilize the area and prevent migration (e.g., placement of berms, etc.). Subsequent to initial visual assessment and any required stabilization, properly trained personnel will sample, test, remove, and dispose of any containers and/or tanks, and their contents. After visual assessment and air monitoring, if the material remains unknown, Level B protection is mandatory.

11.0 ABBREVIATIONS

AFFF	Aqueous Film Forming Foams
bgs	Below Ground Surface
CAMP	Community Air Monitoring Program
CCHD	Cattaraugus County Health Department
CFR	Code of Federal Regulations
CPR	Cardio-Pulmonary Resuscitation
DAY	Day Environmental, Inc.
dBA	Decibels on the A-Weighted Scale
ECP	Emergency Contingency Plan
EMS	Emergency Medical Service
ESA	Environmental Site Assessment
HASP	Health and Safety Plan
IDLH	Immediately Dangerous to Life or Heath
mg/m^3	Milligram Per Meter Cubed
NIOSH	National Institute for Occupational Safety and Health
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PM	Project Manager
PM-10	Particulate Matter Less Than 10 Micrometers In Diameter
PPE	Personal Protection Equipment
ppm	Parts Per Million
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
REC	Recognized Environmental Condition
REL	Recommended Exposure Limit
RI/RAA	Remedial Investigation/remedial Alternatives Analysis
RTAM	Real-Time Aerosol Monitor
SCG	Standards, Criteria and Guidance
SCO	Soil Cleanup Objective
SSO	Site Safety Officer
SVOC	Semi-Volatile Organic Compound
TIC	Tentatively Identified Compound
TAL	Target Analyte List
TCL	Target Compound List
TPH	Total Petroleum Hydrocarbons
TWA	Time-Weighted Average
$\mu g/m^3$	Micrograms Per Meter Cubed
VOC	Volatile Organic Compound

ATTACHMENT 1

Figure 1 – Route for Emergency Services

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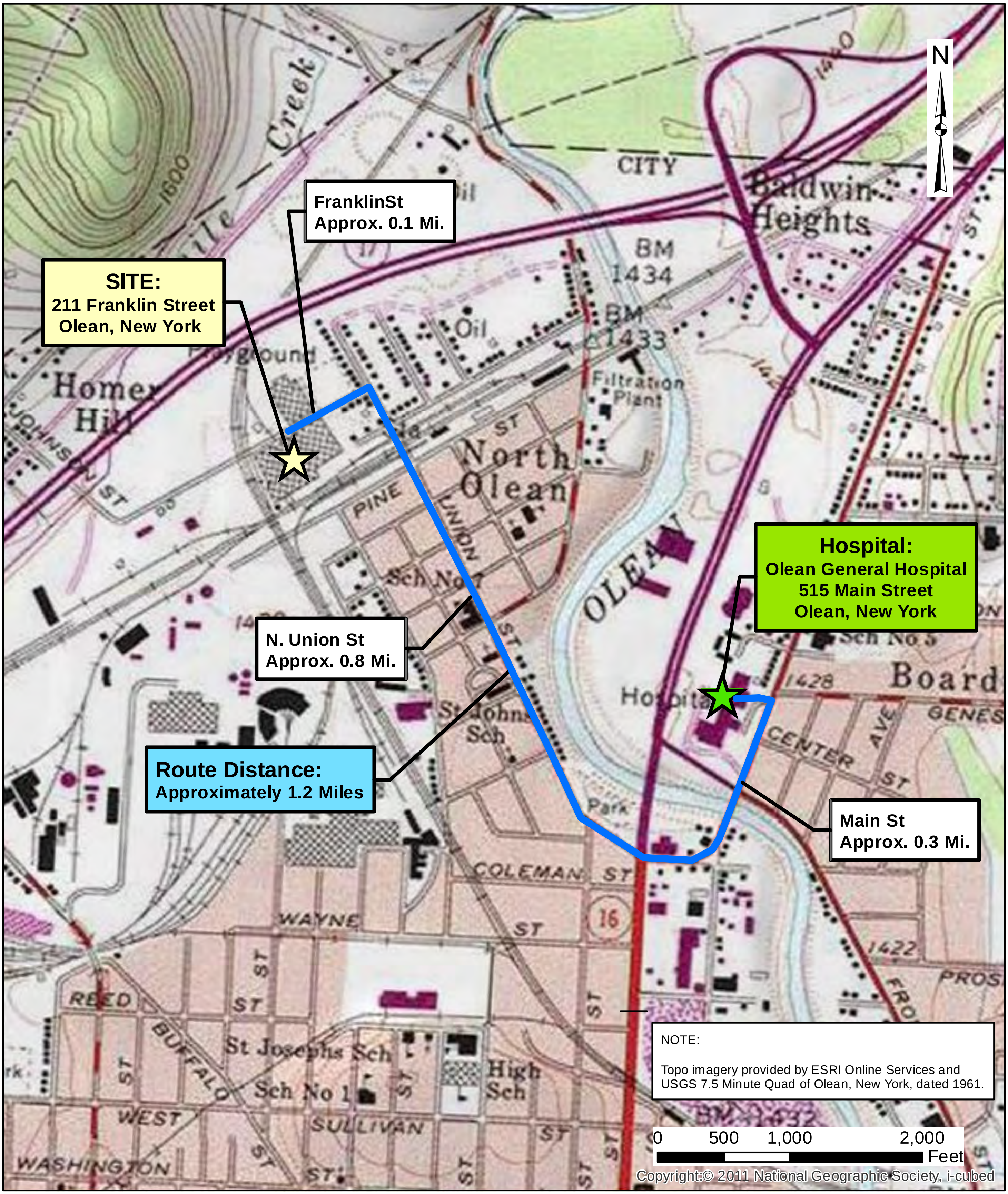


NOTE:

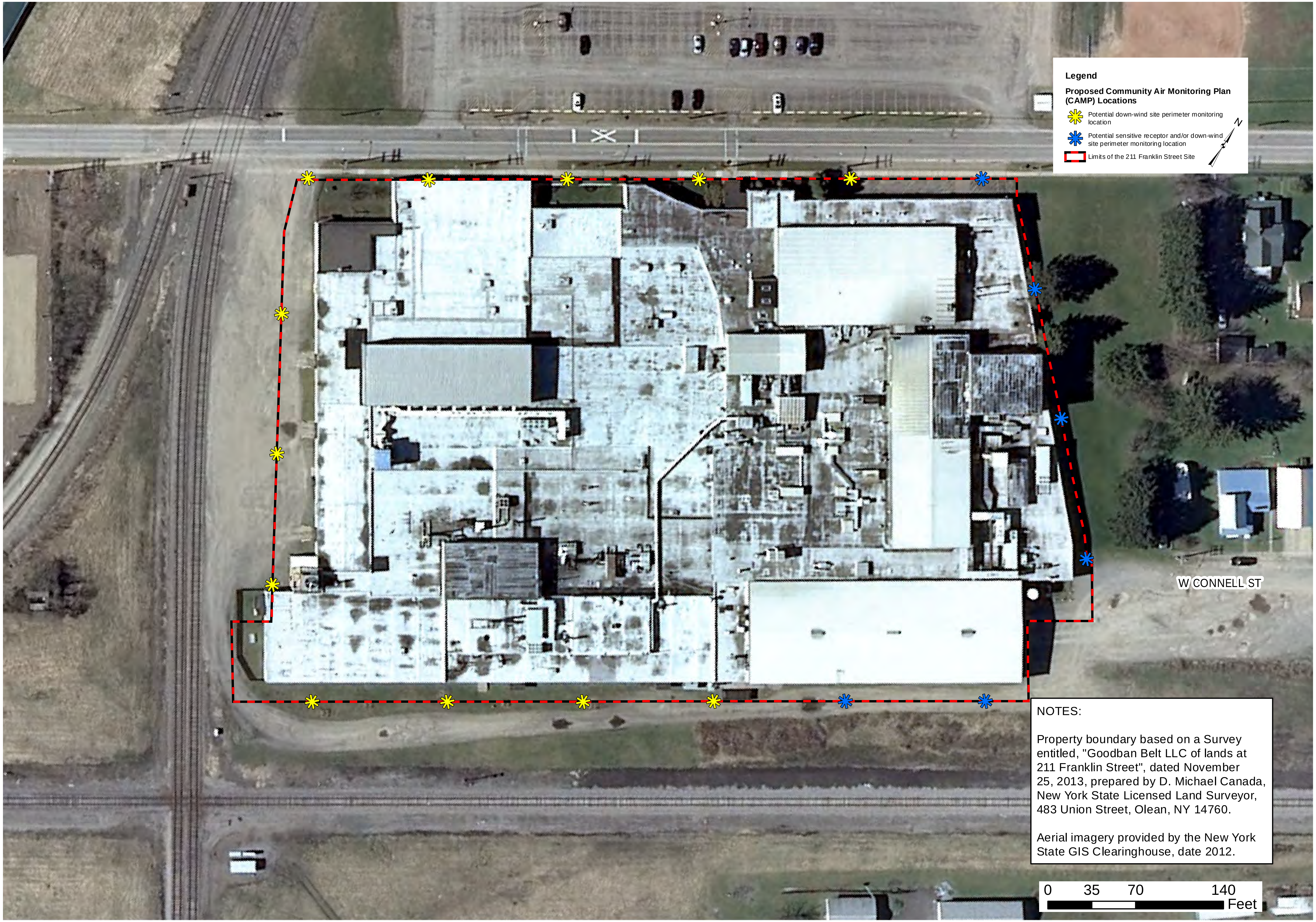
Topo imagery provided by ESRI Online Services and USGS 7.5 Minute Quad of Olean, New York, dated 1961.

Copyright:© 2011 National Geographic Society, i-cubed

Date 11-1-2013	**day** **DAY ENVIRONMENTAL, INC.** **Environmental Consultants** **Rochester, New York 14606** **New York, New York 10170**	Project Title 211 FRANKLIN STREET OLEAN, NEW YORK HEALTH AND SAFETY PLAN	Project No. 4884S-13 FIGURE 1
Drawn By RJM		Drawing Title Route to Emergency Services	
Scale AS NOTED			

ATTACHMENT 2

Figure 2 – Site Plan Depicting Tentative CAMP Station Locations



Legend

Proposed Community Air Monitoring Plan (CAMP) Locations

✳	Potential down-wind site perimeter monitoring location
✳	Potential sensitive receptor and/or down-wind site perimeter monitoring location
▭	Limits of the 211 Franklin Street Site

NOTES:

Property boundary based on a Survey entitled, "Goodban Belt LLC of lands at 211 Franklin Street", dated November 25, 2013, prepared by D. Michael Canada, New York State Licensed Land Surveyor, 483 Union Street, Olean, NY 14760.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

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AS NOTED

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

HEALTH AND SAFETY PLAN

Drawing Title
Proposed Community Air Monitoring Plan Locations

Project No.
4884S-13

FIGURE 2

APPENDIX B

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

REMEDIAL INVESTIGATION
211 FRANKLIN STEET
OLEAN, NEW YORK

BCP SITE NUMBER PENDING

Prepared by:	Day Environmental, Inc. 1563 Lyell Avenue Rochester, New York 14606
Project No.:	4884S-13
Date:	December 2013

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INTRODUCTION

This project-specific Quality Assurance Project Plan (QAPP) was prepared in accordance with Section 2.4 of the New York State Department of Environmental Conservation (NYSDEC) document titled *DER-10, Technical Guidance for Site Investigation and Remediation* dated May 2010 (DER-10). This QAPP provides quality assurance/quality control (QA/QC) protocols and guidance that are to be followed when implementing the Remedial Investigation/Remedial Alternatives Analysis Work Plan (RI/RAA Work Plan) for the property addressed as 211 Franklin Street, Olean, New York (Site). The QAPP also provides a summary of the project, identifies personal responsibilities, and provides procedures to be used during sampling of environmental media, other field activities, and the analytical laboratory testing of samples. The components of the QAPP are provided herein.

1.1 PROJECT SCOPE AND PROJECT GOALS

The QAPP applies to the aspects of the project associated with the collection of field data, the collection and analytical laboratory testing of field samples and QA/QC samples, and the evaluation of the quality of the data that is generated. Specifically, the investigation will include a geophysical survey, passive soil gas testing, utility assessment, surface soil sampling, soil borings and subsurface soil sampling, monitoring well installation and groundwater sampling, aquifer physical characteristic evaluations, an underground storage tank (UST) excavation and removal, and a basement/vault assessment that may include confined space entry. A summary of the anticipated number, type, and test parameters to be submitted for analytical laboratory testing is provided in Table 1. Detailed discussions of the project scope and project goals are provided in the RI/RAA Work Plan. In general, the project goal is to obtain sufficient information to characterize the nature and extent of contamination at the Site sufficiently to develop remedial alternatives for the Site.

2.0 PROJECT/TASK ORGANIZATION

Project organization and tentative personnel to implement the work are outlined in this section of the QAPP.

2.1 DAY ORGANIZATION

Information regarding key personnel for Day Environmental, Inc. (DAY) is provided below, and resumes of key personnel are included in Attachment 1.

DAY Technical Coordinator

The Technical Coordinator is responsible for review of project documents and ensuring the project is completed in accordance with relative work plans. Mr. Charles Hampton will serve as DAY's Technical Coordinator on this project.

DAY Project Manager

The DAY Project Manager has the overall responsibility for implementing the project and ensuring that the project meets the objectives and quality standards as presented in this QAPP. Mr. Raymond Kampff will serve as DAY's Project Manager on this project, and will serve as DAY's primary point of contact and control for the project.

DAY Quality Assurance Officer

The Quality Assurance Officer is responsible for QA/QC on this project. The Quality Assurance Officer's responsibilities on this project are not as a project manager or task manager involved with project productivity or profitability as job performance criteria. Mr. Nathon E. Simon, P.E. will serve as DAY's Quality Assurance Officer on this project. The Quality Assurance Officer may conduct audits of the operations at the Site to ensure that work is being performed in accordance with the QAPP.

DAY Technical Staff

DAY's technical staff for this project consists of experienced professionals (e.g., professional engineers, engineers-in-training, scientists, technicians, etc.) that possess the qualifications necessary to effectively and efficiently complete the project tasks. The technical staff will be used to gather and analyze data, prepare various project documentation, etc.

2.3 ANALYTICAL LABORATORIES

The following analytical laboratories will be used as part of the RI:

- Spectrum Analytical, Inc. (Spectrum) of Warwick, Rhode Island will be used for the soil and groundwater sample analytical services. Spectrum is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified analytical laboratory, ELAP ID LAI00329. A copy of the Spectrum Quality Assurance Plan (QAP) is provided as Attachment 2.

Yihai Ding is the Laboratory Director for Spectrum. The Laboratory Director is responsible for operation, technical performance and data quality of the laboratory and works in conjunction with the Laboratory Manager and QA unit regarding QA and chain-of-custody requirements.

Sharyn B. Lawler is the Quality Assurance Director for Spectrum. The quality Assurance director will work in conjunction with the laboratory QA unit regarding QA elements of specific sample analyses tasks.

- Beacon Environmental Services, Inc. (Beacon) of Forest Hill, Maryland will be used for the screening level passive soil gas sample analytical testing. Beacon is a Environmental Laboratory Accreditation Program (ELAP)-certified analytical laboratory, ELAP ID L12-165. A copy of the Beacon Quality System Manual (QSM) is provided as Attachment 3.

  Steve Thornely is the Laboratory Director for Beacon. The Laboratory Director is responsible for operation, technical performance and data quality of the laboratory and works in conjunction with the Laboratory Manager and QA unit regarding QA and chain-of-custody requirements.

3.0 QUALITY ASSURANCE/QUALITY CONTROL

As part of this Work Plan, QA/QC protocol and procedures have been developed and are described below. The objective of the QA/QC protocol and procedures is to ensure that the information, data, and decisions associated with this project are technically sound and properly documented. The QA/QC protocol and procedures also pertain to the collection, evaluation, and review of activities and data that are part of this project. These QA/QC protocol and procedures will be modified in supplemental work plans when deemed appropriate.

3.1 OPERATION AND CALIBRATION OF ON-SITE MONITORING EQUIPMENT

On-site monitoring equipment will play a significant role in meeting the Remedial Investigation objectives and to determine the appropriate personal protective equipment (PPE) as noted in the health and safety plan (HASP). The on-site, monitoring equipment includes volatile organic compound (VOC) monitors, particulate monitors, air quality monitors, oil/water interface probes, an electronic static water level indicator; water quality monitors, and global position system (GPS) instrumentation. Operation and calibration of on-site monitoring equipment that are anticipated for use during the RI are discussed below.

3.1.1 VOC Monitoring Equipment

Real-time monitoring for VOCs will be conducted to evaluate the nature and extent of petroleum and solvent discharges at the Site and to determine the appropriate PPE as noted in the HASP. The primary field instrument for monitoring VOCs during the RI will be a photoionization detector (PID). It is anticipated that a Minirae 2000 PID (or equivalent) equipped with a 10.6 eV lamp will be used during this project. An accredited firm/testing laboratory will calibrate the equipment on a yearly basis. During fieldwork, the PID will be calibrated on a daily basis in accordance with the manufacturer’s specifications. Isobutylene gas will be used to calibrate the PID prior to use and as necessary during fieldwork. Measurements will be collected before operations begin in an area to determine the amount of VOCs naturally occurring in the air (i.e., background concentrations).

3.1.2 Particulate Monitoring Equipment

Particulate monitoring will be conducted during intrusive activities as noted in the Community Air Monitoring Plan (CAMP) portion of the HASP. It is anticipated that the particulate air monitoring will be conducted using a real-time aerosol monitor (RATM) particulate meter. An accredited firm/testing laboratory will calibrate the equipment on a yearly basis. During fieldwork, the particulate meter will be regularly calibrated in accordance with the manufacturer’s specifications. Measurements will be collected along the upwind perimeter of the intrusive investigation activities to determine the amount of particulates naturally occurring in the air (i.e., background concentrations) as per the requirements of the CAMP.

3.1.3 Carbon Monoxide and Oxygen Monitoring Equipment

Carbon Monoxide (CO) and Oxygen (O_2) monitoring will be conducted during intrusive activities in interior locations as noted in the Community Air Monitoring Plan (CAMP) portion of the HASP. An accredited firm/testing laboratory will calibrate the equipment on a yearly basis. During fieldwork, the particulate meter (such as a RAE QRAE II, or similar) will be regularly calibrated in accordance with the manufacturer's specifications. Measurements will be collected along the perimeter of the intrusive investigation activities to determine the background concentrations of O_2 and CO as per the requirements of the CAMP.

3.1.4 Global Positioning System Equipment

A GPS unit will be used to obtain the precise locations of sampling points and significant site features. It is anticipated that a Trimble GeoXH will be used during this project. The GPS location accuracy of less than 1 horizontal foot is the data quality objective for this project. The GPS unit will be calibrated as needed in accordance with the manufacturer's specifications. The GPS location data will be projected using a coordinate system and datum relevant to the region of the Site (e.g., NAD 1983 State Plane New York West).

3.1.5 Miscellaneous Field Monitoring Equipment

Several other pieces of miscellaneous field monitoring equipment will be used as part of the project including:

- An electronic static water level indicator;
- An oil/water interface meter, and;
- A Horiba U-22 water quality meter that measures pH, specific conductivity, temperature, dissolved oxygen, oxygen-reduction potential, and turbidity.

These meters will be calibrated, operated, and maintained in accordance with the manufacturer's instructions.

3.2 GEOPHYSICAL SURVEY TECHNIQUES

A geophysical survey will be conducted over select exterior portions of the Site to identify potentially significant ferro-metallic (iron-containing metal) materials in the subsurface. To minimize potential interference, a Geonics Ltd. EM-61-MK2 or similar will be used. The EM-61-MK2 minimizes the effect of potential interference by using a pair of antennas that allow subtraction of "noise" produced by surficial metallic debris and many other forms of electromagnetic interference.

Grids will be set up throughout the subject areas measured using a tape measure and compass and marked out using spray paint and/or pin flags. A grid spacing of three feet is typically selected based on the sensitivity of the instrument and the fact the subject of the survey is primarily underground storage tanks and metallic piping or conduits. Locations where obvious sources of interference such as chain-link fences, bollards, etc., will be avoided to the extent possible to prevent artificially anomalous readings from being taken during the survey. The site plan (Figure 9 of the RI/RAA Work Plan) indicates the planned extent of the geophysical survey.

Data will be collected within each survey area and automatically stored in a PDA-type computer attached to the EM-611-MK2. Data will be logged into the PDA along with GPS data captured during the survey process with a linked Trimble Geo XT unit. Data is then transferred electronically into a laptop computer and converted into proper formats for developing contour maps. All data contouring will be completed with Surfer® manufactured by Golden Software, Inc. The contour images will then be electronically transferred to the Site Plan using ArcGIS 10®.

3.3 BEACON ENVIRONMENTAL SERVICES, INC. – PASSIVE SOIL GAS SAMPLING

Passive soil gas sampling will be conducted, in the approximate locations depicted on Figure 9 of the RI/RAA work plan, to evaluate soil vapors within the manufacturing facility at the Site. The sampling will be conducted using the Beacon Environmental Services, Inc. (Beacon) passive soil gas sampling system, or a similar method. A DAY representative will advance a 1.5 -inch diameter hole into the facility floor to the underlying soil using a floor core drill bit. A 1-inch drill bit will then be used to advance the hole to the appropriate depth (between 1 and 3 feet) and fitted with a sanitized metal pipe provided by Beacon. Samplers provided by Beacon, consisting of two absorbent cartridges, will be installed in the hole and covered with an aluminum foil plug, soil cuttings, and concrete or bentonite patch to protect the sample and prevent mixing with ambient air.

Following the suitable exposure time (typically between 3 and 14 days) the samplers will be collected by a DAY representative to be shipped to Beacon's laboratory for analysis. Retrieval of the samplers will include sealing the vials in the vicinity of the sampling location to prevent cross-contamination. Samples will be shipped unpreserved along with QA/QC samples (as indicated on Table 1) along with proper chain of custody forms. Samplers arrive from Beacon in a sealed container and will be shipped sealed to Beacon's laboratory.

Beacon will analyze the samples for VOCs and SVOCs using desorption-gas chromatography/mass spectrometry (TD-GC/MS) instrumentation following EPA Method 8260C. The list of analytes to be tested for includes but is not limited to:

- 1,1,1,2-tetrachloroethane;
- 1,1,1-trichloroethane;
- 1,1,2-trichloroethane;
- 1,1,2-trichlorotrifluoroethane;
- 1,2,4-trimethylbenzene;
- 1,3,5-trimethylbenzene;
- 4-methyl-2-pentanone (MIBK);
- acetone;
- benzene;
- cis-1,2-dichloroethene;
- cyclohexane;
- ethylbenzene;
- hexane;
- methylene Chloride;
- naphthalene;
- o-xylene;
- p & m-xylene;
- tert-butylbenzene;
- tetrachloroethenene;
- tetrahydrofuran;
- toluene;
- trichloroethene; and
- vinyl chloride

3.4 GENERAL BORING SCREENING AND LOGGING

Soil samples will be collected from the ground surface using dedicated hand sampling equipment, and from the subsurface using direct push and/or rotary drilling techniques. Subsurface soil sampling from direct push macro-core samplers will be conducted in accordance with American Society for Testing and Material (ASTM) *D6282-98 Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations*, dated 2005, included as Attachment 4. Subsurface soil sampling from spit spoons advanced ahead of hollow stem augers will be conducted in accordance with ASTM D6282-98(2005) Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations dated 2003, included as Attachment 5.

A DAY representative will: document visual observations; screen the split spoon and macro-core samples with a PID; collect selected portions of the samples for possible laboratory analysis; collect other portions of the samples (and process and screen the headspace of these selected samples with a PID), photograph the test boring work, and prepare test boring logs that provide pertinent field information. Examples of the logs used are included in Attachment 6.

Pertinent information that will be recorded on surface soil sample logs will include:

- Date, sample identification, and project identification;
- Name of individual developing the log;
- Depths recorded in feet and fractions thereof (tenths of inches) referenced to ground surface;
- Description of soil type; and
- PID screening results of ambient headspace air above selected soil samples.

Pertinent information will be recorded on test boring/well logs, and will include:

- Date, boring/well identification, and project identification;
- Name of individual developing the log;
- Name of drilling contractor;
- Drill make and model, and auger or macro-core size;
- Identification of alternative drilling methods used and justification thereof;
- Depths recorded in feet and fractions thereof (tenths of inches) referenced to ground surface;
- Standard penetration test (ASTM D-1586) blow counts;
- The length of the sample interval and the percentage of the sample recovered;
- Description of soil type;
- The depth of the first encountered water table, along with the method of determination, referenced to ground surface;
- Drilling and borehole characteristics;

- Sequential stratigraphic boundaries and soil types consistent with logging performed on other project elements;
- Well specifications (materials; screened interval; amount of Portland cement, bentonite and water used to mix grout; etc.); and
- PID screening results of ambient headspace air above selected soil samples.

3.5 Soil Sample Collection Procedures for VOC Testing

Soil samples to be analyzed for VOCs shall be collected in accordance with USEPA Method 5035. Prior to collection, the soil will be visually examined by a DAY representative for evidence of suspect contamination (e.g., staining, unusual odors) and screened with a PID. Approximately 5 grams of material will be collected in preserved bottles provided by the analytical laboratory as soon as possible after exposure to the atmosphere. Bottles will be sealed with a septum and screw-cap and stored on ice at 4° C. The sample identification number, date, time, and depth of sample will be recorded on a laboratory provided label. When practical, the sample will be weighed using a tare corresponding to the sample container to ensure the appropriate amount of material has been collected.

Two replicate samples will be collected from the same stratum, depth and area as the original sample to provide the analytical laboratory with material for reanalysis. Additionally, one container of soil will be collected in an unpreserved container for screening, dry-weight determination, and high-concentration analysis (if necessary). If the soil samples collected are known to contain high concentrations of VOCs, the samples will be preserved using 10mL of purge-and-trap grade methanol. Samples preserved with methanol will be clearly labeled.

3.6 SOIL SAMPLE HEADSPACE SCREENING

The recovered soil samples will be visually examined by a DAY representative for evidence of suspect contamination (e.g., staining, unusual odors) and screened with a PID. Portions of the recovered soil samples may be placed in containers for possible analytical laboratory testing. Different portions of the soil samples will be placed in sealable Ziploc®-type plastic baggies, and will be field screened the same day they are collected. Each sample will be agitated and homogenized for at least 30 seconds and allowed to equilibrate for at least three minutes. The ambient headspace air inside the baggie above each sample will be screened for total VOC vapors with the PID equipped with a 10.6 eV lamp. The sampling port for the PID will be placed in the ambient air headspace inside the bag by opening a corner of the “locked” portion of the bag. The PID will monitor air inside the baggie for a period of at least 15 seconds and the peak readings measured will be recorded on a log sheet or log book.

3.7 NAPL SCREENING SHAKE TEST

Field evidence of suspect non-aqueous phase liquid (NAPL) will be confirmed in the field utilizing a hydrophobic dye shake test. Field evidence of suspect NAPL include, but not limited to, elevated PID readings (i.e., greater than 1,000 parts per million (ppm)), saturated soil with petroleum or solvent odors or significant staining, and apparent free phase or residual NAPL. The NAPL screening shake test is applicable for both light non-aqueous phase liquid (LNAPL) and DNAPL. If field evidence suggests the presence of LNAPL or DNAPL, DAY will perform a shake test on an aliquot of the corresponding soil sample using hydrophobic dye. The sample aliquot will be mixed with approximately two ounces potable water, and a pinch of Sudan IV or equivalent hydrophobic dye will be placed in a sealable plastic baggie, agitated for approximately 10 seconds, and then noted for pigment staining. If organic NAPL is present, the Sudan IV Pigment should result in pigment staining. The NAPL screening shake test results will be documented and if possible photographed for documentation purposes. The hydrophobic dye will be handled with care using a new pair of disposable gloves. Following the shake test, the plastic baggie containing the soil-dye moisture and associated PPE should be managed as investigation derived waste (IDW). Soils containing hydrophobic dye and PPE will not be used for confirmatory analytical analyses or headspace readings.

3.8 WELL DEVELOPMENT

Monitoring wells will be developed by utilizing either a new dedicated disposable bailer with dedicated cord, and/or a pump and dedicated disposable tubing depending on the field conditions. No fluids will be added to the wells during development without prior approval of the NYSDEC, and well development equipment will be decontaminated prior to development of each well.

The well development procedure is listed below:

- Obtain pre-development static water level and oil/water interface reading for presence of LNAPL or DNAPL using a Heron Model HO1.L oil/water interface probe or similar instrument;
- Calculate water/sediment volume in the well;
- Obtain initial field water quality measurements (e.g., pH, specific conductivity, turbidity, temperature, and PID readings). The pH, specific conductivity, turbidity and temperature readings will be obtained using Horiba U-22 water quality meter (or similar equipment);
- Select development method and set up equipment depending on method used;
- Alternate water agitation methods (e.g., moving a bailer or pump tubing up and down inside the screened interval) and water removal methods (e.g., pumping or bailing) in order to suspend and remove solids from the well;
- Obtain field water quality measurements for every two to five gallons of water removed. Record water quantities and rates removed;
- Stop development when the following water quality criteria are met and at least 10 well volumes have been removed;
    - Water is clear and free of sediment and turbidity is less than 50 nephelometric turbidity units (NTUs);

  - pH is ±0.1 standard unit between readings;
  - Specific conductivity is ±3% between readings, and;
  - Temperature is ±10% between readings.
- Obtain post-development water level readings; and
- Document development procedures, measurements, quantities, etc.

Pertinent information for each well will be recorded on well development logs (included in Attachment 6).

3.9 GROUNDWATER SAMPLING PROCEDURE

Groundwater samples will be collected by utilizing either a low-flow pump and dedicated disposable tubing or by conventional methods using a new dedicated disposable bailer.

The low-flow procedures that will be utilized are outlined below:

- In order to minimize the potential re-suspension of solids in the bottom of the well, well depths will not be measured prior to or during low-flow purging and sampling. Well depth information will be obtained from measurements collected during well development or the well logs.
- PID readings will be obtained from the well headspace immediately following opening the well. The peak PID readings will be noted on the field logbook.
- Prior to purging and sampling, static water level measurements will be taken from each well using a Heron Model HO1.L oil/water interface probe or similar instrument. The presence or absence of LNAPL will be determined. If present, the thickness of LNAPL will be obtained.
- If necessary to confirm whether NAPL is present in groundwater that contain PID measurements greater than 500 ppm or other field indications of NAPL, hydrophobic dye (i.e., Sudan IV) may be introduced to an aliquot of the sample. If LNAPL or DNAPL is detected, the NYSDEC will be notified to determine whether analytical characterization of the NAPL is warranted.
- A portable bladder pump connected to new disposable polyethylene tubing will be lowered and positioned at or slightly above the mid-point of the well screen when the screened interval is set in relatively homogeneous material. When the screened interval is set in heterogeneous materials, the pump will be positioned adjacent to the zone of highest hydraulic conductivity (as defined by geologic samples). Care will be taken to install and lower the bladder pump slowly in order to minimize disturbance of the water column.
- The pump will be connected to a control box that is operated on compressed gas (nitrogen, air, etc.) and is capable of varying pumping rates. An in-line flow-through cell attached to a Horiba U-22 water quality meter (or similar equipment) will be connected to the bladder pump effluent tubing to measure water quality data.

- The pump will be started at a low pumping rate of 100 ml/min or less (for pumps that cannot achieve a flow rate this low, the pump will be started at the lowest pump rate possible). The water level in the well will be measured and the pump rate will be adjusted (i.e., increased or decreased) until the drawdown is stabilized. In order to establish the optimum flow-rate for purging and sampling, the water level in the well will be measured on a periodic basis (i.e., every one or two minutes) using an electronic water level meter or the Heron Model HO1.L oil/water interface meter (or equivalent). When the water level in the well has stabilized (i.e., use goal of < 0.33 feet of constant drawdown), the water level measurements will be collected less frequently.
- While purging the well at the stabilized water level, water quality indicator parameters will be monitored on a three to five minute basis with a Horiba U-22 water quality meter (or similar equipment). Water quality indicator parameters will be considered stabilized after three consecutive readings for each of the following parameters are generally achieved:
  - pH (± 0.1);
  - specific conductance (± 3%);
  - dissolved oxygen (± 10 %);
  - oxidation-reduction potential (± 10 mV);
  - temperature (± 10%); and
  - turbidity (± 10%, when turbidity is greater than 10 NTUs).
- Following stabilization of the water quality parameters, the flow-through cell will be disconnected and a groundwater sample will be collected from the bladder pump effluent tubing. The pumping rate during sampling will remain at the established purging rate or it may be adjusted downward to minimize aeration, bubble formation, or turbulent filling of sample containers. A pumping rate below 250 ml/min will be used when collecting VOC samples.
- To minimize the potential for re-suspension of solids in the bottom of the well, the presence of DNAPL will be determined following purging and sampling at each well location using the Heron oil/water interface probe (or equivalent).
- Field observations, real-time parameter readings, and other pertinent information obtained during the sampling effort will be noted in the field logbook and a low-flow groundwater purge and sample form (included in Attachment 6).

The conventional groundwater sampling procedure is listed below:

- Obtain pre-sampling static water level, depth of well, and oil/water interface reading for presence of LNAPL or DNAPL using a Heron Model HO1.L oil/water interface probe or similar instrument;
- Calculate water/sediment volume in the well and the volume to be purged from the well;
- Purge the appropriate volume from the well (approximately 3 times the casing volume) using the dedicated disposable bailer or a purge pump and dedicated disposable tubing;

- Once the static water level has returned to 90% of the original reading, obtain field water quality measurements (e.g., pH, specific conductivity, turbidity, temperature, and PID readings). The pH, specific conductivity, turbidity and temperature readings will be obtained using Horiba U-22 water quality meter (or similar equipment);
- Collect samples in the bottles provided by the analytical laboratory and place on ice. Each sample will be identified with a unique ID number, the date/time of sampling, method used, and analytical scans to be performed.

Pertinent information for each well will be recorded on monitoring well sampling logs (included in Attachment 6).

3.10 INVESTIGATION DERIVED WASTE CHARACTERIZATION SAMPLING

IDW will be managed in accordance with the guidelines outlined in Section 5.1.7 of the RI/RAA Work Plan. Supplemental sampling of the IDW is anticipated in order to obtain approvals from appropriate disposal and/or recycling at an authorized solid waste management facility or publicly owned wastewater treatment works (liquids). The following protocols likely apply to IDW sampling:

- The objective of IDW sampling is to characterize a substantial mass of waste requiring disposal. Consequently, the sample should be collected in a manner that is representative of the entire waste mass and not limited to a specific zone of concern or observed contamination.
- Grab samples may be composited to form one sample for laboratory analyses.

3.11 CONFIRMATORY SAMPLING PROCEDURES FOR IRM

Confirmatory sampling will be conducted in accordance with the procedures outlined in Section 5.5 of DER-10. Once the UST has been removed from the subsurface, the excavation floor and sidewalls will be examined for physical evidence of soil or groundwater contamination. Field screening will be conducted along transects spaced no more than five feet apart, so that sampling may be biased to the suspected location of greatest contamination. The field screening will consist of screening soil samples collected from 0-1’ below/into the excavation floor and sidewalls with the excavator bucket with a PID using the headspace screening methodology outlined in Section 3.6 of the QAPP.

If soil screening results do not indicate evidence of a discharge from the UST (i.e., staining, petroleum type odors, PID readings greater than 25 ppm, etc.) confirmatory soil samples for laboratory analysis will be collected from the excavator bucket, using the methodology described in Section 3.5. These discrete soil samples will be collected from the approximate center line of the bottom of the excavation at a frequency equal to the total length of the tank (in feet) divided by five. The soil samples will be spaced equidistantly, and the outermost samples obtained will be greater than 2.5 feet from each respective end of the tank. If the total length of a tank in feet is not evenly divisible by five, one additional sample will be obtained for any fraction remaining.

If groundwater is encountered in the excavation, soil samples will be collected as follows:

- One soil sample (biased based upon field screening to the suspected location of greatest contamination) will be collected near or above the water table.
- One soil sample will be collected from the sidewall for every 30 linear feet of sidewall at a minimum rate of one sample per sidewall.
- Where seasonal fluctuations in the water table elevation can submerge and smear product over a range of several feet, the collection of additional samples will be collected in this ‘smear zone’ with input from the NYSDEC.
- A sample of the water in the excavation will also be collected using the conventional sampling techniques outlined in Section 3.9 of the QAPP.

If soil screening results indicate evidence of a discharge from the UST, excavation will continue until the contaminated soil is removed or until further excavation is no longer feasible. Once excavation is complete and if no groundwater is encountered, confirmation soil samples will be collected to demonstrate that contamination has been removed at a rate of 4 sidewall and 1 bottom sample for each 15 linear feet of trench (a minimum of 5 samples). The soil samples will be biased (based upon field screening) toward the suspected location of greatest contamination.

If there is any evidence of groundwater contamination, including a sheen or odor, or if groundwater is within 20 feet of the surface at the location of the excavation, a groundwater will be collected using the conventional sampling techniques outlined in Section 3.9 of the QAPP.

3.12 TANK CONTENTS SAMPLING PROCEDURES

Contained storage tanks located in discrete basement areas (i.e., basements/vaults) have been identified at the Site, located beneath the central and southern portions of the building. Prior to sampling the contents (if present) of each tank, the basement/ vault area will be assessed to determine if confined space entry procedures are warranted (refer to Section 3.13).

The contents of each tank will be sampled in accordance with the procedures outlined in the USEPA document *SOP#2010 Tank Sampling*, dated November 16, 1994, included as Attachment 7. A preliminary inspection of each tank will be conducted to assess the integrity of the tank body and potential sampling points prior to attempting to open a sampling port. Subsequent to opening a sampling port, air quality measurements will be collected from the headspace area within the tank using a flammable gas meter, PID, and CO/O_2 meter. If flammable gasses are detected, they will be vented from the tank using an explosion proof blower or comparable venting system.

The depth to each liquid and solid phase material will be measured using a Oil/water interface meter, tank measuring stick, or equivalent device. A sample of the tank contents will be collected using one of the sampling devices described in Section 7.4 of Attachment 7. It is anticipated that a discrete sample of each phase (i.e., solid, liquid, sludge, etc.) of material encountered in the tank will be collected for testing (if possible). Samples will be transferred from the sampling device directly into a laboratory supplied container and subsequently handled in accordance with Section 5.0 of the QAPP.

3.13 CONFINED SPACE ENTRY

Entry procedures into confined spaces will be completed in accordance with the requirements of 29 CFR 1910.146 (OSHA Permit-Required Confined Space Regulation). Only properly trained individuals shall be allowed to participate in confined space entries.

Permit-required confined spaces that may be entered require a written permit space program that complies with 29 CFR 1910.146 and Sol Epoxy, Inc. requirements. Prior to entry into a permit-required confined space, the conditions within the space will be evaluated to determine hazards present. Using a calibrated direct-reading instrument, the internal atmosphere of the space shall be tested for oxygen content, flammable gasses and vapors, and for potential toxic air contaminants. The internal atmosphere shall be classified as hazardous if the following parameters are met:

- Atmospheric oxygen concentration below 19.5% or above 23.5%;
- Flammable gas, vapor, or mist in excess of 10% of its lower flammable limit (LFL);
- Airborne combustible dust at a concentration that meets or exceeds its LFL;
- Any other atmospheric condition that is immediately dangerous to life or health.

The procedures corresponding to entry into a permit-required confined space may include, but are not limited to:

- Specifying acceptable entry conditions;
- Maintaining the means to contact rescue and emergency services;
- The entry supervisor shall ensure that all testing is documented and completed prior to entrance into a confined space, all entrants are properly authorized and adequate training has been provided to all required parties;
- Providing each authorized (i.e., permitted) entrant or that employee’s authorized representative with the opportunity to observe any monitoring or testing of permit spaces. All tests or monitoring results pertaining to the evaluation of a permit space shall be made available to all representatives and entrants;
- Isolating the permit space;
- Purging, inerting, flushing or ventilating the permit space as necessary to eliminate or control atmospheric hazards. The entrant may not enter the space until forced ventilation has eliminated any hazardous atmosphere.
- Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards an verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry;
- Providing proper monitoring, ventilating, communications lighting, ingress and egress, and rescue equipment for safe entry into a permit space;

- Providing an acceptable level of PPE as required by the hazards indentified in the permit space;
- Providing at least one attendant outside the permit space into which entry is authorized for the duration of the entry operations. The attendant shall have available the means to communicate any potential hazards to the entrant and rescue operators and assist in any rescue operations;
- If hazardous atmospheric conditions are detected during confined space entry operations the entrant shall immediately exit the space;

4.0 EQUIPMENT DECONTAMINATION PROCEDURES

In order to reduce the potential for cross-contamination of samples collected during this project, the following procedures will be implemented to ensure that the data collected (primarily the laboratory data) is acceptable.

It is anticipated that most of the materials used to assist in obtaining samples will be disposable one-time use materials (e.g., sampling containers, bailers, rope, pump tubing, latex gloves, etc.). However, when equipment must be re-used (e.g., drill rigs, static water level indicator, split spoon samplers, etc.), it will be decontaminated by at least one of the following methods:

- Steam clean the equipment within a dedicated decontamination area; or
- Rough wash in tap water; wash in mixture of tap water and Alconox-type soap; double rinse with deionized or distilled water; and air dry and/or dry with clean paper towel.

The effectiveness of the equipment decontamination of non-dedicated sampling equipment such as split-spoon samplers will be evaluated via analytical laboratory testing of field blanks (e.g., rinsate samples). Decontamination liquids and disposable equipment and PPE will be containerized and left on-site until a proper disposal method is determined.

5.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

During sampling activities, personnel will wear disposable latex or nitrile gloves. Between collection of samples, personnel performing the sampling will discard used latex gloves and put on new gloves to preclude cross-contamination between samples. As few personnel as possible will handle samples or be in charge of their custody prior to shipment to the analytical laboratory.

New laboratory-grade sample containers will be used to samples. Sufficient volume (i.e., as specified on Table 7.1 and Table 7.2 of the Spectrum QAP included in Attachment 2) will be collected to ensure that the laboratory has adequate sample volume to perform the specified analyses. Samples with zero headspace will be collected when VOC analysis is going to be performed. Samples will be kept on ice in a cooler for shipment to the analytical laboratory.

Samples will be preserved as specified by the analytical laboratory for the type of parameters and matrices being tested. The required amount of preservatives will be added by the analytical laboratory to the sample containers prior to delivery to the Site. The sample preservation requirements and holding times are also specified on Table 7.1 and Table 7.2 in Attachment 2.

Chain-Of-Custody

Samples that are collected for subsequent testing as part of this project will be handled using chain-of-custody control. Chain-of-custody documentation will accompany samples from their inception to their analysis, and copies of chain-of-custody documentation will be included with the laboratory's report. The chain-of-custody will include the date and time the sample was collected, the sample identity and sampling location, the requested analysis, and any request for accelerated turnaround time.

Sample Labels

Sample labels for field samples and QC samples with adhesive backing will be placed on sample containers in order to identify the sample. Sample information will be clearly written on the sample labels using waterproof ink. Sufficient sample information will be provided on the label to allow for cross-reference with the field sampling records or sample logbook.

The following information will be provided on each sample label:

Name of company;
Initials of sampler;
Date and time of collection;
Sample identification;
Intended analyses; and
Preservation required.

Custody Seals

Custody seals are preprinted adhesive-backed seals that are designed to break if disturbed. Seals will be signed and dated before being placed on the shipping cooler. Seals will be placed on one or more location on each shipping cooler as necessary to ensure security. Shipping tape will be placed over the seals on the coolers to ensure that the seals are not accidentally broken during shipment. Sample receipt personnel at the laboratory will check and document whether the seals on the shipping coolers are intact when received.

Sample Identification

The following format will be used on the labels affixed to sample containers to identify samples:

The sample test location will be provided using the following test location designations:

CS-xx	Confirmatory Sample
SS-xx	Surface Soil Sample
SV-xx	Soil Vapor Samples (i.e., sub-slab sample)
IN-xx	Indoor Air Sample
PSG-xx	Passive Soil Gas Sample
TB-1xx (x-x’)	Boring soil sample with depth interval in parentheses below ground surface in tenths of a foot (x – x’)
MW-X	Groundwater sample with monitoring well letter
TBxx/xx/xx-	Trip Blank sample with day/month/year
FBxx/xx/xx-	Field Blank sample (rinsate) with day/month/year

As an example, assuming the first project sample is a soil sample collected from a test boring TB-101 at a depth of 10 feet, the sample will be designated as TB-101(10’).

Transportation of Samples

Samples will be handled, packaged and shipped in accordance with applicable regulations, and in a manner that does not diminish their quality or integrity. Samples will be delivered to the laboratory no later than 48 hours from the day of collection.

6.0 ANALYTICAL LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Spectrum's analytical laboratory test results will be reported in NYSDEC Analytical Services Protocol (ASP) Category B deliverable reports. Analytical laboratory test results for soil samples will be reported on a dry-weight basis. Spectrum will make every effort to analyze the samples using the lowest practical quantitation limits (PQLs) possible for air, soil and groundwater samples (refer to Attachment 2 and attachment 3 in this QAPP). In addition, analytical laboratory results will be provided to the NYSDEC using the NYSDEC's Equis Format.

Spectrum will provide internal QA/QC checks that are required by NYSDEC ASP and/or USEPA contract laboratory protocol (CLP) protocol, such as analyses performed, spike blanks, internal standards, surrogate samples, calibration standards, and reference standards. Laboratory reports will be reviewed as outlined in the Spectrum QAP that is included in Attachment 2. Laboratory results will be compared to data quality indicators in accordance with the laboratory's QAP/SOP and the NYSDEC ASP.

Beacon's analytical laboratory test results will be reported in accordance with the reporting requirements of ISO 17025. Analytical laboratory test results will be analyzed using the lowest practical reported quantitation limits (RQLs). The report will include objectives, investigation plan, QA/QC program, laboratory data, base and isopleths maps, field procedures, laboratory procedures, Field Deployment Reports, and chain of custody documentation. Beacon's internal QA/QC program is outlined in the Beacon QSM that is included in Attachment 3.

Table 1 provides a summary of the analytical samples scheduled for collection and anticipated sampling parameters. The analytical methods to be used for each type of sample and sample matrix are identified on Table 1 and in the RI/RAA Work Plan. In order to provide control over the collection, analysis, review, and interpretation of analytical laboratory data, the following QA/QC samples will be included as part of this project.

<u>Spectrum</u>

- During the groundwater monitoring for VOCs, one trip blank will be included per set of 20 liquid samples with a minimum of one trip blank per sample shipment. The trip blanks will be analyzed for target compound list (TCL) VOCs.
- One matrix spike/matrix spike duplicate (MS/MSD) for each sample matrix, for each sampling event of 20 samples, or per shipment if less than 20 samples, within a seven-day period. Specific parameters that MS/MSD samples will be tested for is dependent upon the test parameters of the field samples that are being analyzed.
- One field blank (i.e., rinsate sample) will be collected from reusable sampling equipment for each sampling event of 20 samples, or per shipment if less than 20 samples. The field blank(s) will be tested for the suite parameters of the samples obtained using the subject re-useable sampling equipment (i.e. split spoon samplers).

Beacon

- One trip blank will be included for every 20 field samples collected. The trip blank(s) will be analyzed using modified EPA Method 8260C.

Data Usability Summary Report

It is anticipated that Environmental Data Validation Inc. (EDV) of Pittsburgh, Pennsylvania will complete a data usability summary report (DUSR) on the Category B deliverables analytical laboratory data that is generated as part of the scope of work in the RI/RAA work plan. The DUSR will be conducted in accordance with the provisions set forth in Appendix 2B of *DER-10, Technical Guidance for Site Investigation and Remediation* dated May 2010. The findings of the DUSR will be incorporated in the final RI/RAA report. A copy of EDV's *Quality Assurance/Quality Control Plan for Data Validation Services* is included in Attachment 8.

Reporting

Analytical and QC data will be included in the final RI/RAA report. The final report will summarize the environmental work and provide evaluation of the data that is generated, including the validity of the results in the context of QA/QC procedures.

7.0 RECORD KEEPING AND DATA MANAGEMENT

DAY will document project activities in a bound field book on a daily basis. Information that will be recorded in the field book will include:

- Dates and time work is performed;
- Details on work being performed;
- Details on field equipment being used;
- Field evidence of contamination such as staining, odors, degree of saturation, etc.
- Field meter measurements collected during monitoring activities;
- Sampling locations and depths measured in tenths of feet;
- Measurements of sample locations, and test locations, excavations, etc.;
- Personnel and equipment on-site;
- Weather conditions; and
- Other pertinent information as warranted.

In addition, the field notes will be converted into logs for each test pit excavation, soil test boring and monitoring well completed as part of the RI.

Differential GPS, swing ties from existing surveyed site structures, and/or a licensed surveyor will be used to collect spatial data. The spatial data will be plotted using integrated GIS and/or computer-aided design (CAD) mapping. Electronic and hard copy files will be maintained by DAY.

As noted above, DAY will utilize its Trimble Geo-XH sub-foot accuracy GPS with ESRI ArcPad installed software with GIS shape files that have been developed for the Site. A Trimble GeoBeacon will also be available for use to perform real-time differential correction during the fieldwork.

8.0 ACRONYMS

ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
Beacon	Beacon Environmental Services, Inc.
CAD	Computer-Aided Design
CAMP	Community Air Monitoring Plan
CLP	Contract Laboratory Protocol
DAY	Day Environmental, Inc.
DNAPL	Dense Non-Aqueous Phase Liquid
DUSR	Data Usability Summary Report
EDV	Environmental Data Validation, Inc.
ELAP	Environmental Laboratory Approval Program
EM	Electromagnetic
GPS	Global Positioning System
HASP	Health and Safety Plan
IDW	Investigation-Derived Waste
LFL	Lower Flammable Limit
LNAPL	Light Non-Aqueous Phase Liquid
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAD	North American Datum
NAPL	Non-Aqueous Phase Liquid
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSHA	Occupational Safety and Health Administration
PID	Photoionization Detector
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
PVC	Polyvinyl Chloride
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RI/RAA	Remedial Investigation/Remedial Alternatives Analysis
RQL	Reported Quantitation Limit
RTAM	Real-Time Aerosol Monitor
SOP	Standard Operating Procedure
SOQ	Statement of Qualification
Spectrum	Spectrum Analytical, Inc.
SVOC	Semi-Volatile Organic Compounds
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound

TABLE 1

Summary of Analytical Laboratory Testing

TABLE 1
SUMMARY OF ANALYTICAL LABORATORY TESTING
REMEDIAL INVESTIGATION QAPP

202 FRANKLIN STREET
OLEAN NEW YORK

TASK	PARAMETERS	METHOD	SAMPLE MATRIX	MAXIMUM ANTICIPATED # OF FIELD SAMPLES	TRIP BLANKS	MS/MSD OR MS/MD	FIELD BLANKS
Surface Soil Samples	TCL VOCs+TICs	8260	Soil	11	0	1	1
	TCL SVOCs+TICs	8270	Soil	11	0	1	1
	TCL PCBs	8082	Soil	11	0	1	1
	TCL Pesticides	8081	Soil	11	0	1	1
	TAL Metals	6010/7471	Soil	11	0	1	1
	Cyanide	9012	Soil	11	0	1	1
Test Pit Excavations	TCL VOCs+TICs	8260	Soil	10	0	1	1
	TCL SVOCs+TICs	8270	Soil	10	0	1	1
	TCL PCBs	8082	Soil	10	0	1	1
	TCL Pesticides	8081	Soil	10	0	1	1
	TAL Metals	6010/7471	Soil	10	0	1	1
	Cyanide	9012	Soil	10	0	1	1
Soil Borings	TCL VOCs+TICs	8260	Soil	5	0	1	1
	TCL SVOCs+TICs	8270	Soil	5	0	1	1
	TCL PCBs	8082	Soil	2	0	1	1
	TCL Pesticides	8081	Soil	2	0	1	1
	TAL Metals	6010/7471	Soil	5	0	1	1
	Cyanide	9012	Soil	2	0	1	1
Monitoring Well Sampling; assumes 2 rounds of groundwater samples	TCL VOCs+TICs	8260	Groundwater	14	2	2	2
	TCL SVOCs+TICs	8270	Groundwater	14	0	2	2
	TCL PCBs	8082	Groundwater	7	0	1	1
	TCL Pesticides	8081	Groundwater	7	0	1	1
	TAL Metals	6010/7471	Groundwater	7	0	1	1
	Cyanide	9012	Groundwater	7	0	1	1
Waste Characterization - Investigation Derived Waste (IDW)	Soil IDW waste characterization program will be determined prior to disposal, based on quantity and the testing requirements of the disposal facility.						
	Groundwater IDW waste characterization program will be determined prior to disposal, based on quantity and in accordance with the current City of Olean industrial wastewater permit for the Site.						

ATTACHMENT 1

Resumes of Key Personnel

RAYMOND L. KAMPFF

EXPERIENCE

Day Environmental, Inc.: May 1994 to present
Years with Other Firms: 18 years

AREAS OF SPECIALIZATION

- Environmental Site Assessment
- Environmental Restoration
- Geology

EDUCATION

University of Rochester, B. A. Geology 1974
Monroe Community College, Civil Engineering Technology 1976
Various continuing education courses/seminars in environmental regulations, remediation techniques and other technical issues

REGISTRATION/AFFILIATIONS

- 40-Hour OSHA Hazardous Waste Site Worker Training
- 8-Hour OSHA Hazardous Waste Site Supervisor Training
- 8 Hour OSHA Hazardous Waste Site Worker Refresher Training

RESPONSIBILITIES AND PROJECT EXPERIENCE

Mr. Kampff has over 30 years of professional experience and is currently responsible for the overall technical and administrative direction of DAY's Site Evaluation/Environmental Restoration Group. Mr. Kampff's experience includes environmental studies and remediation at inactive hazardous waste sites, industrial facilities, petroleum spill sites, Brownfield sites and municipal properties. Some of his representative projects are described below.

Environmental Site Assessment

Environmental Site Assessments and Facility Audits for an Automobile Manufacturer: various locations throughout the United States and Canada. Responsible for Phase I / Phase II Environmental Site Assessments, regulatory compliance evaluations and remedial activities (i.e., underground tank removal, in-situ treatment systems, etc.) at automobile dealerships and similar commercial facilities.

Site Evaluation and Groundwater Monitoring: MNR Stamford, Connecticut Facility. Responsible for long term monitoring and reporting of the effectiveness of a remedial system installed by others. Also evaluated the data collected to characterize the source of groundwater contamination and to provide recommendations for the modification of the remedial system.

Environmental Evaluation, Waste-To-Energy Facility: Niagara Falls, New York. Responsible for comprehensive studies done as part of a due diligence evaluation of this active waste-to-energy facility prior to its purchase. These studies included an evaluation of past operations to assess potential environmental concerns, a review of state and local regulatory compliance status and the implementation of site-specific studies/sampling to assess the current environmental status of the site.

Petroleum Spills

Underground Storage Tank and Spill Closures: Various MNR Facilities in New York and Connecticut. Assisted MNR representatives in the compilation and submittal of closure reports to the NYSDEC and CtDEP.

Former Bulk Petroleum Storage Facility, Mt. Morris, New York. Responsible for the completion of site investigations and the development of remedial options under the New York State Voluntary Cleanup Program pursuant to redevelopment. Historic operations at this facility resulted in numerous petroleum spills, which resulted from leakage of the underground piping system that connected process/storage tanks. Work included development of work plans/health and safety plans, completion of a hydrogeologic evaluation to define site conditions, evaluation of health risks and assessment of natural attenuation.

Site Characterization: Former Gasoline Station: Rochester, New York. Responsible for detailed studies conducted to evaluate the subsurface conditions and assess the nature and extent of petroleum-impacted soil and groundwater on this 5-acre property. Historically the property was utilized by various entities and it contained several gasoline stations/vehicle repair facilities. As part of the work completed, samples were collected and evaluated to determine the specific types of petroleum products and their estimated date of release. This information was used to assist in the development of clean-up options and cost recovery actions.

York Oil Superfund Site RI/FS: Moira, New York. Managed several studies to evaluate on-site contamination and off-site pathways at this former waste oil recycling facility where large quantities of PCB and solvent-laden oils spilled onto the ground and migrated into adjacent wetlands.

Brownfield and RI/FS Projects

Interim Remedial Measure (IRM) Construction, Confidential Industrial Client: Akron, New York. Responsible for construction oversight during the implementation of IRM activities at an approximate 3-acre former waste disposal area used to dispose of hazardous and industrial wastes. Work included construction oversight during waste consolidation and capping activities, coordination with the NYSDEC, implementation of design modifications and preparation of various closure reports.

Dry Cleaners: Jamestown, New York: Responsible for studies completed to evaluate the extent of chlorinated solvents in the soil and groundwater dry cleaning facility that has operated for the past 50 years and to develop and implement remediation schemes using enhanced biodegradation processes.

Remedial Investigation/Feasibility Study, Endicott Wellfield Superfund Site: Endicott, New York. Managed studies to evaluate the source and extent of volatile organic contamination (vinyl chloride) in a 7,000 gpm municipal well installed in thick glacial outwash deposits. Studies also included groundwater modeling and the development/evaluation of suitable remedial alternatives.

Environmental Restoration Projects

Remediation of Petroleum Contaminated Soils, DePaul Community Facilities: Rochester, New York. Responsible for the design and construction of a combined active and passive soil vapor extraction system at this facility being constructed on the site of a former gasoline station.

Track Platform Assessment and Encapsulation, Grand Central Terminal: New York, New York. Project Manager for a testing program designed to define the extent of PCB contamination and develop a comprehensive remedial program consisting of the initial cleaning of the impacted track area following by a double epoxy coating was required for this site. Due to the location of the site, care was taken to limit potential exposure to the public during remedial activities

Former Silver Stadium Redevelopment: Rochester, New York. Responsible for studies ranging from Phase I environmental site assessment through site characterization to define localized areas requiring subsequent remediation. Based upon the studies completed, areas of petroleum and solvent contamination were identified and a remedial program consisting of a limited soil removal, installation of a groundwater monitoring network, design/installation of vapor control systems and development of an Environmental Management Plan (EMP) was implemented to allow development of the site.

NATHAN E. SIMON, P.E.

EXPERIENCE

Day Environmental, Inc.: June, 2005 to present

AREAS OF SPECIALIZATION

- Environmental Site Assessment
- Environmental Restoration/Remediation
- Environmental Computer Modeling

EDUCATION

University at Buffalo, B. S. Civil Engineering, 2003
University at Buffalo, M. Eng. Environmental and Hydrosystems, 2005

REGISTRATION/AFFILIATIONS

Registered Professional Engineer in State of New York
40 Hour OSHA Hazardous Waste Site Worker Training
Various continuing education courses/seminars in environmental studies and remediation

RESPONSIBILITIES AND PROJECT EXPERIENCE

Mr. Simon's has approximately 4 years of professional experience working on environmental projects as a consultant. Mr. Simon is responsible for taking a leadership role in completing investigation and remediation projects for private and government agencies. Mr. Simon's experience includes: development of work plans in accordance with applicable regulations, corresponding with regulatory agencies and clients, completion of Phase II studies, environmental restoration, Brownfield and remediation projects. Specifically, Mr. Simon is responsibility has included, environmental investigation field activities and associated field documentation, report preparation, engineering design calculations, data management, remedial alternative evaluation and selection and project communication. Some of his representative projects are described below.

Dry Cleaners: Jamestown, New York: Responsible for field studies to evaluate the extent of chlorinated solvent contamination in the soil and groundwater from a dry cleaning facility that has operated for the past 50 years. In addition to writing sections of the remedial investigation report, work on this project included: compiling laboratory data from a sampling event and comparing the results to TAGM 4046 (*Determination of Soil Cleanup Objectives and Cleanup Levels*) and TOGS 1.1.1 (*Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations*) to determine the extent of contamination, developing a conceptual model, evaluating hydraulic conductivity testing data using the SuperSlug^R computer modeling program, completing calculations to estimate contaminant flow rates through the overburden and bedrock based on contaminant specific retardation factors and site specific aquifer characteristics, and designed a Zero-Valent Iron Permeable Reactive Barrier to address potential off-site contaminant migration. The project is on-going and currently in the process of designing/conducting pilot study for in-situ bioremediation.

Former Hazardous Waste Disposal Site: Rochester, New York. Completed hydrogeologic studies to determine the site specific relationship between pumping rate and radius of influence of several bedrock interface extraction wells. Designed an extraction well field to capture the delineated impacted area presented in the Site's Record of Decision (ROD). Determined extraction well specifications and locations using the step drawdown test results, aquifer characteristics and historical site data. Provided significant contributions to the Site's groundwater extraction and treatment remedial design plan. Oversaw the installation of additional bedrock interface wells to verify work was completed in accordance with the approved NYSDEC remedial design plan. Assisted in the installation, startup and routine maintenance, inspection and testing of a 5-gpm pump-and-treat groundwater remediation system designed to remove volatile organic compounds and chromium. Developed a Health and Safety Plan, Community Air Monitoring Plan and a Quality Assurance and Quality Control program to ensure worker and community safety during remedial system installation and that suitable and verifiable data was obtained throughout the remediation efforts. In addition, Mr. Simon developed a work plan to evaluate indoor air quality in accordance with the NYSDOH document titled "*Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*". Conducted a chemical survey and collected confirmatory indoor air samples in accordance with the NYSDOH and NYSDEC approved work plan and presented the results to the client and regulatory agencies.

Underground Storage Tank Closures: Various Clients throughout New York State. Decommissioned numerous Underground Storage Tanks (USTs) throughout New York State in accordance with the New York State Department of Environmental Conservation (NYSDEC) document titled "*Spill Prevention Operations Technology Series, Memo 14 (SPOTS 14*)" and the NYSDEC document titled "*Spill Technology and Remediation Series (STARS) Memo #1 (Petroleum Contaminated Soil Guidance Policy).* The work completed generally included developing and submitting a work plan to the NYSDEC, collection of confirmatory samples, documenting closure, compiling/tracking disposal documentation, evaluating analytical laboratory data and discussing the results with client and regulatory agencies.

Phase II Environmental Site Assessments – Various Clients throughout New York State. Completed numerous Phase II Environmental Site Assessments throughout New York State in accordance with requirements of the American Society for Testing and Materials (ASTM) Practice E 1903-97 (*Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process*) and the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) draft Document DER-10 (*Technical Guidance for Site Investigation and Remediation*). The Phase II projects were completed at various sites including: former gasoline stations, metal recycling facilities, commercial facilities, marinas, lumber yards, dry cleaners, former manufactured gas plants and former agricultural sites. Work generally included developing soil and groundwater sampling programs, evaluating and comparing data to applicable regulatory standards, and discussing the results with clients and regulatory agencies.

Indoor Air Evaluations – Various Clients throughout New York State. Completed numerous indoor air, sub-slab vapor, and soil gas evaluations throughout New York State in accordance with the requirements of the New York State Department of Health (NYSDOH) document titled "*Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*". The air evaluations were conducted at various sites including: manufacturing facilities, commercial facilities, light industrial facilities, former manufactured gas plants, former auto repair facilities, grocery stores and schools. Work generally included developing air sampling programs, conducting an owner interview and chemical survey, evaluating data and discussing the findings with clients and regulatory agencies. In addition, sites in which remediation of indoor was completed, work generally included developing and submitting a work plan to the New York State Department of Environmental Conservation (NYSDEC) and NYSDOH, conducting post-mitigation sampling (confirmatory testing) and post extension testing, and preparing and submitting summary reports to the regulatory agencies.

Subsurface and Indoor Air Evaluation – Commuter Railroad. Developed a test boring and monitoring well program, prior to the client purchasing the Manufactured Gas Plant (MGP) impacted Site, to evaluate the Recognized Environmental Conditions (RECs) identified in a modified Phase I Environmental Site Assessment in conjunction with historical site data and information collected during an EM-61 Geophysical survey. Conducted a supplementary subsurface investigation to delineate MGP-type waste in accordance with DER-10 (*Technical Guidance for Site Investigation and Remediation*), TAGM 4061 (*Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediments from Former Manufactured Gas Plants*), and the American Society for Testing and Materials (ASTM) Practice E 1903-97 (*Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process*). Compared analytical laboratory data collected during the Subsurface Study to New York State Department of Environmental Conservation (NYSDEC) TAGM 4046 (*Determination of Soil Cleanup Objectives and Cleanup Levels*) and TOGS 1.1.1 (*Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations*) soil and groundwater standards respectively. Conducted drain dye testing to determine discharge location of various drains within the on-site building. Estimated vertical and horizontal extent of MGP-type waste in the subsurface. Developed an opinion of probable cost to remediate the delineated volume of MGP-type waste. Performed an indoor air and sub-slab air evaluation in accordance with New York State Department of Health (NYSDOH) document titled: "*Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*". Oversaw the completion of an air communication test to aid in the design of a sub-slab depressurization (SSD) vapor mitigation system. Oversaw the installation of a SSD vapor mitigation system to verify installation was completed in accordance with design specifications. Conducted post SSD confirmatory indoor air testing to evaluate the effectiveness of the SSD system. Submitted a Final Engineering Report documenting the SSD system installation and confirmatory testing results to the NYSDEC and NYSDOH.

Metro North Railroads: Responsible for data management of daily, monthly and quarterly non-aqueous phase liquid (NAPL) measurements. These measurements are used to calculate NAPL recovery quantities that are reported on a quarterly or annually basis.

CHARLES A. HAMPTON

EXPERIENCE

Day Environmental Inc.: June 2008 to present
Years with Other Firms: 3 years

AREAS OF SPECIALIZATION

- Environmental Site Assessment
- Environmental Restoration
- Geographical Information Systems (GIS)

EDUCATION

Trinity University; B.S. Geology; 2000
Various continuing education seminars in Environmental Site Assessments and GIS

REGISTRATIONS/AFFILIATIONS

- OSHA Hazardous Waste Site Worker Training and Confined Space Training

RESPONSIBILITIES AND PROJECT EXPERIENCE

Mr. Hampton's current responsibilities include management of Phase II Environmental Site Assessments and ongoing environmental remediation projects. Mr. Hampton has over seven years of professional experience working on environmental projects as a consultant. Mr. Hampton has also performed various geotechnical and hydrogeologic tasks while working on projects as a consultant with other firms.

NYSDEC Supervised Projects: Responsible for coordination and execution of subsurface investigation activities and remedial tasks at multiple NYSDEC BCP, VCP, and SPILLS sites. Specific tasks include: project planning assistance, soil stratigraphy interpretation, groundwater monitoring and sampling, site surveys, waste disposal coordination, air monitoring, soil vapor intrusion investigation, and report preparation.

Site Redevelopment, Rochester New York: Responsible for the management of tasks required by a site-specific Environmental Management Plan implemented during the redevelopment of an urban property into multi-family residences. Work included management of continuous air monitoring during excavation activities, removal and disposal of petroleum-contaminated fill material, and the preparation of reports documenting the various tasks implemented at the site.

Tank Removal, Rochester New York: Responsible for coordination, observation and documentation of the removal of multiple underground storage tanks at a former gas station site. Tasks included coordination of subcontractors, confirmatory sampling, and the preparation of tank removal documentation.

Fill Removal, Rochester, New York: Responsible for the oversight of removal of arsenic contaminated fill material at a former sewage treatment plant location. Work included intrusive investigations and sampling to quantify the extent of contamination, confirmatory sampling during soil removal, and the preparation of a report to document the removal.

Phase I Assessments, Washington State: Conducted Phase I Environmental Site Assessments for the purpose of real estate transactions. These assessments were conducted on a variety of different types of facilities including agricultural, residential, commercial, and industrial properties.

Phase II Assessments, Washington State: Conducted Phase II Environmental Site Assessments for the purpose of contaminant identification and categorization. These assessments were conducted on a variety of different types of facilities including agricultural, residential, and commercial properties.

Geotechnical and Hydrologic Investigations, Washington State: Staff Geologist responsible for various investigations to determine geotechnical and hydrogeologic site properties for residential and commercial development.

WILLIAM D. BATISTE

EXPERIENCE

Day Environmental, Inc.: June 2011 - Present

AREAS OF SPECIALIZATION

- Field Technician

EDUCATION

Rochester Institute of Technology, B.S. Environmental Management and Technology 2006-2011

REGISTRATIONS/AFFILIATIONS

- 40 Hour OSHA Hazardous Waste Site Worker Training
- 8 Hour OSHA Hazardous Waste Site Worker Refresher Training

RESPONSIBILITIES AND PROJECT EXPERIENCE

Mr. Batiste has been trained in the sampling of different media using various techniques, chain of custody procedures and other attributes applicable to site needs. Mr. Batiste has performed monthly sampling of wastewater for compliance testing, low flow groundwater testing, soil classification, groundwater monitoring, well installation, development, and sampling. Mr. Batiste has had extensive experience with use and maintenance of environmental testing equipment, including PID, FID, Horiba, Herron, handheld Geographic Information Systems (GIS) units, and air quality dust meters. Some projects Mr. Batiste has been involved in are described below.

Metro North, Beacon Station, NY: - Responsibilities included plotting borehole locations utilizing GIS equipment followed by handheld geo-probing, soil classification and sampling. Soil screening and temporary well installation were also tasks carried out by Mr. Batiste.

Soil Removal Oversight, Rochester, NY: - Responsibilities included the oversight of removal of contaminated soils. Work included scanning soils with a photoionization detector, and coordinating with sub-contractors.

Fernwood Site, Rochester, NY: - Responsibilities included low flow sampling and the periodic removal of free product from monitoring wells to evaluate site conditions.

Andrews St, Rochester, NY: Responsibilities included overseeing onsite remedial investigation activities such as test pits, test borings (overburden and rock cores), and conducting low flow sampling.

Waste Water Sampling, Western NY: - Responsibilities include coordination and execution of monthly sampling of wastewater treatment systems to assess the effectiveness of water treatment before discharge.

ZACHARY J. TENNIES

EXPERIENCE	**AREAS OF SPECIALIZATION**
Day Environmental, Inc.: August 2013 - Present	- Field Technician - Technical Specialist

EDUCATION

The University of Chicago, B.S. Geophysical Sciences, June 2012

REGISTRATIONS/AFFILIATIONS

- 40-hour OSHA Hazardous Waste Site Worker Training

RESPONSIBILITIES AND PROJECT EXPERIENCE

Mr. Tennies' current responsibilities include conducting Phase II Environmental Site Assessments and developing industrial compliance programs. Mr. Tennies has been educated and trained in soil classification, soil and groundwater sampling, low flow groundwater testing, passive diffusion bag (PDB) sampling, groundwater monitoring, and test well installation and development.

<u>Phase II Environmental Site Assessment, Rochester, New York</u> Responsibilities included the oversight of drilling and test well installation operations at the site. Soil classification, screening of material with a photoionization detector (PID), soil and groundwater sampling and observation of a sump pit and oil-water separator were also carried out by Mr. Tennies.

<u>Groundwater and Wipe Sampling, Rochester , New York</u> Responsibilities included performing monitoring well development and sampling as well as surface wipe sampling.

<u>Phase II Environmental Site Assessment, Olean , New York</u> Responsibilities included the oversight of drilling and test well installation operations at the site. Soil classification, screening of material with a photoionization detector (PID) and soil and groundwater sampling were also carried out by Mr. Tennies.

Test Pit Excavations, Manchester, New York Responsible for the oversight of test pit excavations to quantify the extent of contamination at the site. Screening of material with a PID, documenting of test pits and collecting soil samples were tasks also required of Mr. Tennies.

Passive Diffusion Bag Sampling, Rochester, New York Responsible for the deployment of PDB samplers in 34 groundwater monitoring and overburden rock wells. Mr. Tennies also conducted the retrieval, processing, labeling and shipment of the PDB samplers after the sampling period.

ATTACHMENT 2

SPECTRUM Quality Assurance Plan

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY
Rhode Island Division

QUALITY ASSURANCE PLAN
2012

Approved By:

Digitally signed by Hanibal C. Tayeh
Date: 2012.10.09 14:40:39 -04'00'

10/09/2012

Hanibal C. Tayeh, Ph. D.
President, and CEO

Date

Yihai Ding

10/09/2012

Yihai Ding
Laboratory Director

Date

Sharyn B Lawler

10/09/2012

Sharyn B. Lawler
Quality Assurance Director

Date

EFFECTIVE DATE: 10/26/2012

646 Camp Ave. North Kingstown Rhode Island 02852 401-732-3400 · FAX 401-732-3499
www.spectrum-analytical.com

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Appendices

3.0 INTRODUCTION

Spectrum Analytical, Inc. Featuring Hanibal Technology Rhode Island Division (formerly MITKEM and referenced as Spectrum Analytical, Inc. RI Division throughout this document going forward) is an environmental testing laboratory dedicated to providing high quality analytical data and exceptional customer service.

Opened in 1994, as Mitkem Corporation, and purchased by Spectrum Analytical, Inc. in 2007, Spectrum Analytical, Inc. RI Division's laboratory facility is designed for high throughput and efficient laboratory operations. Separate secure areas are dedicated to sample receipt and storage. Spectrum Analytical, Inc. RI Division has individual sample preparation laboratories for organic and inorganic analyses and individual instrumentation rooms for extractable organics, volatiles, metals and wet-chemistry analyses.

Spectrum Analytical, Inc. RI Division recognizes the importance of controlling in-house cross contamination. The organic preparation area and the volatile organic instrument room are in separate areas, at opposite ends of the building to minimize solvent contamination of the volatile analysis. The air handling system in the volatiles laboratory is completely isolated from the remainder of the facility. A floor plan of the facility is included (Figure 3-1).

Spectrum Analytical, Inc. RI Division has placed a priority on obtaining and operating a large fleet of the latest, most sophisticated Hewlett-Packard, Thermo Scientific and Perkin-Elmer instruments. This emphasis on instrumentation enables the lab to operate at a high level of analytical efficiency.

Spectrum Analytical, Inc. RI Division specializes in performing laboratory analyses using the newest US EPA Contract Laboratory Program (CLP) *SOM* Organic and *ISM* Inorganic methods, as well as providing CLP-format data reports for virtually any test we perform. Spectrum Analytical, Inc. RI Division provides CLP-format reporting for EPA CLP, SW-846, MCAWW and Standard Methods analyses. Much of this work is performed by the laboratory under Department of Defense Quality Systems Manual (QSM) and ISO-17025 guidelines. Spectrum Analytical, Inc. RI Division has the flexibility to provide project-specific custom method modifications to meet the needs of a unique client or analytical requirement.

Spectrum Analytical, Inc. RI Division has participated in numerous environmental laboratory programs for both state and federal agencies including: the United States Navy, the United States Army Corps of Engineers, and the Air Force Center for Environmental Excellence. In addition Spectrum Analytical, Inc. RI Division is currently providing laboratory services under the United States Environmental Protection Agency Contract Laboratory Program. Spectrum Analytical, Inc. RI Division has been a contractor to the EPA under the CLP program continuously for over 15 years.

Spectrum Analytical, Inc. RI Division is a division of Spectrum Analytical, Inc. of Agawam, Massachusetts. Spectrum Analytical, Inc is an environmental laboratory company with laboratory locations in Agawam, MA, North Kingstown, Rhode Island and Tampa, Florida, providing analyses of soil, water and air samples for a wide variety of private and government clients.

This Quality Assurance Plan (QAP) describes the policies, organization, objectives, and quality control activities. It also specifies quality assurance functions employed at Spectrum Analytical, Inc. RI Division and demonstrates our dedication to the production of accurate, consistent data of known quality. This QAP is developed by following the guidelines discussed in the EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5, Reissued May 2006: EPA Requirements for Quality Management Plans, EPA QA/R-2, Reissued May 2006: Department of Defense (DOD QSM) Quality Systems Manual for Environmental Laboratories Version 4.2: and the National Environmental Laboratory Accreditation Conference (NELAC) standards, June 5, 2003 (Effective July 1, 2003)/ The NELAC Institute (TNI) Standards.

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

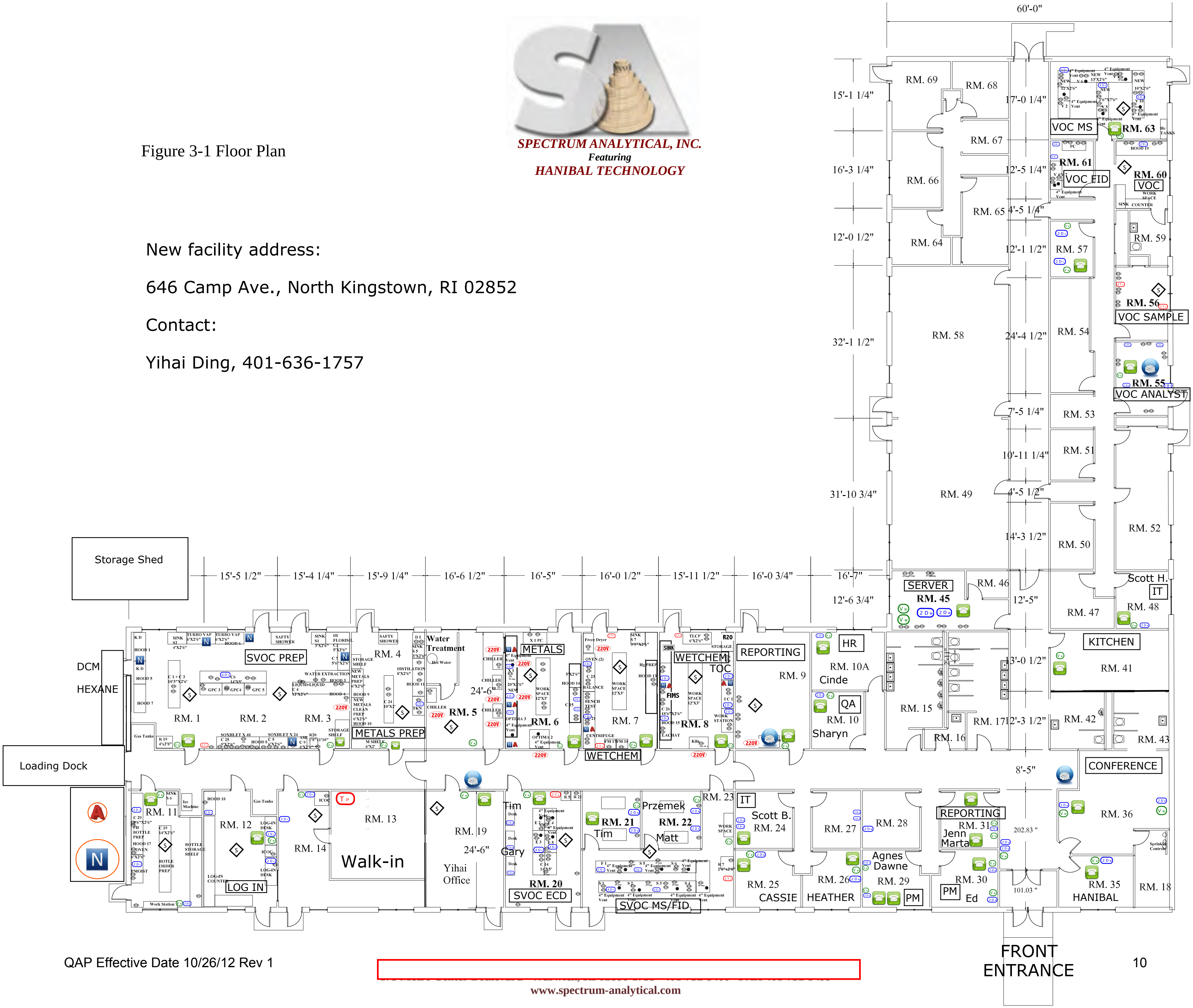
Figure 3-1 Floor Plan

New facility address:

646 Camp Ave., North Kingstown, RI 02852

Contact:

Yihai Ding, 401-636-1757



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www.spectrum-analytical.com

4.0 QUALITY ASSURANCE POLICY STATEMENT

Spectrum Analytical, Inc. RI Division is firmly committed to the production of valid data of known quality through the use of analytical measurements that are accurate, reproducible and complete. To ensure the production of such data, Spectrum Analytical, Inc. RI Division has developed a comprehensive Quality Assurance/Quality Control Program that operates throughout the entire organization.

Spectrum Analytical, Inc. RI Division Management considers Quality Assurance/Quality Control to be of the highest importance in the success of its Analytical Testing Laboratory and therefore fully supports the staff in the implementation and maintenance of a sound and thorough Quality Assurance Program.

Spectrum Analytical, Inc. RI Division’s corporate success is based on its participation in the most rigorous and quality-focused environmental testing programs, such as the EPA Contract Laboratory Program, US Department of Defense programs, NELAC, and other nationwide and state-specific certification and approval programs. These programs require consistent application of the QA/QC procedures described in this document. Spectrum Analytical, Inc. RI Division’s ability to demonstrate and document that analyses were performed in this manner is one of the foundations of its business. The other foundation of its business is to provide superior levels of customer service, above and beyond the norm for laboratories performing at this level of quality.

Spectrum Analytical, Inc. RI Division’s approach to customer service is to aggressively meet or exceed customer expectations, particularly in terms of turnaround time for results. While the production of rapid turnaround time data may require lab employees to “go the extra mile” for the customer, without quality, the data are useless. Spectrum Analytical, Inc. RI Division constantly strives to manage its business to rapidly provide data to meet all the requirements of its quality program.

- Spectrum Analytical, Inc. RI Division management works to insure: that employees understand the primary importance of quality in its day to day operations,
- that employees will not be subjected to pressure to sacrifice quality for turnaround, financial or other considerations,
- that employees understand the importance of their ethical responsibilities in terms of data manipulation, falsification or other illegal or improper actions,
- that the company avoids involvement in activities that diminish its competence, impartiality, judgment or operational integrity.
- that employees maintain all client information in a confidential manner, and
- that employees understand that any short-term gain realized by disregarding the QA/QC program will be more than wasted by the serious penalties for these actions.
- That the laboratory has the technical personnel to identify occurrences of departure from the quality system and to initiate actions to prevent or minimize such departures.

All employees receive training in these issues as part of the initial orientation process, and are required to acknowledge that they understand their responsibilities in these areas. These issues are also discussed among all laboratory staff at company meetings and re-training sessions. The QA Officer, Technical Director and other senior management are readily available to all staff through their daily presence, "open door" policy and approachable manner. This allows any employee to readily discuss any questions, concerns or issues that may occur.

Quality Control is defined as an organized system of activities whose purpose is to demonstrate that quality data are being produced through documentation. Quality Assurance is more broadly defined as a system of activities designed to ensure that the quality control program is actually effective in producing data of the desired quality.

Quality Control is included as part of Quality Assurance. In supporting government regulatory and enforcement proceedings, a high degree of attention to quality is essential. Thorough application of quality control principles and routine quality assurance audits is required.

The basic components of the Spectrum Analytical, Inc. RI Division's QA/QC Program are control, evaluation and correction.

Control ensures the proper functioning of analytical systems through the implementation of an orderly and well-planned series of positive measures taken prior to and during the course of analysis including quality control practices, routine maintenance and calibration of instruments, and frequent validation of standards.

Evaluation involves the assessment of data generated during the control process. For example, precision and accuracy are determined from the results of duplicates and spikes, and other check samples. Long-term evaluation measures include performance and systems audit conducted by regulatory agencies, as well as the lab's quality assurance department.

Correction includes the investigation, diagnosis and resolution of any problems detected in an analytical system. Proper functioning of the system may be restored through method re-evaluation, analysis of additional check samples, trouble-shooting and repair of instrumentation or examination and comparison with historical data. Corrective actions are documented and reviewed to make sure they are implemented.

Certain situations may occur when there are occasional departures or exceptions from documented policies and procedures or standard specifications due to client or project specific protocols, unusual sample matrix, or special non-target analyte or non-routine analyses. Spectrum Analytical, Inc. RI Division's policy is to fully document all such procedures and their associated QC, and notify the client or regulatory agency. If the situation is to continue, a Standard Operating Procedure will be written and implemented.

5.0 QUALITY ASSURANCE MANAGEMENT, ORGANIZATION AND RESPONSIBILITY

Quality Assurance at Spectrum Analytical, Inc. RI Division is a company-wide function that depends on:

(1) cooperative working relationships at all levels within the laboratory and

(2) Multi-level review through all working levels of responsibility.

Responsibilities for QA/QC functions begin with the bench scientist and extend to the chief executive officer.

The primary level of quality assurance resides with the bench scientist. After completion of the documented training program, his/her responsibilities include:

- complying with all aspects of formally approved analytical methods and SOPs,
- carefully documenting each step of the analytical process,
- conscientiously obtaining peer review as required,
- promptly alerting laboratory supervisors and/or QA staff members to problems or anomalies that may adversely impact data quality, and
- participation in corrective actions as directed by the laboratory supervisor or QA Director.

The Manager of each laboratory department is responsible for ensuring thorough oversight of the quality of the data generated by the department supervisors, technicians and/or analysts. The Department Manager implements and monitors the specific QC protocols and QA programs with the laboratory to ensure a continuous flow of data meeting all control protocols and Spectrum Analytical, Inc. RI Division QA requirements. The Department Manager’s responsibilities include providing the technicians and/or analysts with adequate resources to achieve the desired quality of performance.

The Spectrum Analytical, Inc. RI Division organizational structure is shown in the Organization Chart (Figure 5-1).

Spectrum Analytical, Inc. RI Division’s lines of communication flow upward on the Organizational Chart. The open door policy allows all employees’ access to anyone on the organization chart. If an employee has an issue with his/her immediate supervisor, he or she may, at any time, speak with someone in management higher up in the Organizational Chart.

Implementation of the entire Quality Assurance Program is the responsibility of the QA Director. While interacting on a daily basis with laboratory staff members, the QA Director remains independent of the laboratories and reports directly to the Laboratory

Director. The QA Director evaluates laboratory compliance with respect to the QA program through informal and formal systems and performance audits as described in Section 13. Remedial action, to alleviate any detected problems, is suggested and/or discussed with the appropriate parties and implemented when necessary.

With input from the appropriate staff members, the QA Director writes, edits and archives QA Plans, QC protocols, and Standard Operating Procedures (SOPs) in accordance with US EPA approved methodologies, and GLP procedures. If site-specific or project-specific QA Plans and/or QC protocols are required, these will be generated as needed.

An essential element of the QA program is record keeping and archiving all information pertaining to quality assurance including QA/QC data, pre-award check sample results, performance test sample results, scores, and follow-up; state certifications of the laboratory; external and internal audits with resolution of EPA and other audit team comments, recommendations and reports. The QA Director also plays an important role in the corrective action mechanism described in Section 16.

In addition, the QA Director works with laboratory staff and management to continuously upgrade procedures and systems to improve the laboratory's efficiency and data quality.

Ultimately, the success of the QA program depends on the cooperation and support of the entire organization. Spectrum Analytical, Inc. RI Division's most valuable resource is its staff of dedicated professionals who take personal pride in the quality of their performance.

Laboratory management works to ensure the competence of all who operate equipment, perform tests and calibrations, evaluate data and sign reports. When employees are in training, appropriate supervision will be provided until the employee has demonstrated the appropriate level of understanding, training, and skill.

Spectrum Analytical, Inc. RI Division's personnel job descriptions:

Responsibilities of each staff area in the laboratory include:

Technician / Preparation Laboratory Areas:

- Analysis of samples through compliance with all aspects of formally approved analytical methods and laboratory SOPs.
- Carefully documenting each step of the analytical process.
- Noting in the appropriate logbook area any unusual occurrences or sample matrix problems.
- Conscientiously obtaining peer review as required.

- Promptly alerting laboratory supervisor, Department Managers and/or QA staff members to problems or anomalies that may adversely impact data quality.
- Routine housekeeping duties for their laboratory area.

Analyst / Instrument Laboratory Areas:

- Analysis of samples through compliance with all aspects of formally approved analytical methods and laboratory SOPs.
- Routine maintenance of instrumentation.
- Preparation of analytical standards and spiking solutions which are documented and traceable to their original source.
- Carefully documenting each step of the analytical process.
- Noting in the appropriate logbook area any unusual occurrences or sample matrix problems.
- Conscientiously obtaining peer and Department Manager review as required.
- Promptly alerting the appropriate Department Manager and/or QA staff members to problems or anomalies that may adversely impact data quality.
- Documenting the initial review of analysis data to determine compliance with established company QA/QC protocols and any project-specific QA criteria, and noting any unusual occurrences or discrepancies on the data review checklist.
- Routine housekeeping duties for their laboratory area.

Data Reporting Specialists:

- Assemble CLP-format data reports by organizing data report forms and raw data in proper order to allow for technical data review.
- Enter data into LIMS or other data reporting computer programs, and print report forms as appropriate.
- Provide non-technical typographical review of data entered into computer systems by other individuals.
- Deliver data reports to customers by FAX or electronic mail.
- Paginate, photocopy, scan, save to CD (bookmark if required) and archive copies of customer reports or other documentation to be retained by the laboratory, or prepare paperless reports.
- Ship, or organize for courier delivery, final data reports to customers.
- Assist the QA Director in management of the document control system.
- Assist Project Managers with bottle order requests and shipment of coolers.
- Assist Project Managers in other tasks as required.

Laboratory Department Manager/Supervisors:

- Oversight of supervisors (where applicable), technicians and/or analysts in their laboratory areas.

- Monitors the status of all work in their laboratory area to insure compliance with holding time and turnaround time requirements.
- Training new scientists in the appropriate procedures and methods in the laboratory.
- Works with Laboratory Director and the QA staff to review, revise and implement SOPs.
- Insures adequate resources to perform the needed tasks by working with administrative personnel to order needed supplies.
- Insures all supplies and reagents meet the QC requirements of their intended task prior to their use in the laboratory.
- Insures all staff are using proper safety protocols.
- Works with Laboratory Director on the annual review of personnel performance.
- Interviews prospective new employees to insure they have the minimal level of qualifications, experience, education and skills necessary to perform their tasks, as well as the appropriate work ethic and social skills necessary for proper teamwork and productivity.
- Review of analytical data to insure compliance with method/SOP requirements prior to release to the client.
- Documents any non-compliance or other unusual occurrences noted during sample analysis and data review such that these can be included in the report narrative and explained to the client.

Data Reviewer:

- Review of analytical data to insure compliance with method/SOP requirements prior to release to the client.
- Generates paperless CLP and CLP-like data packages.
- Documents any non-compliance or other unusual occurrences noted during sample analysis and data review such that these can be included in the report narrative and explained to the client.
- Compiles narrative.
- Assist Laboratory Director, Supervisors and Department Managers in other tasks as required.

Laboratory Director:

- Works with Department Managers to coordinate laboratory areas in the completion of analytical projects.
- Review of analytical data to insure compliance with method/SOP requirements prior to release to the client.
- Works with QA Director to implement new SOPs and to annually review and revise existing SOPs.
- Works with the QA Director, Department Managers and Supervisors to develop and implement corrective action when needed.

- Works with management and supervisory staff to continuously improve the quality and efficiency of all company procedures.
- Assists Department Managers in the annual review of personnel performance.
- Supervises all Management, QA and Supervisory staff to insure compliance with company QA policies and other company procedures.
- Provides technical assistance to all areas of the laboratory staff.
- Acts as technical consultant for chemistry related issues that arise in the lab.
- Provides assistance with instrument optimization or performance issues as needed.
- Offers input on the purchase and operation of new instrumentation.
- Trains other analysts in procedures and methodologies.

Director of Business Development

- Pursues new contracts/projects as well as clients.
- Works with Spectrum Marketing to prepare Bids.
- Ensures laboratory is aware of specific requirements of new projects/contracts.
- Works with clients to insure all questions and concerns are addressed and answered.
- Works with clients to insure their understanding of complex technical issues.
- Works with Quality Services Department staff to continuously improve the quality and efficiency of all company procedures.

Data Reporting Supervisor:

- Works with Laboratory Director, Department Managers and Supervisors to prioritize and coordinate laboratory areas in the timely completion of analytical projects.
- Review of analytical data to insure compliance with method/SOP requirements prior to release to the client.
- Writes project report narratives to document any unusual occurrences noted during sample analysis.
- Works with management and supervisory staff to continuously improve the quality and efficiency of all company procedures.
- Works with Laboratory Director on the annual review of personnel performance.

Project Manager:

- Works with the client to completely understand the requirements of all incoming work.
- Evaluates the client’s requirements as compared to the abilities of the laboratory as stated in Standard Operating Procedure (SOP) #110.0023 Project Management.
- Works with the Data Reporting staff to continuously improve the quality and efficiency of all company procedures.

- Communicates the customer's requirements to all laboratory staff working on the project.
- Works with the customer to determine the number and type of sample containers required for the project.
- Works with the Sample Custodian to resolve and communicate to the client any problem or discrepancies with incoming samples.
- Maintains open, responsive and continuous communication with the customer.
- Follows up with the client to assess level of satisfaction, and insure all project goals have been accomplished.
- Assist Business Development and Marketing Staff in other tasks as required.

Information Technology Director:

- Oversees the operations of the three divisions of Spectrum Analytical, Inc. (MA, FL and RI). The IT Director's role is technical guidance, IT long term planning, coordination/communication between the divisions, oversees and makes the necessary decision to support the overall IT function.

Information Technology Manager:

Primary function is to oversee the operations of the Spectrum Analytical, Inc. RI Division's IT department.

- Oversee the operations of the network, including servers and workstations.
- Plan for hardware and software updates
  1) Support users IT needs.
  2) Support client IT needs.
  3) Oversee security of network
- Development and expansion of LIMS.
  1) Program new functionality into LIMS including program based protocols requirements
  2) hard copy reports
  3) electronic reports
  4) processing of data to web site
  5) tracking of data
  6) maintenance of LIMS
  7) security of LIMS
- Generate and troubleshoot more complex EDDs
- Provide backup for the Information Technology Specialist when out and support when it is needed.

Secondary function is to work with the other divisions to try and make transfer of information as seamless as possible. Lend technical support to other divisions and help to bring technical help from other divisions to Spectrum Analytical, Inc. RI Division IT department.

Information Technology Specialist:

- Primary duty is to generate and review EDDs using EDD module.
  a) Generate and validate EDDs using EDD specific tools (CRA, Tetra Tech, CH2M Hill, etc…).
  b) Generate all SEDD files for the EPA SOM contract, and work with the chemists to resolve any defects, if possible.
- Perform server room duties.
  a) Monitor the servers and troubleshoot (if needed)
  b) Perform backup/archive of data on servers
  c) File grooming at the end of the month
  d) Monitor event logs of the servers for issues.
  e) Monitor status of centralized anti-viral program (AVG). Includes monitoring AVG status of workstations
  f) Monitor centralized Windows System Update Server (WSUS). Includes monitoring WSUS status of workstations.
- Handles user issues with printer/scanner/copier systems from Ikon. Based on evaluation, schedule service calls or replaces consumable parts.

Quality Assurance Director:

- Implements the entire QA program.
- Interacts on a daily basis with laboratory staff.
- Evaluates compliance with the QA program through formal and informal reviews of data and processes.
- Implements the corrective action system.
- Maintains a master list of all SOPs and monitors review schedules.
- Works with Department Managers and Supervisors to implement new SOPs and to annually review and revise existing SOPs.
- Controls all master and controlled-copies of SOPs and QAP as per SOP #80.0012; Production of Standard Operating Procedures.
- Posts to intranet, and archives all old and edited revisions of SOPs and QA manual as per SOP# 80.0012; Production of Standard Operating Procedures.
- Interfaces with certification authorities and agencies to maintain existing certifications and programs, and obtain new certifications.
- Maintains records of employee training and certification as per SOP# 80.0016; Training Procedures and Tracking.
- Instructs laboratory personnel on ethics in the workplace.
- Oversees analytical trends that need to be evaluated and corrected.
- Oversees the implementation of MDLs and control limit studies.
- Directs the internal audit program as per SOP# 80.0006; Internal Audits.
- Coordinates all external audit corrective action reports and investigations.
- Maintains certification of NIST thermometers and weights.

- Schedules annual hood inspections and balance calibrations.

In Spectrum Analytical, Inc. RI Division’s organizational structure, the Laboratory Director has the ultimate authority for all chemistry-related aspects of the company.

The QA Director reports directly to the Laboratory Director. She has the authority within the management system to bring any issue to the highest levels of the company management and ownership, as well as to halt the release of data she believes to be questionable or suspend the performance of an analysis she believes to be unreliable.

The Director of Business Development works with the project managers and marketing staff and with the Department Managers and Supervisors to prioritize and coordinate work within the laboratories.

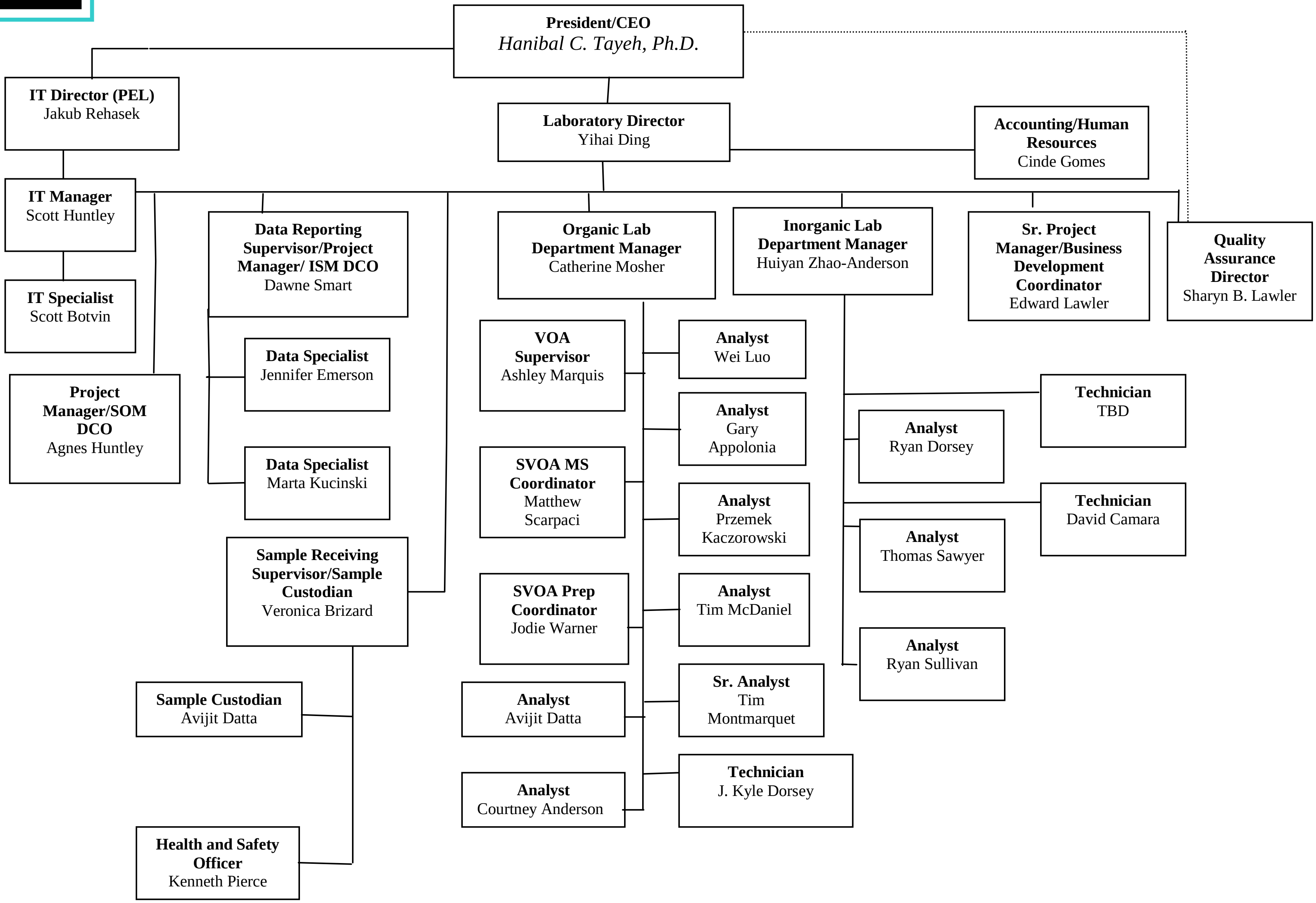
The personnel training records are located in the QA department on-site as well as additional training documents being saved in pdf form on the Spectrum network. All individual training is documented including new employee training, individual training, annual retraining procedures, and Health and Safety training.

Figure 5-1

SPECTRUM ANALYTICAL, INC. RI Division’s Organizational Chart

Spectrum
Analytical RI

Organizational Chart



6.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATION, COMPLETENESS AND COMPARABILITY AND QA REPORTING

As part of the evaluation component of the overall QA Program, laboratory results are compared with the data quality indicators defined as follows:

- Precision: the agreement of reproducibility among individual measurements of the same property usually made under identical conditions.

- Accuracy: the degree of agreement of a measurement with the true or accepted value.

- Representation: the degree to which data accurately and precisely represent a characteristic of a population, parameter variations of a sample of a finite process condition, or of a finite environmental condition.

- Completeness: a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions.

- Comparability: an expression of the confidence with which one laboratory data set can be compared with another laboratory data set in regard to the same property and laboratory sample population.

Quality Assurance objectives may vary by project and requested parameters. The accuracy, precision, and representation of data will be functions of the origins of the sample material, the procedures used to analyze sample and generate data, and the specific sample matrices involved in each project. Quality control practices utilized in the evaluation of these data quality indicators include blanks, replicates, spikes, standards, check samples, calibrations and surrogates. The process for quantifying or assessing the above indicators for data quality is addressed in Section 15.

6.1 Precision and Accuracy:

For each parameter analyzed, the QA objectives for precision and accuracy will be determined from:

- Published historical data;
- Method validation studies;
- Spectrum Analytical, Inc. RI Division’s experience with similar samples and/or;
- Project-specific requirements, such as those stipulated by the USEPA in the CLP protocols and control documents.

6.2 Representation:

Analytical data should represent the sample analyzed regardless of the heterogeneity of the original sample matrix. In most cases, representation is achieved by mixing the laboratory sample well before removing a portion for analysis. On occasion, multi-phase laboratory samples may require that each phase be analyzed individually and reported in relation to its proportion in the whole sample.

6.3 Completeness:

The completeness goal is 100% in all cases and includes:

- Analysis of all samples;
- Generation and analysis of all required QC samples;
- Sufficient documentation of associated calibration, tuning and standardization;
- Records of data reduction processes, including manual calculations.

While the laboratory staff is responsible for achieving the completeness objective stated above, assigning each project a specific project manager whose functions include sample management and tracking ensures completeness.

6.4 Comparability:

To assure comparability, Spectrum Analytical, Inc. RI Division employs established and approved analytical methods (e.g. USEPA protocols), consistent analytical bases (dry weight, volume, etc.) and consistent reporting units (mg/Kg, µg/L, etc.). Where data from different samples must be comparable, the same sample preparation and analysis protocols are used for all of the samples of interest.

6.5 QA Reporting

General QA procedures require that an MS/MSD or DUPLICATE/MS be reported with each sample batch up to 20 samples. In addition, each batch requires a method blank (MB) and laboratory control sample (LCS).

An acceptance criterion for the MB depends upon the method criteria. In-house control limits dictate the acceptability of the LCS in many methods. Several methods have set LCS control limits. A high bias LCS is considered acceptable if the analyte is not present in the samples above the reporting limit. A low bias LCS will require re-extraction (if sample volume allows) and re-analysis.

DUP, MS, and MSD recoveries and calculated RPDs are specified in the analytical methods. Recoveries outside the limits require some form of corrective action, whether that includes a post-digestion/distillation spike, re-extraction, re-analysis and/or notification to the client in the project narrative.

LIMS will flag any QA samples outside method criteria on the reporting forms. Formal written corrective action reports are required for any incident that does not meet method criteria and cannot be remedied or explained by the laboratory. The QA Officer signs off on any corrective actions and can also track QA trends in this manner.

7.0 SAMPLING PROCEDURES

For most projects, outside sampling teams deliver or send samples to Spectrum Analytical, Inc. RI Division's. When sampling by Spectrum Analytical, Inc. RI Division's personnel is required, the sampling team follows the sampling procedures outlined in the EPA *Test Methods for Evaluating Solid Wastes*, SW-846, 3rd Edition, or procedures found in the EPA "Handbook for Sampling and Sample Preservation of Water and Wastewater".

Appropriately prepared sample containers are supplied by Spectrum Analytical Inc., RI Division at clients' request. When required, preservatives are added to the sample containers. Tables 7-1 through 7-3 provide the Spectrum Analytical, Inc. RI Division Recommended Container, Preservation Techniques and Holding Times. Additional sample volumes may be required if additional QC functions are to be performed.

Holding times for SW846, CLP Methods, Standard Methods and certain USEPA methods are different and are presented in Tables 7-1 to 7-3. Holding times for most methods are calculated from the date of sample collection. Holding times for CLP methods are calculated from the Validated Time of Sample Receipt (VTSR). It should be noted that the CLP analysis program combines chemical analyses and contract compliance procedures in one document. For laboratory analysis and contract compliance purposes, holding times are calculated from VTSR, while post-analysis data usability and validation (generally performed by the client or a third party) compares holding times to the SW-846 method holding times calculated from date of sample collection.

Representative portions of samples are taken for analysis by following Spectrum Analytical, Inc. RI Division's SOP 110.0039 Standard Operating Procedure for Sub-Sampling.

Table 7-1

Recommended Container, Preservation Techniques and Holding Times For SW-846 Analyses

Analytes	Method	Containers	Required* Volume	Preservation	Holding Times
Volatile Organics					
Solid	8260, 5030	Amber glass jar with Teflon lining	Minimal head-space in jar	4°C	14 days
Solid [a]	8260, 5035	40mL vial or Encore with Teflon lining	5.0gram ± 0.5	4°C, unpreserved	48 hours
				DI Water -10 to –20^{0}C	14 days
				Sodium bisulfate -10 to –20^{0}C, 4^{0}C	14 days
				Methanol 4^{0}C	14 days
Aqueous	8260, 5030	40mL VOA Vials with Teflon septum	40mL	4°C HCl, pH<2	14 days
Semivolatile Organics					
Solid	3540, 3550 8270	Amber glass jar with Teflon lining	30gram	4°C	Extraction within 14 days Analysis within 40 days
Aqueous	3510, 3520 8270	Amber glass bottles with Teflon lining	1L	4°C	Extraction within 7 days Analysis within 40 days
Polychlorinated Biphenyls					
Solid	3540, 3550 8082	Amber glass jar with Teflon lining	30gram	4°C	Extraction within 14 days Analysis within 40 days
Aqueous	3510, 3520 8082	Amber glass bottle with Teflon lining	1L	4°C	Extraction within 7 days Analysis within 40 days
Organochlorine Pesticides					
Solid	3540, 3550 8081	Amber glass jar with Teflon lining	30gram	4°C	Extraction within 14 days Analysis within 40 days
Aqueous	3510, 3520 8081	Amber glass bottle with Teflon lining	1L	4°C	Extraction within 7 days Analysis within 40 days
Chlorinated Herbicides					
Solid	8151	Amber glass jar with Teflon lining	30gram	4°C	Extraction within 14 days Analysis within 40 days
Aqueous	8151	Amber glass bottle with Teflon lining	1L	4°C	Extraction within 7 days Analysis within 40 days

Table 7-1 (cont'd)

Recommended Containers, Preservation Techniques and Holding Times For SW846 Analyses

Analytes	Method	Containers	Required* Volume	Preservation	Holding Times
Total Petroleum Hydrocarbons					
Gasoline Range Organics, including Maine-GRO**					
Solid	8015, 5030 ME 4.1.17	Amber glass jar With Teflon lining	Minimal head-space in jar	4°C	14 days
Solid[a]	8015, 5035	40mL vial or Encore with Teflon lining	5.0gram ± 0.5	4°C, unpreserved	48 hours
				4°C, Methanol	14days
Aqueous	8015, 5030 ME 4.1.17	40mL VOA vials With Teflon septum	40mL	4°C HCl, pH<2	14 days
Diesel Range Organics, including Maine-DRO					
Solid	3540, 3550 8015 ME 4.1.25	Amber glass jar with Teflon lining	30gram	4°C	Extraction within 14 days Analysis within 40 days
Aqueous	3510, 3520 8015 ME 4.1.25	Amber glass bottle with Teflon lining	1L	4°C H_2SO_4, pH<2	Extraction within 7 days Analysis within 40 days
Total Metals except Mercury and Chromium (VI)					
Solid	3050 6010	Amber glass jar with Teflon lining	10g	4°C	180 days
Aqueous	3005, 3010	Polyethylene bottle	100mL	HNO_3, pH<2	180 days
Chromium (VI)					
Solid	3060, 7196	Amber glass jar with Teflon lining	10g	4°C	Digestion within 30 days Analysis within 96 hours
Aqueous	7196	Polyethylene bottle	25mL	4°C	24 hours
Mercury					
Solid	7471	Amber glass jar	10g	4°C	28 days
Aqueous	7470	Polyethylene bottle	100mL	4°C HNO_3, pH<2	28 days
Cyanide					
Solid	9012	Amber glass jar with Teflon lining	10g	4°C	14 days
Aqueous	9012	Polyethylene bottle	50mL	4°C NaOH, pH≥12	14 days
Flashpoint					
Aqueous	1010	Amber glass bottle	30mL	4°C	28 days

Table 7-1 (cont'd)

Recommended Containers, Preservation Techniques and Holding Times For SW846 Analyses

Analytes	Method	Containers	Required* Volume	Preservation	Holding Times
Chloride					
Aqueous	9056	Polyethylene bottle	50mL	4°C	28 days
Nitrate					
Aqueous	9056	Polyethylene bottle	50mL	4°C	48 hours
Nitrite					
Aqueous	9056	Polyethylene bottle	50mL	4°C	48 hours
Orthophosphate					
Aqueous	9056	Polyethylene bottle	50mL	4°C	48 hours
Sulfates					
Aqueous	9056	Polyethylene bottle	50mL	4°C	28 days

Table 7-2

Recommended Container, Preservation Techniques and Holding Times
For
CLP/ASP Analyses

Analytes	Method	Containers	Required* Volume	Preservation	Holding Times
Volatile Organics					
Solid	CLP/ASP	Amber glass jar with Teflon lining	Minimal head-space in jar	4°C	10 days from VTSR
Aqueous	CLP/ASP	40mL VOA vials with Teflon septum	40mL	4°C HCl, pH<2	10 days from VTSR
	CLP Low	40mL VOA vials with Teflon septum	40mL	4°C HCl, pH<2	10 days from VTSR
Semivolatile Organics					
Solid	CLP/ASP	Amber glass jar with Teflon lining	30gram	4°C	10 days from VTSR Analysis within 40 days
Aqueous	CLP/ASP	Amber glass bottle with Teflon lining	1L	4°C	5 days from VTSR Analysis within 40 days
	CLP Low	Amber glass bottle with Teflon lining	1L	4°C	5 days from VTSR Analysis within 40 days
Organochlorine Pesticide/PCB					
Solid	CLP/ASP	Amber glass jar with Teflon lining	30gram	4°C	10 days from VTSR Analysis with 40 days
Aqueous	CLP/ASP	Amber glass bottle with Teflon lining	1L	4°C	5 days from VTSR Analysis within 40 days
	CLP Low	Amber glass bottle with Teflon lining	1L	4°C	5 days from VTSR Analysis within 40 days
Cyanide					
Solid	CLP/ASP	Amber glass jar	10gram	4°C	12 days from VTSR
Aqueous	CLP/ASP	Polyethylene bottle	50mL	4°C NaOH, pH>12	12 days from VTSR
Total Metals except Mercury					
Solid	CLP/ASP	Amber glass jar	10gram	4°C	180 days from VTSR
Aqueous	CLP/ASP	Polyethylene bottle	100mL HNO_3, pH<2	4°C	180 days from VTSR

Table 7-2 (cont'd)

Recommended Container, Preservation Techniques and Holding Times For CLP/ASP Analyses

Analytes	Method	Containers	Required* Volume	Preservation	Holding Times
Mercury					
Solid	CLP/ASP	Amber glass jar	10gram	4°C	26 days from VTSR
Aqueous	CLP/ASP	Polyethylene bottle	100mL	4°C HNO_3, pH<2	26 days from VTSR

Table 7-3

Recommended Containers, Preservation Techniques and Holding Times for Other Analyses

Analytes	Method	Containers	Required* Volume	Preservation	Holding Times
Volatile Organics					
Aqueous	624	40mL VOA vials with Teflon septum	40mL	4°C HCl, pH<2	14 days
Semivolatile Organics					
Aqueous	3510, 3520 625	Amber glass bottle with Teflon lining	1L	4°C	Extraction within 7 days Analysis within 40 days
Organochlorine Pesticide/PCB					
Aqueous	3510, 3520 608	Amber glass bottle with Teflon lining	1L	4°C	Extraction within 7 days Analysis within 40 days
EDB/DBCP					
Aqueous	8011	40mL VOA vials with Teflon septum	35mL	4°C HCl, pH<2	28 days
MA Extractable Petroleum Hydrocarbons (EPH)					
Solid	3540, 3550 MADEP	Amber glass jar with Teflon lining	10gram	4°C	Extraction within 7 days Analysis within 40 days
Aqueous	3510, 3520 MADEP	Amber glass bottle with Teflon lining	1L	4°C HCl, pH<2	Extraction within 14 days Analysis within 40 days
MA Volatile Petroleum Hydrocarbons (VPH)					
Solid	MADEP	Amber glass jar with Teflon lining	10gram	4°C 10mL Methanol	14 days
Aqueous	MADEP	40mL VOA vial with Teflon lining	40mL	4°C HCl, pH<2	14 days
Total Metals excluding Mercury					
Aqueous	200.7, 200.8	Polyethylene bottle	100mL	HNO_3, pH<2	180 days
Mercury					
Aqueous	245.1	Polyethylene bottle	100mL	HNO_3, pH<2	28 days
Cyanide					
Aqueous	335.4	Polyethylene bottle	50mL	NaOH, pH>12	14 days

Table 7-3 (cont'd)

Recommended Containers, Preservation Techniques and Holding Times for Other Analyses

Analytes		Method	Containers	Required Volume*	Preservation	Holding Times
Chloride		E300.0	Polyethylene bottle	50mL	4°C	28 days
COD						
	Aqueous	SM5220D	Amber VOA vial	40mL	4°C H_2SO_4, pH<2	28 days
Color						
	Aqueous	SM2120B	Polyethylene bottle	50mL	4°C	Immediate
Nitrate						
	Aqueous	E300.0	Polyethylene bottle	50mL	4°C	48 hours
Nitrite						
	Aqueous	E300.0	Polyethylene bottle	50mL	4°C	48 hours
Orthophosphate						
	Aqueous	SM4500-P, E E300.0	Polyethylene bottle	50mL	4°C	48 hours
Total phosphate						
	Aqueous	SM4500-P B5,E	Polyethylene bottle	50mL 50mL	4°C H_2SO_4, pH<2	28 days
Phenols						
	Aqueous	SM5530B E420.1	glass	250mL	4°C H_2SO_4, pH<2	28 days
Sulfates						
	Aqueous	SM426 15th Ed. SM4500-SO4 E, E300.0	Polyethylene bottle	50mL	4°C	28 days
Sulfide Total						
	Aqueous	SM4500-S-D	Polyethylene bottle	50mL	4°C NaOH, pH>12 ZnAc	28 days
Reactivity						
	Solid	Chapter 7 SW846	Amber glass jar	10gram	4°C	28 days
	Aqueous	Chapter 7	Polyethylene bottle	250mL	4°C	28 days
Total Organic Carbon (TOC)						
	Solid	Lloyd Kahn Walkley-Black	Amber glass jar	10g	4°C	14 days

Table 7-3 (cont'd)

Recommended Containers, Preservation Techniques and Holding Times For Other Analyses

Analytes	Method	Containers	Required* Volume	Preservation	Holding Times
Total Organic Carbon					
Aqueous	SM5310B	40mL VOA vials	40mL	4°C H_3PO_4, pH<2	28 days
TKN					
Aqueous	SM4500Norg C	Polyethylene bottle or Amber glass bottle	50mL	4°C H_2SO_4, pH<2	28 days
Total Solids (TS)					
Aqueous	SM2540B	Polyethylene bottle	200mL	4°C	7 days
Total Dissolved Solids (TDS)					
Aqueous	SM2540C	Polyethylene bottle	200mL	4°C	7 days
Total Suspended Solids (TSS)					
Aqueous	SM2540D	Polyethylene bottle	200mL	4°C	7 days
Settleable Solids					
Aqueous	SM2540F	Polyethylene bottle	200mL	4°C	48 hours
Chromium (VI)					
Aqueous	SM3500 Cr+	Polyethylene bottle	25mL	4°C	24 hours
Alkalinity					
Aqueous	SM2320B	Polyethylene bottle	100mL	4°C	14 days
Ammonia					
Aqueous	SM4500NH3B	Polyethylene bottle	100mL	4°C H_2SO_4, pH<2	28 days
Oil & Grease					
Aqueous	1664	Amber glass bottle with Teflon lining	1L	4°C HCl, pH<2	28 days

* These represent minimum required volume. Additional sample volumes should be collected to minimize headspace loss for volatile analysis. Additional sample aliquots are also required to perform QA/QC functions (e.g. spikes, duplicates), % moisture for solid samples and sample re-analysis (if needed).

[a] For Massachusetts analyses, the Volatile Organics soil samples are preserved in Methanol in the field.

EPA SW-846 Method 5035 provides several options for preservation of soil samples for volatile organics. Certain projects have not adopted these options to-date, and continue to recommend the collection of unpreserved soil sample aliquots for volatiles analysis. Spectrum Analytical Inc., RI Division's preference for low-level analysis is to collect approximately 5 grams of soil into 5mL of organic-free DI water and to preserve by freezing within 48hours of collection. A separate container with approximately 5 grams of soil into 5mL of methanol is also collected for potential medium-level analysis. A separate container of unpreserved soil also must be collected to perform percent moisture analysis.

** Maine GRO soil analysis requires a medium level methanol extraction. A 10 gram sample and 10mL methanol volume is used.

8.0 SAMPLE CUSTODY

8.1 Chain of Custody:

Samples are physical evidence collected from a facility or the environment. In hazardous waste investigations, sample data may be used as evidence in (EPA) enforcement proceedings. In support of potential litigation, laboratory chain-of-custody procedures have been established to ensure sample traceability from time of receipt through the disposal of the sample.

A sample is considered to be in the custody under the following conditions:

- It is in an authorized person's actual possession, or
- It is in an authorized person's view, after being in that person's physical possession, or
- It was in an authorized person's possession and then was locked or sealed to prevent tampering, or
- It is in a secure area.

Chain-of-custody originates as samples are collected. Chain-of-custody documentation accompanies the samples as they are moved from the field to the laboratory with shipping information and appropriate signatures indicating custody changes along the way.

Laboratory chain-of-custody is initiated as samples are received and signed for by the Sample Custodian or his/her designated representative at Spectrum Analytical, Inc. RI Division. Documentation of sample location continues as samples are signed in and out of the designated storage facility for analysis in the several laboratory departments, using the Internal Chain of Custody (IntCOC) barcode system. After analysis, any remaining sample is held in the designated storage area to await disposal. Spectrum Analytical Inc., RI Division's policy is to hold spent samples for a period of at least thirty days from submittal of final report, unless other arrangements are agreed upon with the client. USEPA samples and empty containers are held for 60 days.

8.2 Laboratory Security:

Samples and all data generated from the analyses of samples at Spectrum Analytical, Inc. RI Division are kept within secure areas during all stages of residence, including the periods of time spent in preparation for analysis, while undergoing analysis, and while in storage.

The entire laboratory is designated as a secure area. The doors to the laboratory are under continuous surveillance, are kept locked after regular business hours and may only be accessed by key or keypad entry. Only authorized personnel are allowed to enter the secure areas. The laboratory facility and IT office are only accessed through keypad entry. A Spectrum Analytical, Inc. RI Division staff member must accompany visitors to the laboratory.

8.3 Duties and Responsibilities of Sample Custodian:

Duties and responsibilities of the Sample Custodian include:

8.3.1 Receiving samples.

8.3.2 Inspecting and documenting sample shipping containers for presence/absence and condition of:

8.3.2.1 Custody seals, locks, “evidence tape”, etc.;

8.3.2.2 Container breakage and/or container integrity, including air space in aqueous samples, or proper preservation for soil samples for Volatiles analysis.

8.3.3 Recording condition of both shipping containers and sample containers (cooler temperature, bottles, jars, cans, etc.).

8.3.4 Signing documents shipped with samples (i.e. air bills, chain-of-custody record(s), Sample Management Office (SMO) Traffic Reports, etc.)

8.3.5 Verifying and recording agreement or non-agreement of information on sample documents (i.e. sample tags, chain-of-custody records, traffic reports, air bills, etc.). If there is non-agreement, recording the problems, contacting the project manager for direction, and notifying appropriate laboratory personnel. (Client’s corrective action directions shall be documented in the case file.)

8.3.6 Initiating the paper work for sample analyses on laboratory documents (including establishing sample workorder files) as required for analysis or according to laboratory standard operating procedures.

8.3.7 Label samples with laboratory sample identification numbers and cross-referencing laboratory numbers to client numbers and sample tag numbers.

8.3.8 Scanning samples into the ICOC system.

8.3.9 Placing samples and spent samples into appropriate storage and/or secure areas.

8.3.10 Where applicable, making sure that sample tags are removed from the sample containers and included in the workorder file.

8.3.11 Where applicable, accounting for missing tags in a memo to the file or documenting that the sample tags are actually labels attached to sample containers or were disposed of, due to suspected contamination.

8.3.12 Monitoring storage conditions for proper sample preservation and prevention of cross-contamination.

8.3.13 Sending shipping containers with prepared sample bottles and sample instructions to clients who request them.

8.3.14 Calibrating the non-contact infrared temperature gun quarterly.

8.3.15 Disposal of samples after a specified time period determined by contract or client request.

8.4 Sample Receipt:

The Sample Custodian or his/her designated representative receives sample shipments at Spectrum Analytical, Inc. RI Division. Unless the shipment is a continuation of a previous workorder, a new workorder file is started for the sample.

The cooler is inspected for the following (if applicable) and findings are documented on the Sample Login Form (Figure 8.4-1) for USEPA CLP samples, and on the Sample Condition Form (Figure 8.4-2) for all other samples:

- Custody seal (conditions and custody number)
- Air bill (courier and air bill #)

The cooler is then opened and the following items are checked (in order). Make sure the hood is turned on when the cooler is opened.

- Chain of custody (COC) records (or traffic report). These are usually taped to the inside of the cooler cover.
- Radioactivity using the Geiger counter, which continuously monitors the receiving area for radiation
- Cooler temperature using the non-contact infrared temperature gun. Record the temperature of a temperature blank if available, using a calibrated thermometer. Record each temperature on the COC.

The Sample Custodian will perform the following:

- Remove the sample containers and arrange them in the same order as documented in the chain of custody report.
- Inspect condition of the sample containers.
- Assign laboratory sample ID and cross-reference the laboratory ID to the client ID.
- Remove tags and place in the workorder file.
- Check preservative and document in the Sample Condition Form (Figure 8.4-2) if needed. If additional preservative is needed, it is added at this time.
- Check for air bubbles in aqueous samples and for proper preservation and immersion of soil samples designated for volatile organic analysis.
- Ensure peer review occurs for proper cross-referencing and labeling of sample containers.

Any discrepancies or problems are noted in the Sample Condition Notification Form (Figure 8.4-3).

The sample custodian conveys the information to the project manager who will in turn inform the client, or may directly inform the client of the discrepancies.

Samples can be rejected at Spectrum Analytical, Inc. RI Division for any of the following reasons:

1. Complete and proper documentation was not sent with the samples.
2. Sample labels cannot be identified because indelible ink was not used during the sampling procedure.
3. Hold times had already been exceeded when samples arrived at the laboratory.
4. Inadequate sample volume.
5. Potential cross-contamination has occurred among samples.
6. Samples are inadequately preserved.
7. The samples or shipping container is badly destroyed during shipping.
8. The samples are potentially radioactive.
9. The samples represent untreated fecal waste for which Spectrum Analytical Inc., RI Division employees are currently not inoculated against.

In all instances, the client is contacted initially before any action is taken at Spectrum Analytical, Inc. RI Division.

The Sample Custodian signs the Sample Receipt Form and originates a file folder for the set of samples. The following forms are included in the file: the Sample Receipt Form, chain of custody records, shipping information, and an orange

Sample Condition Notification Form if any problems or discrepancies need to be addressed.

When the Sample Custodian is not available to receive samples, another lab staff member will sign for the sample container. The time, date and name of the person receiving the container are recorded on the custody records. In addition, the cooler temperature is measured and recorded on the Sample Condition Form. The samples are then stored in the centralized walk-in refrigerator in the sample receipt area. The sample receipt area is located in the secure central storage facility of the laboratory. VOA samples are stored in the VOA analysis laboratory. The samples are officially received and documented by the Sample Custodian or designee before the next business day.

At times, samples will be sent to another lab for analysis not performed at Spectrum Analytical, Inc. RI Division. These subcontracted analyses are performed by laboratories certified to perform the analyses. The use of a subcontractor laboratory is discussed with the client prior to sending samples, per Spectrum Analytical, Inc. RI Division's Project Management Standard Operating Procedure.

These samples are packed to prevent breakage and stored in a cooler in the walk-in or stored in the small refrigerator in the central storage facility. The samples are either hand delivered to a local sub-contract lab, or shipped with sufficient coolant to maintain a 4 degree temperature by air courier under Spectrum Analytical, Inc. RI Division's chain-of-custody (Figure 8.4-4).

8.5 Sample Log-in Identification:

8.5.1 Sample Identification:

To maintain sample identity, each sample received at Spectrum Analytical, Inc. RI Division is assigned unique sample identification (Sample ID) numbers. Samples are logged into the laboratory via the Laboratory Information Management System (LIMS).

After inspecting the samples, the Sample Custodian logs each sample into the LIMS, which assigns a lab Sample ID Number. These Numbers are assigned sequentially in chronological order. Spectrum Analytical Inc., RI Division Sample Identification Numbers appear in the following format: **YXXXX-NNF**

In which: Y – represents the current year with A for 2002, B for 2003, C for 2004, etc.
XXXX – represents a four-digit work order number that is assigned sequentially to each submittal of samples
NN – represents the sample number within the group or workorder.

F – represents the fraction. All sample portions that are received in identical bottles with identical preservatives are grouped into one fraction.

For example, the first fraction of the fifth sample of the 20th workorder of 2003 would have the number: B0020-05A

The Sample ID Number is recorded on the Sample Login Form (Figure 8.4-1) for USEPA CLP samples, and on the Sample Condition Form (Figure 8.4-2) for all other samples. Information on these forms cross-reference the Sample ID Numbers with SDG numbers, sample tag numbers and/or other client identifiers. Each sample is clearly labeled with its lab Sample ID Number by the Sample Custodian. The same sample ID Number appears on the LIMS status report, on each sample preparation container and extract vial associated with the sample.

8.5.1.1 Sample Extract Identification:

As described in Section 8.5.1, a sample extract is identified with the same unique sample identification number as the sample from which it derives

8.5.2 Sample Login:

The sample login system at Spectrum Analytical, Inc. RI Division consists of computerized entry using LIMS (Figure 8.5-1). The information recorded onto the Workorder Report includes:

- Workorder number
- Client name
- Project name and location
- Final data report format
- Date of receipt
- Date sample collected
- Due date, fax and/or hardcopy
- EDD requirements
- Comments or notes on the workorder
- Lab Sample Identification numbers
- Client Sample Identification numbers
- Sample matrix
- Analyses required
- Case number, where used by the client
- SDG number, where used by the client

8.5.3 Sample Information:

After sample information is properly recorded and the samples have been properly logged into the LIMS, bottle labels are generated and applied to the sample containers. The Sample Custodian notifies the Project Manager or peer or supervisor to review the sample bottle labeling. This person reviews all the information associated with the samples. He/she verifies (by initialing) the correctness of the information on the Sample Condition Form or Sample Log-In Form. Sample login information is available through the LIMS to all appropriate laboratory staff. The Sample Custodian then scans the samples into the IntCOC system and posts the samples.

The Sample Custodian initiates a red workorder file. This file contains the original Sample Log-In Form or Sample Condition Form, air bills, SMO traffic reports, sample tags, workorder reports and all correspondence with the Client or SMO or others. The red workorder file is forwarded to the Project Manager for review of the login paperwork, and for updating status of the workorder in the LIMS. Once the login information is thoroughly reviewed for correctness, the red workorder file is stored in the data reporting area. Analytical data are placed in this as analyses are completed and data are reviewed.

8.6 Sample Storage and Disposal:

Samples at Spectrum Analytical, Inc. RI Division are stored in a central storage facility or in satellite designated areas, (see SOP 30.0003 Sample Receipt Storage Tracking and Disposal). After sample receipt and login procedures are completed, the Sample Custodian places the samples in the centralized walk-in refrigerator. Volatile Organic sample aliquots are released to the volatile organic lab with documentation (Figure 8.6-1).

The central storage facility is for samples only; no standards or reagents are to be stored there. Access to the centralized sample storage facility is limited by keypad entry at all times. All sample storage areas are within the secure laboratory facility.

All sample/extract refrigerators are maintained at 4°C ± 2°C. Standards are kept in freezers maintained at -10 to -20°C. The temperature is recorded electronically using temperature probes that are affixed inside all refrigerator and freezer units (see SOP #80.0020 Temperature Monitoring Systems).

When analysis is complete, any remaining sample is retained in the designated storage facility until it may be removed for disposal (see SOP 30.0024 Sample Disposal). Broken and damaged samples are promptly disposed in a safe manner. Unless there is a specific request by the client, excess, unused sample aliquots are stored for at least 30 days after the submission of compliant data (USEPA is 60 days for samples and empty containers). The samples are then disposed after such period. USEPA and NYS ASP extracts are stored under refrigeration for at least one year. Other extracts are stored under refrigeration for up to three months, unless there is a specific agreement with the client. After such time, the extracts are disposed. All disposals are performed in a manner compliant with federal and state regulations. International samples require special disposal procedures associated with the USDA Soil Permit (see SOP #30.0024 Sample Disposal).

8.6.1 Extract Transfer:

The extracts generated during the preparation for the organic analyses are transferred from the Organic Prep Lab to the Analysis Labs. The transfer of extracts for Semivolatiles, TPH, Pesticides and PCBs, are documented electronically in the Prep Batch Log with the storage location (refrigerator ID).

Metals analysis samples that are transferred from the prep area to the analysis room are also documented in the Prep Batch Log with the storage location (ICP or Hg lab).

There is no extract transfer that occurs with either Wet Chemistry or VOA samples.

8.6.2 Extract Storage:

Semivolatile, Pesticide/PCB, and TPH extracts, which are contained in crimp top vials or screw cap vials with Teflon lined septa, are stored at 4°C ± 2°C. Semivolatile and Pesticide/PCB extracts are stored in refrigerators in the Semivolatiles Analysis room. They are catalogued numerically by workorder number that approximates chronological order, according to date of receipt. USEPA CLP extracts are stored separately within the refrigerator from sample extracts of other clients.

Excess Pesticide extracts, not analyzed, are stored in screw cap vials with Teflon lined septa in the Organic Prep Lab. In most instances, they consist of the remaining 8-9 mL aqueous and soil sample extracts and are stored chronologically by workorder.

8.7 Sample Tracking:

When a sample is removed from storage, the analyst must scan each jar or bottle taken, using the IntCOC program and their user ID. When the sample(s) are returned to the central storage facility, the analyst must scan the samples back into the system using the IntCOC program and their user ID, and return the physical samples to their original storage location. In addition to the individual’s initials, the date and time is recorded. This system maintains the location of the sample at any point in time.

Chain-of-custody of a sample ensures that the sample is traceable from the field, where it was taken, through laboratory receipt, preparation, analysis and finally disposal. The primary chain-of-custody documents are used to locate a sample at any point in time.

1. The chain-of-custody form from the field describes the origin and transportation of a sample;

2. The ICOC document acceptance of a sample by Spectrum Analytical Inc., RI Division; and

3. The ICOC documents which analyst has custody of the sample after removal from storage.

4. The sample preparation logs and/or extract transfer logs document when the extracts or digestates were received by the analytical labs and where they are stored in the refrigerator.

Figure 8.4-1
USEPA CLP Sample Login Form

SAMPLE LOG-IN SHEET
FORM DC-1

Lab Name		Page _____ of _____
Received By (Print Name)		Log-in Date
Received By (Signature)		
Case Number	Sample Delivery Group No.	Mod. Ref. No.

Remarks:			Corresponding		
		EPA Sample #	Sample Tag #	Assigned Lab #	Remarks: Condition of Sample Shipment, etc.
1. Custody Seal(s)	Present/Absent* Intact/Broken				
2. Custody Seal Nos.	____________________				
3. Traffic Reports/ Chain of Custody Records (TR/COCs) or Packing Lists	Present/Absent*				
4. Airbill	Airbill/Sticker Present/Absent*				
5. Airbill No.	____________________				
6. Sample Tags	Present/Absent*				
Sample Tag Numbers	Listed/Not Listed on Chain-of-Custody				
7. Sample Condition	Intact/Broken*/ Leaking				
8. Cooler Temperature Indicator Bottle	Present/Absent*				
9. Cooler Temperature	____________________				
10. Does information on TR/COCs and sample tags agree?	Yes/No*				
11. Date Received at Laboratory	____________________				
12. Time Received	____________________				
Sample Transfer					
Fraction	Fraction				
Area #	Area #				
By	By				
On	On				

* Contact SMO and attach record of resolution

Reviewed By	Logbook No.
Date	Logbook Page No.

SAMPLE LOG-IN SHEET

Lab Name: Spectrum Analytical Inc., Rhode Island Division		Page __ of ___
Received By (Print Name)		Log-in Date
Received By (Signature)		
Case Number	Sample Delivery Group No.	Mod. Ref. No.

Remarks:	
1. Custody Seal(s)	Present/Absent* Intact/Broken
2. Custody Seal NOs.	________________ ________________
3. Traffic Reports/Chain of Custody Records or Packing Lists	Present/Absent*
4. Airbill	Airbill/Sticker Present/Absent*
5. Airbill No.	________________ ________________
6. Sample Tags Sample Tag Numbers	Present/Absent* Listed/Not Listed on Traffic Report/Chain of Custody Record
7. Sample Condition	Intact/Broken*/ Leaking
8. Cooler Temperature Indicator Bottle	Present/Absent*
9. Cooler Temperature	________________
10. Does information on Traffic Reports/Chain of Custody Records and sample tags agree?	Yes/No*
11. Date Received at Lab	________________
12. Time Received	________________

Sample Transfer	
Fraction	Fraction
Area#	Area#
By	By
On	On

			Corresponding		
	EPA Sample #	Aqueous/ Water Sample pH	Sample Tag #	Assigned Lab #	Remarks: Condition of Sample Shipment, etc.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

* Contact SMO and attach record of resolution

Reviewed By	Logbook No.
Date	Logbook Page No.

ISM01.3 (10/11) Form DC-1

Figure 8.4-2
Sample Condition Form

SPECTRUM ANALYTICAL, INC. RI DIVISION

Sample Condition Form

Page _____ of _____

Received By:	Reviewed By:	Date:	Spectrum RI Work Order #:
Client Project:		Client:	

1) Cooler Sealed Yes / No

2) Custody Seal(s) Present / Absent
Coolers / Bottles
Intact / Broken

3) Custody Seal Number(s) ____________________
____
____
____

4) Chain-of-Custody Present / Absent

5) Cooler Temperature ____________________
IR Temp Gun ID ____________________
Coolant Condition ____________________

6) Airbill(s) Present / Absent
Airbill Number(s) ____________________
____
____
____
____

7) Samples Bottles Intact / Broken / Leaking

8) Date Received ____________________

9) Time Received ____________________

Preservative Name/Lot No.:
____
____
____
____
____

Lab Sample ID		Preservation (pH)					VOA Matrix	Soil Headspace or Air Bubble ≥ 1/4"
		HNO_3	H_2SO_4	HCl	NaOH	H_3PO_4		

VOA Matrix Key:

US = Unpreserved Soil	A = Air
UA = Unpreserved Aqueous	H = HCl
M = MeOH	E = Encore
N = NaHSO4	F = Freeze

See Sample Condition Notification/Corrective Action Form yes / no

Form ID: QAF.0006 Rad OK yes / no

Figure 8.4-3
Sample Condition Notification Form

Page ____of____

Spectrum Analytical, Inc. RI Division Sample Condition Notification

Project#:_____________ **Date of Receipt:_____________**
Client:_______________________ **Received By:________________**
Client project #/name:________________________

Unusual Occurance Description:

____

____

____

____

____

____

Client Contacted:

Contacted via: Phone/Fax/E-mail
Date:__________ Time:___________
Contacted By:_________________________
Name of person contacted:________________________

Client Response:

Responded via: Phone/Fax/E-mail
Date:____________
Name of person responding:__________________________
Responding to:_________________________

____

____

____

____

____

Action Taken: ____

____

____

____

____

Form ID: QAF.0005

Figure 8.4-4
Spectrum Analytical, Inc. RI Division Chain-of-custody Form

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

Page ______ of ______

CHAIN OF CUSTODY RECORD

☐ 11 Almgren Drive
Agawam, MA 01001
(413) 789-9018

☐ 8405 Benjamin Road, Ste A
Tampa, FL 33634
(813) 888-9507

☐ 175 Metro Center Blvd
Warwick, RI 02886
(401) 732-3400

Special Handling:

TAT- Indicate Date Needed: __________
- All TATs subject to laboratory approval. Min. 24-hour notification needed for rushes.
- Samples disposed of after 60 days unless otherwise instructed.

Report To: ______________________________
____
____
____
Telephone #: ______________________________
Project Mgr. ______________________________

Invoice To: ______________________________
____
____
____
P.O. No.: ______________ RQN: ____________

Project No.: ______________________________
Site Name: ______________________________
Location: ______________________ State: _______
Sampler(s): ______________________________

$1=Na_2S2O_3$ $2=HCl$ $3=H_2SO_4$ $4=HNO_3$ $5=NaOH$ 6=Ascorbic Acid $7=CH_3OH$
$8=NaHSO_4$ 9= Deionized Water $10=H_3PO_4$ 11= ______________ 12= ______________

DW=Drinking Water GW=Groundwater WW=Wastewater
O=Oil SW= Surface Water SO=Soil SL=Sludge A=Air
X1= _______________ X2= _______________ X3= _______________

G=Grab C=Composite

						Containers:					List preservative code below:								QA/QC Reporting Notes:
											Analyses:								QA/QC Reporting Level ☐ Level I ☐ Level II ☐ Level III ☐ Level IV ☐ Other _______________ State-specific reporting standards: _______________________
Lab Id:	Sample Id:	Date:	Time:	Type	Matrix	# of VOA Vials	# of Amber Glass	# of Clear Glass	# of Plastic										

Relinquished by:	Received by:	Date:	Time:	Temp°C

☐ EDD Format ______________________________
☐ E-mail to ______________________________

Condition upon receipt:
☐ Ambient ☐ Iced ☐ Refrigerated ☐ DI VOA Frozen ☐ Soil Jar Frozen

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Revised Mar 2012

Figure 8.5-1
Workorder Information Form

Spectrum Analytical, Inc. Featuring Hanibal Technology -- Rhode Island Division

WorkOrder: L1458

Client ID: MITKEM_WARWICK
Project: INTERNAL TESTING
WO Name: INTERNAL TESTING
Location: WATER_TESTING, WW, 6/2012
Comments: Internal test

Case:
SDG:
PO: INTERNAL TESTING

HC Due: 07/12/12
Fax Due:
Fax Report: ☐

Report Level: LEVEL 2
Special Program:
EDD:

Lab Samp ID	Client Sample ID	Collection Date	Date Recv'd	Matrix	Test Code	Samp / Lab Test Comments	HF	HT	MS	SEL	Storage
L1458-01A	WW-6/28-G	06/28/2012 08:05	06/28/2012	Aqueous	E624	/				Y	VOA
L1458-01B	WW-6/28-G	06/28/2012 08:05	06/28/2012	Aqueous	E625	/ Needs benzidine, 1,2-diphenyhydr, n-nitrosodimethl				Y	Disposed
L1458-01C	WW-6/28-G	06/28/2012 08:05	06/28/2012	Aqueous	E335.4	/					Disposed
L1458-02A	WW-6/28-C	06/28/2012 15:00	06/28/2012	Aqueous	E200.7	/ Cd, Cr, Cu, Pb, Ni, Ag, Zn				Y	Disposed
L1458-02B	WW-6/28-C	06/28/2012 15:00	06/28/2012	Aqueous	SM5220	/					Disposed

HF = Fraction logged in but all tests have been placed on hold

HT = Test logged in but has been placed on hold

09/20/2012 10:42

Lab Client Rep: Edward A Lawler

Figure 8.6-1
Volatiles Receiving Logbook Form

Spectrum Analytical, Inc. RI Division : VOLATILE SAMPLES RECEIVING LOGBOOK

VOA Log-In Date	Workorder	Client ID	Sample Numbers	Relinquished by:	Received by:	Pres. Used	F/R	Returned to R1

Logbook ID 90.0191-04/12

Reviewed By:

__"Preservative Used"__ Key

UA = Unpreserved Aqueous
H = HCL
A = Air
M = MeOH
E = Encore

US = Unpreserved Soil
N = NaHSO$_4$
F = Freeze
T = Trace, HCL

9.0 CALIBRATION PROCEDURES AND FREQUENCIES

All purchased equipment, materials, and services must meet specific method requirements, standard requirements, or project specific requirements. These requirements are documented in the individual analytical or project SOPs.

9.1 Instruments:

Specific calibration and check procedures are given in the analytical methods referenced in Section 10. The frequencies of calibration and the concentrations of calibration standards are determined by the cited methods and any special project or contract-specific requirements. Standard calibration curves of signal response versus concentration are generated on each analytical instrument used for a project, prior to analysis of samples. A calibration curve of the appropriate linear range is established for each parameter that is included in the analytical procedure employed and is verified on a regular basis with check standards as specified in the appropriate CLP Protocols. For non-CLP work, Spectrum Analytical, Inc. RI Division adheres to the calibration criteria specified by SW-846 and/or Standard Methods for both organic and inorganic analyses. Where requested, other method specific calibration criteria are used. Refer to the individual Standard Operating Procedures listed in Figure 11.7-1 of this QAP for the specific calibration and check procedures as well as concentration and frequency requirements.

For organic analyses whenever possible, unless otherwise specified in the individual methods, the initial calibration standards (ICAL), continuing calibration verification standards (CCV), laboratory control sample spike (LCS) and matrix spike (MS) will all be from the same source. The initial calibration verification (ICV) standards are prepared from a separate source. Refer to the Standard Operating Procedures listed in Figure 11.7-1 of this QAP for the specific calibration source and procedural requirements of each method. The following are examples of calibration procedures for various instrumental systems:

GC/ECD and GC/FID – An initial calibration is performed using five different concentration levels for each parameter of interest for SW-846 analyses. The initial calibration is done on each column and each instrument, and is repeated each time a new column is installed or whenever a major change is made to the chromatographic system.

Initial calibration verification (ICV), near mid level concentration for all analytes, is performed immediately after the calibration. If the ICV does not meet method specific criteria, a new calibration curve is generated and an ICV is analyzed. If repeated ICV failures are encountered, the system is checked to find the cause of these failures, and the problem is corrected. For certain GC/FID analyses (i.e. GRO /DRO), the instrument is calibrated using individual compounds while the laboratory control sample or ICV uses a product (diesel or gasoline).

Continuing calibration verification (CCV), near a mid-level concentration for all analytes, is run at intervals determined by sample number or time allowed, as required by the individual methods. If CCV values are determined outside the upper limit of the method specified range and if no analytes were detected in the samples, the run will be accepted as valid and ‘Non Detects’ reported for the sample. If an analyte is detected and the CCV is out at the high end, the problem will be identified and corrected and the affected samples will be re-analyzed with a compliant CCV.

If a CCV value is out of the method specified limits at the lower limit, the cause of the problem will be identified and corrected, and all samples affected by the out of control CCV will be rerun with a compliant CCV.

For CLP-type analyses, the continuing calibration takes place at the beginning of the analytical sequence and once every twelve (12) hours throughout the analytical sequence, and again at the end of the sequence. The percent difference in calibration factors for each standard must not exceed the criteria specified by the method.

If a CCV fails to meet criteria limits, a new calibration curve will be generated and all samples affected will be re-analyzed.

GC/MS – For CLP methods, a minimum of five-level calibration (four-level for select semivolatile compounds) is carried out for each analyte per system before analysis of samples take place.

Continuing calibrations, near midpoint levels, are analyzed every twelve hours of instrument analysis time for CLP analyses.

Re-calibration takes place whenever a major change occurs in the system, such as a column change in the GC or a source cleaning of the mass spectrometer or when the continuing calibration fails to meet method specific requirements.

Tunes are performed once every twelve (12) hours of instrument run time for all CLP-type and SW846 analyses. The GC/MS system is tuned to USEPA specifications for bromofluorobenzene (BFB) or decafluorotriphenylphosphine (DFTPP) for volatile and semivolatile analyses, respectively. Extended tune time is allowed in CLP SOM protocols where an ending CCV is acceptable as an opening CCV.

More detailed instrument and method-specific calibration procedures and criteria are described in the individual analysis SOPs.

ICP/AES and ICP/MS – Instrument calibration, for each wavelength used, occurs at the start of each analysis. The calibration curve is constructed per method specification.

An initial calibration verification and initial calibration blank (ICB) are analyzed before analysis of samples. If the ICV and ICB do not meet method specific criteria for an analyte, the analyte is re-analyzed with a new calibration.

During the analysis, a continuing calibration verification (CCV) and continuing calibration blank (CCB) is analyzed at least every ten (10) samples or two hours depending on method. If either the CCV or CCB fails to meet method specific criteria for an analyte, the source of the problem is investigated. If it can be determined that the failed CCV and/or CCB is not representative (such as for instrument carryover from previous sample or from an empty autosampler tube), the CCV and/or CCB are re-analyzed and the reason for the failure documented. If a failure still occurs, further corrective action is performed, and the analyte is re-analyzed with a new calibration.

The CCV is obtained from a source independent from that of the standards. The CCV concentration for the different analytes are at method specified levels.

The Flow Injection Mercury System (FIMS) - Instrument calibration occurs at the start of each analysis. The calibration curve is constructed per method specification.

An initial calibration verification (ICV) and initial calibration blank (ICB) are analyzed before analysis of samples. If the ICV and ICB do not meet method specific criteria for Mercury, re-calibration and reanalysis are required.

During the analysis, a continuing calibration verification (CCV) and continuing calibration blank (CCB) is analyzed at least every ten (10) samples. If either the CCV or CCB fails to meet method specific criteria for Mercury, the source of the problem is investigated. If it can be determined that the failed CCV and/or CCB is not representative (such as for instrument carryover from previous sample or from an empty autosampler tube), the CCV and/or CCB are re-analyzed and the reason for the failure documented. If a failure still occurs, further corrective action is performed, and the analyte is re-analyzed with a new calibration.

The CCV is obtained from a source independent from that of the standards. The CCV concentration for Mercury is at method specified levels.

Other instrumentation:

IC- The Ion Chromatograph is calibrated each day of use. Calibration verification is analyzed at the beginning, end, and at least every 10 samples. The verification standard is from an independent source. If the calibration verification does not meet method specific criteria for an analyte, it is re-analyzed once. If failure still occurs, a new calibration curve is established and any affected samples are reanalyzed.

pH- the meter is calibrated at two pH levels (4.0 and 10.0) before analyses of samples. The pH 7.0 buffer is analyzed as an LCS and recovery is calculated.

Lachat 8000- automated flow-through spectrophotometer is calibrated per method specification before the analyses of samples.

An initial calibration verification and initial calibration blank (if required) are analyzed before analysis of samples. If the ICV and/or ICB do not meet method specific criteria for an analyte, re-calibration must occur.

During the analyses, continuing calibration verification and continuing calibration blanks are analyzed at least every ten (10) samples. If either the CCV or CCB fails to meet specified criteria for an analyte, the source of the problem is investigated. If it can be determined that the failed CCV and/or CCB is not representative (such as for instrument carryover from previous sample or from an empty autosampler tube), the CCV and/or CCB are re-analyzed and the reason for the failure documented. If a failure still occurs, further corrective action is performed, and the analyte is re-analyzed with a new calibration.

The CCV is obtained from a source independent from that of the standards. The CCV concentration for the different analytes are at method specified levels.

SpecGenesys- manual spectrophotometer is calibrated per method specification.

Calibration curve calibration verification is analyzed at the beginning, end, and at least every 10 samples. The verification standard is from an independent source. If the calibration verification does not meet method specific criteria for an analyte, it is re-analyzed once. If failure still occurs, a new calibration curve is established and any affected samples are reanalyzed. Calibration curves are established at least quarterly.

Annual calibration and preventative maintenance is required by an outside vendor unless calibration can be performed in-house using a calibration kit.

Balances: are calibrated by an outside source on an annual basis.

The balances are calibrated externally each day of use by a lab technician with NIST traceable Class “1” or “2” weights. The weights are certified by an outside service on a regular basis, not to exceed five years.

Thermometers are calibrated once a year against a NIST-verified thermometer or as they are replaced. Digital thermometers are verified quarterly. The NIST-verified thermometers are certified by an outside certified service annually.

Gel Permeation Chromatography is used to clean samples according to CLP and client requirements. GPCs are calibrated using a calibration standard provided by Ultra Scientific, Cat. # CLP-340. Once a successful calibration is achieved it is valid for a period of seven days.

9.2 Standards and Reagents:

Standard reference materials used for routine calibration, calibration checks, and accuracy are obtained from commercial manufacturers. These reference materials are traceable to the source and readily compared to EPA references. All standards come with a Certificate of Analysis which is kept on record in the appropriate laboratories. When a chemical standard can not be purchased in solution form, a neat source may be bought. The lab must attempt to obtain the highest purity available. If the lab can not find a neat source with at least 97% purity, the laboratory must document why. In addition, the impurity correction factor must be used when calculating the standard concentration. See SOP #80.0001, Standard Preparation, Equivalency and Traceability, for more details. While most standards are traceable to NIST; however, certain projects, especially those involving pesticide registration, may necessitate the use of reference standards supplied by the client. New standards are also routinely validated against known standards that are traceable to EPA or NIST reference materials.

Organic Preparatory Lab Surrogate and Matrix spikes are prepared in the appropriate instrument labs and then QA’d by diluting the standard and analyzing it on the GC or GC/MS. Criteria for the diluted spike analysis must meet the method or in-house criteria. If acceptable, the spike is able to be used. If unacceptable, another standard is prepared and the same steps repeated. Data from the QC analysis is retained in the laboratory for reference and traceability.

Primary, intermediate and working standards are all named using specific nomenclature as designated in the QA Department SOP# 80.0001, Standard Preparation, Equivalency and Traceability.

Standards are dated and labeled upon arrival. Any material exceeding its shelf life as described by the methods in QAP Section 10 is discarded and replaced. Standards are periodically analyzed for concentration changes/degradation and inspected for signs of deterioration such as color change and precipitate formation. Standards Logbooks, which contain all pertinent information regarding the source and preparation of each analytical standard, are maintained by each of the laboratory departments in the LIMS.

See individual analytical SOPs (listed in Figure 11.7-1), sections 7 and 8 for standards preparation procedures.

Solvents are tested for purity prior to use to ensure there is no external source of contamination. For organic solvents, each lot number of solvent is QC'd prior to use. This is accomplished by concentrating an aliquot of solvent or extracting with reagent media (such as sodium sulfate) in the same manner as the samples and analyzing it for contamination by GC/MS. Any detectable analyte could render the solvent or reagent unsuitable for use. Supervisors make the final decision as to the suitability of the solvent or reagent, and whether the lot may be used for standard or sample preparation.

Chemicals and Reagents are stored in the respective laboratories during use. Backup supplies are stored in the stockroom. Reagent grade chemicals are used in all tests. All dry chemicals and reagents are given a 5-year expiration period unless designated otherwise by the manufacturer. Sometimes the viability of the reagent does not remain throughout the entire 5-year period (as determined through investigation following poor results in a preparation method blank or bench analysis, for example). In this case, the chemical or reagent is readily discarded. Acids/caustics are given a 3-year expiration period unless designated otherwise by the manufacturer. Solvents are given a 1-year expiration period unless designated otherwise by the manufacturer.

Chemicals and reagents are logged into the laboratory and each bottle is given a unique ID. The ID is based upon the date of its arrival at the laboratory. The only exceptions include cases/cycletainers of solvents and cases of acids. For solvents and acids, the boxes/cases are labeled with received date to insure first in/first out usage. All other chemicals and reagents are named using specific nomenclature as designated in the QA Department SOP # 80.0013, Reagent Purchasing and Tracking.

When a bottle is opened in the laboratory, it is inspected to ensure it meets the requirements of the method. The analyst records his or her initials on the bottle along with the date opened and the ID. Any applicable certificates of analysis (COA) are scanned and archived. They may also be stored in the individual laboratories or in the QA Department.

10.0 ANALYTICAL PROCEDURES

Spectrum Analytical, Inc. RI Division uses the methods specified in Tables 10-1 through 10-6 unless otherwise specified by the client. Spectrum Analytical, Inc. RI Division performs analyses on non-potable waters, groundwater and soil/solids. The RI Division does not perform regulatory potable (drinking) water analyses with the exception of trace metals by EPA 200.8, or environmental lead (paint chips, wipes, etc. for RIDOH compliance) testing. Associated Standard Operating Procedures related to these analytical procedures can be found in Figure 11.7-1 of this QAP.

Table 10-1
Potable Water Analytical Methods

Parameter	Method Description	Method Reference
Metals	ICP-MS	200.8

Table 10-2
Non-potable Water Analytical Methods

Parameter	Method Description	Method Reference
Metals	ICP-AES	200.7
Mercury	Cold Vapor	245.1
Cyanide		
	Midi-distillation Automated	EPA 335.4
Alkalinity	Titration	SM2320B
Anions	Ion Chromatography	EPA 300.0
Chloride		
Sulfate		
Nitrate		
Nitrite		
Orthophosphate		
Bromide		
Fluoride		
Volatile Fatty Acids	Ion Chromatography	EPA 300.0 Mod
Acetic		
Butyric		
Lactic		
Propionic		
Pyruvic		
pH	Electrode	SM4500 H+ B
Sulfate	Turbidimetric	SM4500-SO4 E.
Ammonia	Distillation/Titration	SM4500-NH3 B, C
Total Kjeldahl Nitrogen	Digestion	SM4500- Norg C
	Distillation/Titration	SM4500- NH3 B, C
Orthophosphate	Ascorbic, Manual	SM4500-P E
Total phosphate	Persulfate, Manual	SM4500-P B5 & E

Table 10-2
Non-potable WaterAnalytical Methods (cont.)

Parameter	Method description	Method Reference
Chemical Oxygen Demand	Spectrophotometric(Closed Reflux)	SM5220-D
Total Organic Carbon	Combustion	SM5310 B
Phenols	Distillation, 4-AAP, Direct Photometric	SM5530 B E420.1
Total Dissolved Solids	Gravimetric	SM2540 C
Total Solids	Gravimetric	SM2540 B
Total Suspended Solids	Gravimetric	SM2540 D
Total Settleable Solids	Imhoff cones	SM2540 F
Hexavalent Chromium	Diphenyl Carbazide Colorimetric	SM 3500Cr B
Volatile Organics		
Halocarbons	Purge & Trap, GC/MS	624
Aromatics	Purge & Trap, GC/MS	624
Semivolatile Organics	Extraction, GC/MS	625
Organochlorine Pesticides/ PCBs	Extraction, GC/ECD	608
Oil & Grease (HEM, SGT)	Extraction, Gravimetric	1664A

Table 10-3
SW-846 Inorganic Analytical Methods

Parameter	Method Description	Method Reference
Metals		
Aqueous	Acid digestion ICP/AES ICP/MS	Method 3005A/3010A Method 6010C Method 6020A
Solid	Acid digestion ICP/AES ICP/MS	Method 3050B Method 6010C Method 6020A
Mercury		
Aqueous	Permanganate digestion Cold Vapor analysis	Method 7470A
Solid	Permanganate digestion Cold Vapor analysis	Method 7471B
Hexavalent Chromium		
Aqueous	Colorimetric	Method 7196A
Solid	Acid Digestion Colorimetric	Method 3060A/7196A
Cyanide		
Aqueous	Midi-distillation Automated	Method 9012B
Solid	Midi-distillation Automated	Method 9012B
pH		
Solid	Electrode	Method 9045D
Ignitability (Flashpoint)		
Aqueous	Pensky-Martens closed cup	Method 1010A
Solid	Pensky-Martens closed cup	Method 1010A Mod.
Reactive Cyanide		
Solid & Aqueous	Distillation Automated	SW 846 7.3.3.2

Table 10-3
SW-846 Inorganic Analytical Methods (cont.)

Parameter	Method Description	Method Reference
Reactive Sulfide Solid & Aqueous	Distillation Colorimetric	SW 846 7.3.4.2
Anions Chloride Sulfate Nitrate Nitrite Orthophosphate Bromide Fluoride	Ion Chromatography	SW 846 9056A
Total Organic Carbon	Combustion	SW 846 9060A
Toxicity Characteristic Leaching Procedure (TCLP)		
Aqueous	Leachate by Filtration	Method 1311
Solid	Leachate Generation	Method 1311
Synthetic Precipitation Leaching Procedure (SPLP)		
Aqueous	Leachate by Filtration	Method 1312
Solid	Leachate Generation	Method 1312

Table 10-4
SW-846 Organic Analytical Methods

Parameter	Sample Preparation	Sample Analysis
Volatile Organic Compounds		
Aqueous	Method 5030B	Method 8260C
Solid	Method 5035A	Method 8260C
1,2-Dibromo-3-chloropropane 1,2-Dibromomethane	Micro extraction GC\ECD Analysis	Method 8011
Semivolatile Organic Compounds		
Aqueous	Method 3510C Method 3520C	Method 8270D
Solid	Method 3540C Method 3550B Method 3545 Method 3570	Method 8270D
Organochlorine Pesticides		
Aqueous	Method 3510C Method 3520C	Method 8081B
Solid	Method 3540C Method 3550B Method 3545 Method 3570	Method 8081B
Polychlorinated Biphenyls (Aroclors and Congeners)		
Aqueous	Method 3510C Method 3520C	Method 8082A
Solid	Method 3540C Method 3550B Method 3545 Method 3570	Method 8082A
Total Petroleum Hydrocarbons		
Aqueous	Method 3510C Method 3520C	Method 8015B,D
Solid	Method 3540C Method 3550B	Method 8015B,D

Table 10-4
SW-846 Organic Analytical Methods (cont.)

Parameter	Sample Preparation	Sample Analysis
Herbicides		
Aqueous	Method 8151A	Method 8151A
Solid	Method 8151A	Method 8151A
Toxicity Characteristic Leaching Procedure (TCLP)		
Aqueous	Method 1311	
Solid	Method 1311	
Synthetic Precipitation Leaching Procedure (SPLP)		
Aqueous	Method 1312	
Solid	Method 1312	
Gel Permeation Chromatography (GPC)		
Aqueous	Method 3640A	
Solid	Method 3640A	
Florisil Cleanup		
Aqueous	Method 3620B	
Solid	Method 3620B	
Silica Gel Cleanup		
Aqueous	Method 3630C	
Solid	Method 3630C	
Sulfur Cleanup		
Aqueous	Method 3660B	
Solid	Method 3660B	
Sulfuric Acid Cleanup		
Aqueous	Method 3665A	
Solid	Method 3665A	

Table 10-5
CLP-Type Analytical Methods

Parameter	Method Reference
USEPA CLP Organics	OLM04.3, SOM01.2
USEPA CLP Inorganics	ILM05.4, ISM01.3
USEPA Low Level Organics	OLC03.2
NYS-ASP CLP Organics	ASP 2000/2005 SOW
NYS-ASP CLP Organics	ASP 2000/2005 SOW

Table 10-6
Other Analytical Methods

Parameter	Method Reference
Volatile Petroleum Hydrocarbons	
Aqueous	MADEP VPH 1.1
Solid	MADEP VPH 1.1
Extractable Petroleum Hydrocarbons	
Aqueous	MADEP EPH 1.1
Solid	MADEP EPH 1.1
Extractable Total Petroleum Hydrocarbons	
Aqueous	CT ETPH 99-3
Solid	CT ETPH 99-3
Diesel Range Organics	
Aqueous	ME 4.1.25
Solid	ME 4.1.25
Gasoline Range Organics	
Aqueous	ME 4.2.17
Solid	ME 4.2.17

10.1 Analytical References

1. Analysis of Extractable Total Petroleum Hydrocarbons (ETPH) Using Methylene Chloride Gas Chromatograph/Flame Ionization Detection, Environmental Research Institute, University of Connecticut, March, 1999

2. Analytical Services Protocol, Volume 1-8, New York State Department of Environmental Conservation, 2003.

3. Annual Book of ASTM Standards. Part 31-Water. American Society for Testing and Materials, Philadelphia, PA, 1981.

4. Chemical Characteristics of Marine Samples, API Publications No. 4307, API, Washington, D. C.

5. Federal Register. Vol. 72, No. 47, March 12, 2007.

6. Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100).

7. Methods for the Determination of Metals in Environmental Samples, Supplement 1 (EPA/600/R-94/111).

8. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 3/83 Revision.

9. The EPA 600 Series. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, Appendix A, 40 CFR Part 136, Federal Register, Vol. 49, No. 209, 1984.

10. Methods of Soil Analysis. Part 2, Chemical and Microbiological Properties, Second Edition, American Society of Agronomy, Inc., Soil Science Society of America, Inc., Madison, WI, 1982.

11. Standard Methods for the Examination of Water and Wastewater, 18th Edition, APHA, Washington, D. C., 1992.

12. Standard Methods for the Examination of Water and Wastewater, 20th Edition, APHA, Washington, D. C., 1998.

13. Test Methods for Evaluating Solid Waste-Physical/Chemical Methods, SW-846, 3rd Edition Final Updates I through IV. Office of Solid Waste and Emergency Response, USEPA, Washington, D. C., 1998. Status table found at http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/methstat.pdf

14. USEPA Contract Laboratory Program. Statement of Work for Organic Analysis, USEPA, OLM04.3, OLC03.2, and SOM01.2.

15. USEPA Contract Laboratory Program. Statement of Work for Inorganic Analysis, USEPA ILM05.4, and ISM01.2.

16. Maine Health and Environmental Testing Laboratory. Modified GRO and DRO Methods, Method 4.2.17 and 4.1.25, September 6th 1995.

17. EPA Methods and Guidance for Analysis of Water, Version 2.0. includes MCAWW Methods and most current EPA Methods @ http://www.epa.gov/ost/methods/

11.0 DATA COLLECTION, REDUCTION, VALIDATION AND REPORTING

11.1 Data Collection:

Most of the lab's data is uploaded into the LIMS systems directly from the instruments. The exception is the GC's and GC/MS's in which data is first processed in Target and then uploaded into the LIMS.

Either the instrument analyst or data reporting group will upload the data into the LIMS. The person who performs the upload does a technical review to ensure recoveries of CCVs, MS, MSD, and LCS all seem to be correct. A completeness review is done at this time to ensure all applicable samples have been uploaded for all the necessary analytes.

Next, an employee with a technical background will perform the QA process of the uploaded data. This person is either a supervisor or someone with extensive experience in environmental chemistry. Corrections to the run are made at this step if necessary. When the review is complete, this technical person authorizes the data to be reported by "QA-ing" the run in the LIMS. For a more detailed view of the LIMS uploading/review procedure, see SOP # 110.0028, Data Validation/Self Inspection Procedures.

11.2 Data Reduction:

Instrument printouts, computer terminal displays, chromatograms, strip chart recordings and physical measurements provide raw data that are reduced to concentrations of analytes through the application of the appropriate calculations.

Equations are generally given within the analytical methods referenced in Section 10. Data reduction may be performed automatically by computerized data systems on the instrument, manually by the analyst, or by PCs using verified spreadsheets and/or data base software.

11.3 Data Verification:

The verification process requires the following checks to be made on data before they are submitted to the client:

- A completeness inspection is required which ensures that all required data are included in the data packages submitted to the client and that the appropriate signatures are present on the data packages.

- A contract compliance screening to ensure that contractual requirements have been satisfied.

- A consistency check to ensure that nominally identical or similar data appearing in different places within a data package are consistent with respect to value and units.

- All manual integrations are properly performed and documented.

- A correctness check to ensure that reported data have been calculated correctly or transcribed correctly.

11.4 Data Validation:

Data validation is an essential element of the QA evaluation system. Validation is the process of data review and subsequent acceptance or rejection based on established criteria.

The following analytical criteria are employed by Spectrum Analytical, Inc. RI Division in the technical evaluation of data:

- Accuracy requirements.
- Precision requirements.
- Detection limits requirements.
- Documentation requirements.

As in the case of EPA/CLP procedures, data acceptance limits may be defined within the method. As one means of tracking data acceptability, quality control charts are plotted for specific parameters determined in similar, homogeneous matrices. Control limits for non-CLP methods are statistically determined as analytical results are accumulated unless provided by method or program.

Upon completion of the evaluation, the evaluator dates and initials the data review checklist as described in Section 11.5 below.

11.5 Data Interpretation and Reporting:

Interpretation of raw data and calculation of results are performed by a scientist experienced in the analytical methodology. Upon completion of data reduction, the scientist signs for the reported results on the data review checklist. For GC/ECD, GC/FID and GC/MS, a technical peer review is performed using the data processing software prior to form generation.

The laboratory supervisor is responsible for the data generated in that department. The supervisor or other senior technical staff performs an independent review of data and completed report forms. Members of the QA staff also check the results on selected sets of data (usually 10%).

11.5.1 Report Formats:

Spectrum Analytical, Inc. RI Division uses a flexible data reporting system where final report format is based on the requirements of the client. The two most common types of data reports generated by the Spectrum Analytical Inc., RI Division are Level 2 or “commercial-format” and Level 4 or “CLP-format”. The lab adapts its data report format, wherever possible, to meet customer requirements. Occasionally reports are generated that are a compromise between “commercial” and CLP-format deliverables or are designed to meet the needs of a particular regulatory format or sampling program.

Drinking water Metals samples have special reporting requirements and client notification criteria for results exceeding the MCL. Clients are notified via facsimile or e-mail of all samples that exceed any EPA maximum contaminant level (MCL), maximum residual disinfectant level or reportable concentration within 24 hours of obtaining valid data. Drinking water Metals analyses are reported using a custom reporting format that will list the associated MCL and certification status for each element. Additionally, the requirement for the 24 hour MCL exceedence report will be highlighted in the comment section of the Subcontract Work Order for any subcontracted potable water samples.

Commercial data reports are generated using the LIMS. All instrumental analysis data are uploaded from instruments to the LIMS by electronic data transfer. Non-instrumental analysis data or sample preparation data are manually entered into the LIMS. All manual data entry steps are double-checked to insure they are correct, and instrumental data are spot-checked to insure the proper functioning of the data upload system. All data receive a 100% review before they are released to the client as final.

CLP data reports are generated using specialized CLP report modules in the LIMS for all inorganic and most organic analyses. These reports also undergo a 100% review before they are released to the client in their final form.

Records are maintained for all data, even those results that are rejected as invalid.

11.6 Levels of Data Review:

Spectrum Analytical, Inc. RI Division employs five (5) levels of data review. These are based on requirements outlined in several government and other environmental analysis programs including the U. S. Army Corps of Engineers, Air Force Center for Environmental Excellence (AFCEE), Naval Facilities Engineering Service Center (NFESC), HAZWRAP, Department of Defense

ELAP (QSM), EPA Contract Laboratory Program (SOM/ISM), as well as commercial engineering firm programs.

The data review and evaluation process is structured to insure that all data reported to customers has been thoroughly reviewed and approved using a multi-step process designed to identify and correct any error. At any step in the data evaluation and review process, the reviewer has the responsibility and authority to return any data not meeting requirements back to the previous step for re-analysis or correction. No reports are released to the client as final data without successfully passing through each step in the data evaluation and review process. The steps of the data review process are documented, generally using a checklist. Several checklists are used, depending on the type and format of analysis data being reviewed. Any data released prior to the completion of the full review process are released with the statement that the data is preliminary pending final review. The word “Preliminary” is automatically printed on the bottom of all data sheets that are generated prior to completion of data review.

The five levels of data review are detailed in SOP # 110.0028 Data Validation/Self Inspection Procedures. A Flow chart of the data review process follows in Figure 11.6-1.

11.7 Document Control:

All login sheets, Chains-of-Custody (COC) and Sample Condition Forms (SCF) and other sample transmittal documentation are generated in Sample Receiving. A red Workorder File is initiated to contain all workorder-specific hard copy documents. Samples are signed in/out of the sample receiving area by analysts. In the Prep lab, samples and all pertinent information is recorded into logbooks. Once samples are moved to the instrument lab, the transfer of extracts is documented in the electronic transfer logbook (ICOC). In the instrument lab, the analysis of extracts is recorded in the instrument run log. All analysis data, including ICAL, CAL and raw data are acquired using computer-controlled instruments, and stored on the hard drive of the computer performing data acquisition. Data are automatically copied to the company file server after acquisition. Organics analysis data are processed using Thru-Put Systems’ Target software. This system creates a folder on the file server for each analysis fraction for each work order or SDG. This folder contains raw data, processed analysis results, instrument tune, initial calibration and continuing calibration results as well as a copy of the data processing method used. This allows for long-term archiving and complete reconstruction of the data at any time in the future. Organic data files are also uploaded into LIMS so reporting forms can be printed. The raw data are printed electronically and arranged with all appropriate sample-preparation and instrument run logbook page copies for technical review.

Inorganic data files are uploaded into LIMS and reporting forms are printed electronically. The original instrument data files and the processed SDG are stored on the file server where they can later be archived by the LIMS Administrator. PDF printouts for reporting forms, instrument data output and all associated preparation logbook page copies are assembled for technical data review through a custom reporting system, Package Maker.

Spectrum RI is primarily utilizing a paperless reporting system with the exception of our EPA CLP reports which require a hard copy report.

See SOP # 110.0029, Electronic Data Management for a detailed description of data management activities used to support laboratory activities.

Following technical review and generation of the report narrative, results go into the workorder file in data reporting. The original copy or electronic pdf version (dependent on client requirements) of the report is sent to the client. Spectrum offers our clients secure access to their pdf reports and EDDs via our website eServices portal. All other information associated with the report, including data review checklists are kept in the red workorder file. The non-reported data (NRD) is scanned into the optical file database for long-term archiving. As documents are scanned into the database they are recorded for permanent storage on hard drives within the fileserver. The archived electronic data is kept for a minimum of ten (10) years or according to contract/program requirements. Prior to the use of the optical file database, hardcopy reports and NRD were shipped to an offsite storage area where they will remain for a minimum of ten (10) years. After this time, these older files will be destroyed.

11.7.1 Logbooks:

All logbooks are issued and controlled by the QA Department. Logbooks are given a unique ID that includes the mm/yy the logbook was printed. Laboratory personnel must sign for the logbook when it has been released by the QA Department. When logbooks are complete, the analyst returns them to the QA Department for archiving unless still needed for reference in the lab. A new logbook is released. The archived logbooks are stored in an on-site storage box for approximately 4-6 months and then are stored in an off-site storage facility or may remain on-site depending on storage space. Refer to SOP # 80.0040, Logbook Use, Review, and Control for more detail. In addition, refer to SOP # 110.0027, Documentation Policy and Procedures for details on Spectrum Analytical, Inc. RI Division’s Logbook policies. Logbooks are archived for a minimum of ten (10) years or according to contract/program requirements.

11.7.2 Workorder/Data Files:

Spectrum Analytical, Inc. RI Division is a secured, limited access building. The doors are secured with a keypad entry system. All hard copy information pertaining to the analysis of samples is maintained and stored in a workorder file folder. This information includes all login sheets, COC, SCF, bench sheets and printed analytical data. Electronic data are also stored by laboratory workorder number on the company file server, and in the optical file database of completed reports and NRD as mentioned in section 11.7. File folders containing any remaining workorder information are stored in an off-site storage facility or may remain on-site for a total of 10 years.

The off-site storage facility referred to in the above sections is a locked storage area. Access is limited to the Laboratory Director or his designee and request to retrieve a file will be made to this person.

In the event Spectrum Analytical, Inc. RI Division changes ownership, the maintenance, control, storage and eventual disposal at the end of the appropriate time period, of all records, including client data and QA/QC files, will transfer to the new owners.

In the event Spectrum Analytical, Inc. RI Division decides to cease operations, clients will be notified prior to the cessation of operations and their files/records will be made available to them. Within a designated time period after notification, the client will be responsible for taking custody and the future maintenance of their records. If the client determines they do not want to maintain the records, these will be disposed of properly.

11.7.3 Standard Operating Procedures (SOPs):

SOPs are prepared by the Lab Supervisor and laboratory personnel in conjunction with the QA Director. The QA Director/Staff downloads a copy of the current SOP to the network at Public on ‘Bernoulli’. The SOPs can be found in Q:\QA_SOPs. In addition a .pdf file of the SOP is located in Q:\QA_PUBLIC\PDF-MITKEM SOPs. A list of the current SOPs in use at Spectrum Analytical, Inc. RI Division is given in Figure 11.7-1.

The laboratory staff revises the SOPs by making changes to the document that is then reviewed by the department supervisor only if the supervisor is not the party responsible for the revisions. Any additional changes are made at this point.

The QA Department is notified that revisions are completed. The QA Director/Staff moves the revised copy of the SOP to the QA directory, QA Safety/SOPs Needing QA Revision. The QA Director makes changes to the document to include revision number and date and title clarification, if necessary. Changes from the last revision are clearly marked using ‘Track Changes’ in Microsoft Word.

The QA Director prints a searchable pdf copy of the SOP. At this time, hard copies of several pages are printed for original signatures of the Laboratory or Technical Director, and the QA Director. The effective date is then added to the SOP and the signed pages are scanned and inserted into the pdf document. If an older version of the SOP exists, it is moved to its archive location. The new version will be moved into the Spectrum Analytical, Inc. RI Division Intranet SOP Database as the only version accessible by laboratory personnel. Each analyst who performs any duties related to the SOP must review the new version and enter electronically that he or she has read and understands the material there.

SOP review/revisions occur on an annual basis. The procedure for preparing, reviewing, approving, revising and distributing SOPs as well as the SOP Revision Schedule are described in SOP No. 80.0012.

Minor changes to the SOP between revision dates can be done as needed. Minor changes are recorded in the Revision Record that is a part of the master copy. Edits are clearly marked. This allows readers quick access to the changes.

11.7.4 Quality Assurance Manual:

The lab will review the QA Manual annually at a minimum. Past versions of the QA Manual are maintained and archived by the QA Director in the same manner as SOPs. Edits to the QA Manual are made by the QA Director in conjunction with the laboratory management. Spectrum Analytical, Inc. RI Division will amend the QAP and any affected SOPs within 14 days when technical changes (or any of the circumstances outlined in the USEPA SOW for SOM or ISM, Exhibit E, section 5.3.2) occur. The revised QAP with visible markups will be sent to the USEPA as per section 5.3.2.1.

11.7.5 Method Updates:

In most cases it is the laboratory’s policy to implement new revisions of frequently used methods within six months of the date the method revision is promulgated or published as a final method (non-CLP methods, for CLP methods see below). The QA Director, Deputy Director for Quality Services, Technical Director and Laboratory Director make the final decision on when a method revision will be adopted by the laboratory. Additionally, if a client specifically requests or mandates that an “older” method, Spectrum Analytical, Inc. RI Division will advise the client that it is not the most recent method. If the client still insists upon the older method, the lab will comply and make a note in the narrative.

When the laboratory is in the middle of a client's project, the lab will continue using the same revision for the entire sampling event unless advised otherwise by the client. Consequently, once the laboratory has formally adopted a new method revision, both the old and new revision may be in use at the same time, depending on the project.

If a client should not specify which methods to be used, the methods employed by the laboratory shall be fully documented and validated. Additionally, the methods shall be published in a reputable technical journal or text or by a reputable technical organization or instrument manufacturer.

Revisions to USEPA CLP methods are required to be implemented within 14 days of notification when the EPA modifies the technical requirements of the statement of work, or the contract. At this same time, the QAP will be amended as necessary as noted in section 11.7.4.

Laboratory-developed methods can be used as long as they have been documented and validated by qualified personnel. In all cases the client should be notified.

Figure 11.6-1
Data Review Flow Diagram

Spectrum Analytical, Inc. RI Division
Review Process Flow Diagram

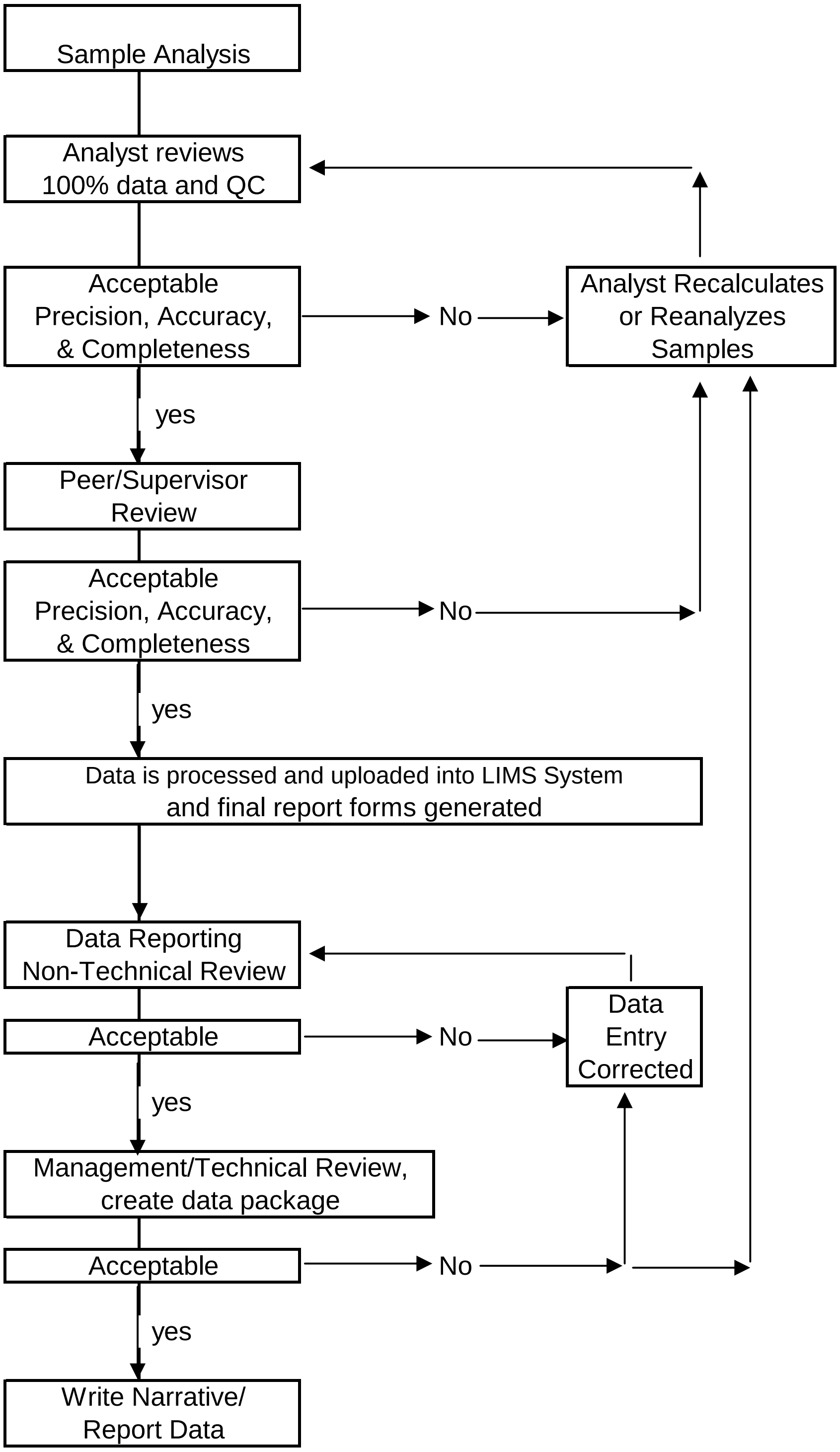


Figure 11.7-1
Standard Operating Procedures (SOPs)

Spectrum Analytical, Inc. Rhode Island Division

Standard Operating Procedures (SOPs)
Master List

SOP #	Title
10.0016	Assembly of Inorganic CLP and CLP-type Reports
10.0017	Assembly of Organic CLP and CLP-type Reports
10.0018	Assembly of Commercial Data Reports
10.0021	Data Report Options
10.0036	EPA/SOM Organic Data PDF Bookmarking
10.0037	EPA/ISM Inorganic Data PDF Bookmarking
20.0003	Logging Workorders into Omega
20.0005	Level 2 LIMS report preparation
30.0002	Bottle order preparation
30.0003	Sample Receipt, Storage, Tracking and Disposal
30.0024	Sample and Waste Disposal
30.0030	ICOC Procedures using IntCOC program
50.0004	Glassware Cleaning - Organics
50.0027	Organic Preparation of Aqueous/Soil Samples for Chlorinated Herbicides by SW-846 Method 8151A
50.0030	SOM01.2 Sulfur Cleanup
50.0031	SW-846 Method 3665A Acid Cleanup
50.0032	Gel Permeation Chromatography by SW-846 Method 3640A
50.0033	SW-846 Method 3620B Florisil Cleanup
50.0034	SW-846 Method 3630C Silica Gel Cleanup
50.0035	Oil&Grease (HEM&SGT) by Method 1664 Revision A
50.0036	SW-846 Method 3660B Sulfur Cleanup

Spectrum Analytical, Inc. Rhode Island Division

Standard Operating Procedures (SOPs)
Master List

SOP #	Title
50.0050	Organic Preparation of Aqueous Samples by Continuous Liquid-Liquid (Method 3520)
50.0051	Organic Preparation of Aqueous Samples by Separatory Funnel (Method 3510)
50.0052	Organic Preparation of Soil Samples by Sonication (Method 3550)
50.0053	Organic Preparation of Soil Samples by Soxhlet (Method 3540)
50.0054	Organic Extract Filtration and Concentration Techniques
50.0060	Organic Preparation of Aqueous Samples by Continuous Liquid-Liquid for Pesticides/Aroclors for SOM01.2
50.0061	Organic Preparation of Aqueous Samples by Separatory Funnel for Pesticides/Aroclors for SOM01.2
50.0062	Organic Preparation of Solid Samples by Sonication for Pesticides/Aroclors for SOM01.2 by Method 3550B
50.0063	Organic Preparation of Aqueous Samples by Continuous Liquid-Liquid for Semivolatiles for SOM01.2
50.0064	Organic Preparation of Solid Samples by Sonication for Semivolatiles for SOM01.2
50.0100	Preparation of Soil Samples by MSE by Method 3570
50.0101	Preparation of Soil Samples by PFE by Method 3545
50.0102	Percent Lipid Determination in Tissue Samples
60.0002	Pesticide/PCB Analysis by EPA Method 608
60.0003	Determination of Polychlorinated Biphenyls by Gas Chromatography/Electron Capture Detector Analysis by SW846 Method 8082A
60.0006	Determination of Pesticides by Gas Chromatography/Electron Capture Detector Analysis by SW846 Method 8081B
60.0007	EDB/DBCP by EPA Method 504.1 and SW-846 8011

Spectrum Analytical, Inc. Rhode Island Division

Standard Operating Procedures (SOPs)
Master List

SOP #	Title
60.0034	Determination of Chlorinated Herbicides by Gas Chromatography/Electron Capture Detector Analysis by
60.0048	Aroclor Analysis GC/ECD by USEPA SOW SOM01.2
60.0049	Pesticide Analysis GC/ECD by USEPA SOW SOM01.2
60.0050	Total Petroleum Hydrocarbons by GC-FID using EPA SW-846 Methods 8015/State Methods
60.0053	PCB Congeners by SW-846 Method 8082 (MOD)
60.0054	PCB Homologs by E680 GC/MS SIMS (MOD)
70.0011	Determination of Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) Analysis by SW846 Method 8270D
70.0030	Screeening for Semivolatile Organic Analysis by Gas Chromatography/Mass Spectrometry for SOM01.2
70.0033	SIM Analysis by GC/MS (Modified EPA Method 8270D)
70.0035	Semivolatile Organic Analysis by SIM Gas Chromatography/Mass Spectrometry for SOM01.2
70.0048	Semivolatile Organic Analysis by Gas Chromatography/Mass Spectrometry for SOM01.2
70.0051	Semivolatile Organics by GC/MS for Aqueous Samples by EPA Method 625
80.0001	Standard Equivalency/Traceability
80.0002	Client Complaint Policies
80.0004	QA Data Pkg Review
80.0005	Method Detection Limit Determination
80.0006	Internal Audit Procedures
80.0007	Corrective Action Procedures

Spectrum Analytical, Inc. Rhode Island Division

Standard Operating Procedures (SOPs)
Master List

SOP #	Title
80.0009	Newly Implemented Methods (Demonstration of Acceptable Performance)
80.0010	Control Chart Generation and Use
80.0012	The Production of Standard Operating Procedure
80.0013	Reagent Purchasing & tracking
80.0016	Training Procedures and Tracking
80.0020	Temperature Monitoring Systems
80.0030	Labware Volume Verification
80.0040	Logbook Use, Review, and Control
80.0050	Performance Testing Procedures
90.0012	Determination of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) Analysis by SW846 Method 8260C
90.0035	Low/Med Volatile OrganicsAnalysis GC/MS by USEPA SOM01.2
90.0036	Trace Volatile OrganicsAnalysis GC/MS for USEPA SOM01.2
90.0038	Gasoline Range Organics by GC/FID using Methods SW-846 8015 and Maine 4.2.17
90.0040	Trace Volatile OrganicsAnalysis GC/MS using SIM for USEPA SOM01.2
90.0052	Volatile Organics by GC/MS for Aqueous Samples by EPA Method 624
90.0060	Methane, Ethane, and Ethene by GC/FID Method RSKSOP-175
100.0001	Glassware Cleaning - Inorganics
100.0002	Alkalinity (by Standard Method 2320)
100.0003	Sample Preparation of Aqueous Samples by Acid Digestion ICP (3005/3010)
100.0004	Total Cyanide by Automated Colorimetric with Midi-distillation by SW846 9012B

Spectrum Analytical, Inc. Rhode Island Division

Standard Operating Procedures (SOPs)
Master List

SOP #	Title
100.0005	Determination of Metals and Trace Elements in Water and Waste by ICP - Atomic Emission Spectrometry by EPA Method 200.7
100.0006	ICAP 3000XL/4300DV Operation
100.0007	Aqueous sample Prep E200.8
100.0010	Nitrite Analysis by Standard Method 4500-NO2 B
100.0011	pH Value by Standard Methods 4500-H+ B
100.0012	Mercury Analysis in Aqueous Samples by Flow Injection Analysis System for Atomic Analysis by Method 7470A/7471B
100.0013	Total and Ortho Phosphate using Ascorbic Acid Method by Standard Method 4500-P E
100.0014	Mercury (Manual Cold Vapor Technique) by EPA Method 245.1
100.0015	The Preparation of Waste Samples for reactive Cyanide and Sulfide; Determination of Reactive Cyanide by Automated Colorimetric Method and Reactive Sulfide by Spectrophotometric Method SW-846 Methods 7.3.3.2 and 7.3.4.2
100.0016	Preparation of Soil Samples for Sulfide Analysis by Modified SW-846 Method 9031
100.0017	Inorganic Analysis of Sulfates in Aqueous Samples by SM 426 C 15th Ed and SM4500 SO4 E-.
100.0018	Inorganic Analysis of Sulfides in Aqueous Samples (Methylene blue method)
100.0019	Total Dissolved Solids Dried at 180°C by Standard Method 2540 C
100.0020	Total Solids Dried at 103-105°C by Standard Method 2540 B
100.0021	Total Suspended Solids Dried at 103-105°C by Standard Method 2540 D
100.0022	TKN Distillation and Determination by Manual Spectrophotometric Analysis by Standard Method 4500-N
100.0023	Color Analysis by Visual Comparison by Modified Standard Methods 2120B
100.0024	Flashpoint Analysis by SW846 Method 1010A
100.0025	Total Organic Carbon by Methods SW-846 9060A and SM5310B

Spectrum Analytical, Inc. Rhode Island Division
Standard Operating Procedures (SOPs)
Master List

SOP #	Title
100.0026	Settleable Solids by Standard Method 2540 F
100.0027	Paint Filter Liquids Test by SW-846 Method 9095A
100.0028	Carbon Dioxide (CO2) and Forms of Alkalinity by Calculation by Standard Method 4500-CO2 D
100.0029	Ferrous Iron Analysis by Standard Method 3500-Fe B, Phenanthroline Method
100.0030	Phenols Analysis by EPA Method 420.1 and Standard Method 5530 B & D, Cleanup and Direct Photometric Method
100.0032	Total Volatile Solids for Solids by SM 2540 E, E160.4; Fixed and Volatile Solids Ignited at 550 C
100.0033	Total Cyanide by Auto-Colorimetric with Midi-Distillation by EPA Method 335.4
100.0053	ISM01.3 ICP-AES Analysis
100.0054	ISM01.3 ICP-MS Analysis
100.0055	Mercury Preparation and Analysis by ISM01.3
100.0056	Cyanide Preparation and Analysis by ISM01.3
100.0100	Sample Preparation of Soils by Acid Digestion for ICP/MS (3050B/6020A)
100.0103	AVS and SEM
100.0104	Sample Preparation of Soils by Acid Digestion for ICP/AES (3050B/6010C)
100.0106	Chemical Oxygen Demand Determination SM5220D
100.0110	Determination of Metals in Water and Wastes by Inductively Coupled Argon Plasma Mass Spectrometry by SW846 Method 6020A
100.0111	Determination of Metals in Water and Wastes by Inductively Coupled Argon Plasma Atomic Emission Spectrometry by SW846 Method 6010C
100.0112	pH in Soil Samples by SW846 9045D/SOM1.2
100.0113	Determination of Metals and Trace Elements in Water by ICP - MS by EPA Method 200.8
100.0121	ICP Aqueous Preparation by ISM01.3

Spectrum Analytical, Inc. Rhode Island Division

Standard Operating Procedures (SOPs)

Master List

SOP #	Title
100.0122	Prep of Soil, Wipe/Air Filter for ICP Analysis by ISM01.3
100.0201	Ammonia Distillation & Determination SM4500-NH3 B&C
100.0208	Inorganic Analysis of Hexavalent Chromium in Soil Samples by SW846 Methods 3060A & 7196A
100.0209	Mercury Speciation…SW846 Method 3200
100.0308	Inorganic Analysis of Hexavalent Chromium in Aqueous Samples by SM 3500 Cr +6 B
100.0400	Inorganic Anions by IC EPA 300.0 and 9056A
100.0410	TOC in Soil by Lloyd-Kahn and SW-846 9060
100.0420	Volatile Fatty Acids by IC using EPA 300.0 (modified)
100.0430	Walkley Black TOC in Soil
100.0440	Total, Fixed and Volatile Solids in solid/semisolid samples by SM2540G
110.0006	Thermometer Calibration
110.0007	Balance Calibration
110.0008	Manual Integration of GC, IC and GC/MS Chromatograms
110.0012	Laboratory Security
110.0013	North Carolina Samples
110.0021	Bids and Proposals
110.0023	Project Management
110.0025	Toxicity Characteristic Leaching Procedure by SW846 Method 1311
110.0026	Handling of Evidentiary Materials
110.0027	Documentation Policy and Procedures
110.0028	Data Validation-Self Inspection Procedures
110.0029	Electronic Data Management
110.0031	Synthetic Precipitation Leaching Procedure by SW-846 Method 1312
110.0032	ASTM Leachate Procedure D3987-06

Spectrum Analytical, Inc. Rhode Island Division

Standard Operating Procedures (SOPs)

Master List

SOP #	Title
110.0034	Sample Data Control for Inorganic CLP (ILM/ISM)
110.0035	Sample Data Control for Organic CLP (SOM)
110.0038	Percent Solids Determination as Required for Various SW-846 and EPA Methods
110.0039	Sub-Sampling for Soil and Solid Samples
110.0040	Instrument Maintenance
110.0041	Multiple Extraction Procedure by SW846 EPA Method 1320
110.0043	Standard Elutriate Preparation
110.0060	Tissue Sample Preparation

12.0 LABORATORY QUALITY CONTROL CHECKS

Spectrum Analytical, Inc. RI Division’s analytical procedures are based on sound quality control methodology, which derives from three primary sources:

1. Specific EPA and other approved analytical methods, and

2. “Handbook for Analytical Quality Control in Water and Wastewater Laboratories” (EPA 600/4-79-019).

3. Standards for Good Laboratory Practice.

In the application of established analytical procedures Spectrum Analytical, Inc. RI Division employs, at a minimum, the QC protocols described in the references found in the Analytical Methods section of this document. Specific projects may require additional quality control measures, due to such factors as difficult sample matrices or use of innovative techniques. For those projects Spectrum Analytical, Inc. RI Division will recommend and implement, subject to client approval, QC measures to produce data of known quality.

Each of the Spectrum Analytical, Inc. RI Division laboratory departments have an individual QC program, which includes, but is not limited to, the practices described below.

12.1 Method Detection Limit Determination/Verification:

Method Detection Limits are developed annually for certain inorganic and many organic analyses. Per NELAC Standards, MDLs are not required where target analytes are not reported below the lowest calibration standard concentration. For these analyses, results are only reported within the calibration range, and MDLs are not appropriate or needed. The reporting limit for these compounds is the concentration of the lowest standard in the calibration. For certain inorganic analyses and most organic analyses, Spectrum Analytical, Inc. RI Division typically reports analytes below the lowest level of the calibration range, but above the MDL, as estimated and are qualified with the “J” flag. Spectrum Analytical, Inc. RI Division reports estimated values below the calibration range for those analyses where results are able to be confirmed as in dual column confirmation, or by two concurrent determinative tests such as retention time and mass spectra as in GC/MS analyses. For these analyses MDLs are determined or verified annually, depending on program requirements.

MDLs are determined for all test methods where required by specific program or state regulations. Methods analyzed for the State of Massachusetts which do not detail MDL requirements within the published method, require preparation and analysis of the MDL samples over a minimum of three days. This is believed to better mirror real world samples and day to day variability of preparatory and analytical steps.

In addition, to address special project requirements, MDLs can be determined for those tests which are not routinely reported below calibration range. If a client requests results to be reported below the calibration range without an MDL study, this is clearly identified in the workorder narrative.

Following an MDL study, the determined limits are verified by the analysis of an MDL Verification Standard. This standard is analyzed at approximately 2 to 3 times the calculated MDL for single analyte tests or 1-4 times the calculated MDL for tests with multiple analytes. This spike concentration is also referred to as the Limit of Detection in Department of Defense Quality Systems Manual (DoD QSM). DoD QSM requires quarterly verification of the LOD. For more details refer to SOP 80.0005 Determination of Method Detection Limits.

12.2 Personnel Training:

Chemists who begin their employment at Spectrum Analytical, Inc. RI Division are to be instructed under the lab’s Safety Training Program within the first month. The Safety Training Program includes laboratory basics, safety video and testing, and MSDS instruction.

Before performing any analyses, a chemist is required to read the appropriate protocols and SOPs. The chemist is required to sign off on all documents read in the electronic SOP database located on our lab Intranet.

The new analyst must become familiar with the laboratory equipment and the analytical methods, and begins a training period during which he or she works under strict supervision. Independent work is only permitted after the chemist successfully completes an accuracy and precision study.

The accuracy and precision study is also commonly referred to as a Demonstration of Capability exercise. Upon the successful completion of the Initial Demonstration of Capability exercise, the QA Department issues a Demonstration of Capability Certificate (IDOC) which is signed by both the QA Director and Laboratory Director.

Demonstration of Capability studies requires the acceptable mean recovery of 4 LCS samples for each matrix or the acceptable analysis of a blind spike sample such as a Performance evaluation sample. Acceptance limits are established by the method. It is necessary to pass the study whether for extraction and/or analysis.

Annually thereafter the employee must perform an acceptable demonstration of capability study to document continued acceptable performance in his/her particular preparatory or analytical method specialty. This is referred to as the On-going DOC. All DOCC documentation is filed in the employee's personnel folder, which is stored in the QA Department/or in the electronic personnel folder as the system has transitioned to a paperless filing system for DOCC.

Initial and on-going personnel training include data integrity training. The 4 required elements of the data integrity system include: 1) data integrity training, 2) signed data integrity documentation, 3) in-depth, periodic monitoring of data integrity, and 4) data integrity procedure documentation.

Data integrity training topics will include the need for honesty and full disclosure in all analytical reporting, how and when to report integrity issues and what those issues could be. Employees will understand that infractions of data integrity procedures can result in an investigation that could lead to serious consequences which include immediate termination, and civil or criminal prosecution. At the start of employment all new employees read, discuss and sign a Confidentiality, Ethics and Data Integrity Agreement. Annually, an on-going integrity training session is held. An attendance sheet will be generated for every integrity session. These sheets are filed in the QA Office under "Training". Another option for the annual training session is having all staff review refresher materials online and documents their having done so. This is done within the framework of the SOP database on the lab's intranet.

Data integrity procedures are reviewed and updated annually by senior management.

Training for the EPA Statement of Work occurs according to the above requirements. In addition, analysts are required to read the CLP Statement of Work as a part of the documentation training.

12.3 Control Charts:

For organic and inorganic analyses, the recoveries of analytes in the lab control samples are plotted on control charts. These charts are used to establish control and warning limits.

12.3.1 Control limits are calculated ,compared, and/or updated at least annually from the LCS, MS/MSD, and Surrogate data points for each analyte and matrix using the following equations:

$$Average(\overline{x}) = \frac{\left[\sum_{i=1}^{n} x_i\right]}{n}$$

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\left(x_i - \overline{x}\right)^2}{n-1}}$$

In which:
SD = Standard Deviation
N = number of data points

Warning Limits = Average ± 2 * SD

Control Limits = Average ± 3 * SD

12.3.2 Control limits must be approved by the QA Director and by the Laboratory Director prior to adoption by the laboratory. In the event that limits are wider than method recommended limits, the method recommended limits may be adopted and the analytical procedure will be re-evaluated and/or re-determined to identify possible causes. Additionally, in the event that control limits are tighter than 15% from the average, the lab may adopt a control limit of ±15% from the average. If in the experience of the laboratory, statistical control limits are unreasonably wide or narrow, alternative limits may be used until appropriate statistical limits are developed. Alternative limits are based on sources such as DoD QSM published guidelines, EPA limits from the specific test method or from similar methods, laboratory experience with the method or other sources.

12.3.3 Control charts are plotted in EXCEL using the LIMS system.

Data from each laboratory is uploaded into the LIMS. The compounds, recoveries, and date analyzed for each test are recorded in the system. In order for LIMS generated control limits to be valid, all data, including data not meeting existing recovery criteria, must be uploaded. A control chart is then printed for review by the QA Director and by the Lab Supervisor. Out of control situations noted on the control chart are discussed with the Supervisor or Laboratory Director by the QA Director.

An example control chart is presented as Figure 12.3-1. LCS data must be reviewed and evaluated daily against the Control Limits to establish that the system is in control.

12.3.4 The following situations constitute an out of control situation on a control chart:

- One data point above or below the Control Limit line.
- Two consecutive data points above or below the Warning Limit line.
- Six or more consecutive data points above the Average Line or six or more consecutive data points below the Average Line. This situation suggests a trend and suggests the procedure has been changed in some way (for better or worse). The cause for this trend must be investigated.

12.4 General QC Protocols:

12.4.1. Organics Laboratory:

- Trip blanks and holding blanks, when applicable, are analyzed to detect contamination during sample shipping, handling and storage.
- Method blanks, at a minimum of one in every 20 samples, are analyzed to detect contamination during analysis.
- Volatile organic method blanks are analyzed once during each analytical sequence.
- One blank spike (Laboratory Control Sample or LCS) consisting of an analytical sample of laboratory water, anhydrous sodium sulfate, or Ottawa sand with every batch of 20 or fewer samples, is analyzed to determine accuracy.
- Sample spikes and spike duplicates, as requested, are analyzed to determine accuracy and the presence of matrix effects. The Relative Percent Difference (RPD) is also determined for matrix spike/matrix spike duplicates to measure precision. The criteria followed are stated in the individual methods. For batches without a sample duplicate (for example, if insufficient sample volume is provided), a duplicate blank spike (LCSD) is performed to provide for precision measurement.

- Performance evaluation samples from EPA and state agencies are analyzed to verify continuing compliance with EPA and NELAC QA/QC standards.

- Surrogate standards are added to samples and calculations of surrogate recoveries are performed to determine matrix effect and extraction efficiency.

- Internal standards for GC/MS analysis are added to sample extracts to account for sample-to-sample variation.

- Analysis of EPA traceable standards (ICV) to verify working standard accuracy and instrument performance.

- Initial multi-level calibrations are performed to establish calibration curves.

- Instrument calibration is established or verified with every analytical sequence.

- Tuning of GC/MS systems once every 12 hours for CLP and SW-846 methods or 24 hours for methods 624/625 to method specifications is implemented for consistency in data generation.

- Quarterly analysis of LOD and/or LOQ check samples to verify low level detection and reporting limits for Department of Defense QSM programs.

- Annual Verification of MDL for NELAC/TNI.

When QC limits are not met during an analytical run, the source of the problem must be investigated. Following an evaluation of the data, those samples affected must be re-analyzed after the problem has been solved. If QC limits continue to be out of control, the instrument must be checked and/or a service call made and/or further corrective action implemented.

12.4.2. Inorganic Laboratory:

- Trip blanks are analyzed when applicable, to detect contamination during sample shipping, handling and storage.

- Method blanks are analyzed at a minimum of one every 20 samples, to detect contamination during analysis.

- One matrix spike of an analytical sample or laboratory water or soil is made and spike recoveries are calculated with every batch up to 20 samples to determine accuracy. Duplicate samples are analyzed and the RPD between the sample and duplicate is calculated for every batch up to 20 samples. If insufficient volume of sample is received, a note is made in the appropriate preparation logbook.

- Performance evaluation samples from EPA and state agencies are analyzed to verify continuing compliance with EPA and NELAC QA/QC standards.

- Metals analysis instruments are calibrated for every analytical run.

- Analysis of EPA traceable standards (ICV) to verify working standard accuracy and instrument performance.

- QC/LCS checks samples are analyzed during every analytical batch of up to20 samples in order to document accuracy.

- Quarterly analysis of LOD and LOQ check samples to verify low level detection and reporting limits for Department of Defense QSM programs.

- Annual Verification of MDL for NELAC/TNI.

When QC limits are not met during an analytical run, the source of the problem must be investigated. Following an evaluation of the data, those samples affected must be re-analyzed after the problem has been solved. If QC limits continue to be out of control, the instrument must be checked and/or a service call made and/or further corrective action implemented.

12.5. Lab Pure Water used for method blanks and dilutions:

Spectrum Analytical, Inc. RI Division uses several systems to generate analyte-free water for use in the laboratory. These systems generate high quality, analyte free water dedicated to the needs of specific analyses.

12.5.1. For inorganic analyses the wet chemistry and metals labs use a US Filter mixed-bed deionization system followed by particle and carbon filters. This is followed by a polishing system using Barnstead E-Pure cartridges optimized for removal of inorganic constituents. Purity is monitored using an in-line electrical resistivity meter with integral cell. Finished Inorganic reagent water is tested for conductance on a routine basis (at least annually), through the use of an external conductivity meter.

12.5.2. For organic analyses, the extractable organics laboratory uses a Barnstead E-Pure system optimized for removal of organic constituents. As organic contaminants are not measured by a resistivity meter, this is not a relied-upon method to monitor the quality of organic analyte-free water. Instead, laboratory method blanks are used, typically several per working day, to monitor the acceptability of the water for its intended use. Any analyte detected above (half of) the reporting limit is investigated. If this can be traced to the water purification system as its source, maintenance is performed on the water purification system. The volatile organics laboratory uses a Whirlpool Model WHER25 Reverse Osmosis Drinking water system to provide analyte free water.

Figure 12.3-1
Example Control Chart

Spectrum Analytical, Inc. Featuring Hanibal Technology

REC QUALITY CONTROL CHART

Date: *24-Sep-12*

Test Code: SW8081_W Analyte: 4,4´-DDD

SampType	Sample ID	Analysis Date	Batch ID	Low Limit	High Limit	% Recovery
LCSD	LCSD-65227	3/23/2012	65227	25	150	94.0
LCS	LCS-65227	3/23/2012	65227	25	150	88.6
LCS	LCS-65354	4/3/2012	65354	25	150	93.9
LCS	LCS-65320	4/3/2012	65320	25	150	91.4
LCSD	LCSD-65320	4/3/2012	65320	25	150	84.5
LCS	LCS-65743	4/26/2012	65743	25	150	92.8
LCS	LCS-65925	5/7/2012	65925	25	150	91.6
LCS	LCS-66030	5/14/2012	66030	25	150	75.4
LCS	LCS-66116	5/15/2012	66116	25	150	93.2
LCSD	LCSD-66116	5/15/2012	66116	25	150	92.7
LCS	LCS-66132	5/16/2012	66132	25	150	92.8
LCS	LCS-66631	6/12/2012	66631	25	150	94.4
LCSD	LCSD-66631	6/12/2012	66631	25	150	99.1
LCS	LCS-66758	6/18/2012	66758	25	150	90.8
LCSD	LCSD-66767	6/18/2012	66767	25	150	82.5
LCSD	LCSD-66758	6/18/2012	66758	25	150	79.9
LCS	LCS-66767	6/18/2012	66767	25	150	89.5
LCS	LCS-66817	6/19/2012	66817	25	150	92.8
LCSD	LCSD-66817	6/19/2012	66817	25	150	92.6
LCS	LCS-66801	6/20/2012	66801	25	150	99.0
LCSD	LCSD-66801	6/20/2012	66801	25	150	98.6
LCS	LCS-66899	6/28/2012	66899	25	150	80.5
LCSD	LCSD-66899	6/28/2012	66899	25	150	83.1
LCSD	LCSD-67208	7/19/2012	67208	25	150	84.8
LCS	LCS-67208	7/20/2012	67208	25	150	89.5
LCS	LCS-67206	7/20/2012	67206	25	150	80.6
LCS	LCS-68027	9/13/2012	68027	25	150	96.9
LCS	LCS-68082	9/13/2012	68082	25	150	100.3

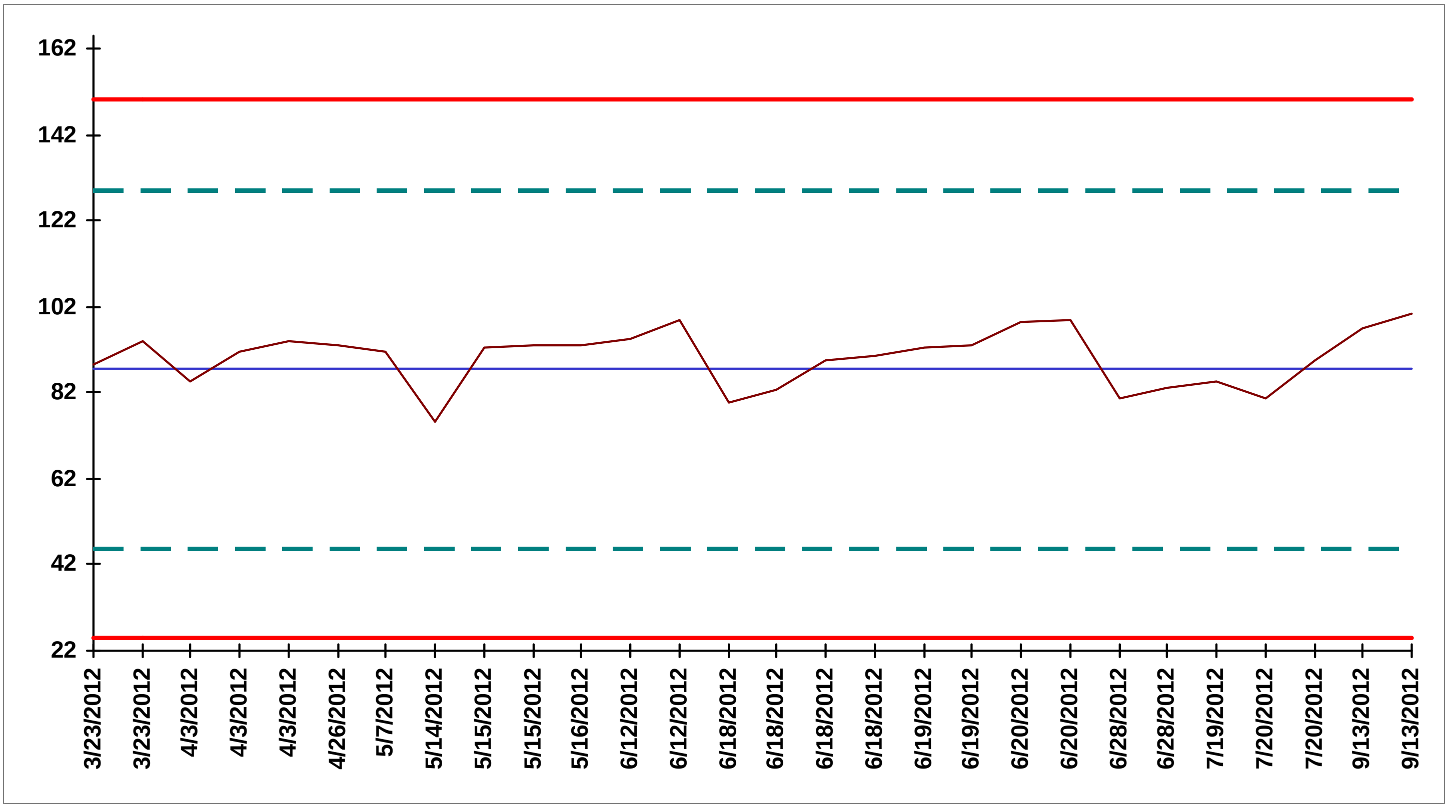
Spectrum Analytical, Inc. Featuring Hanibal Technology

REC QUALITY CONTROL CHART

Date: ***24-Sep-12***

Test Code: **SW8081_W** **Analyte:** **4,4´-DDD**

SampType	Sample ID	Analysis Date	Batch ID	Low Limit	High Limit	% Recovery



13.0 QUALITY ASSURANCE SYSTEMS AUDITS, PERFORMANCE AUDITS AND FREQUENCIES, PEER REVIEW

The Spectrum Analytical, Inc. RI Division Quality Assurance staff performs routine internal audits of the laboratory. The frequency of such audits depends on the workload in house but is done annually, at a minimum. These audits entail reviewing laboratory logbooks and all appropriate operations to ensure that all laboratory systems including sample control, analytical procedures, data generation and documentation meet contractual requirements and comply with good laboratory practices.

13.1 System Audits:

The QA Director audits each individual laboratory annually in order to detect any sample flow, analytical or documentation problems and to ensure adherence to good laboratory practices as described in Spectrum Analytical, Inc. RI Division's Standard Operating Procedures and Quality Assurance Plan. A checklist used in an internal systems audit is presented in Figure 13.1-1.

Areas covered by the internal audit include logbook documentation and review, standard traceability, standard storage and expiration dates, method criteria adherence, instrument maintenance records, SOP review, and knowledge of the analysts. Often, deficiencies that have been noted during "outside" audits will also be reviewed.

Upon the completion of the internal audit, a formal audit report is presented to the laboratory supervisor who is given a specific timeframe to respond in writing to the deficiencies. The QA Department will do a follow up audit to check that at least the major deficiencies have been corrected. The follow-up audit occurs within 30-45 days from the date of the audit response.

13.2 Performance Audits:

Spectrum Analytical, Inc. RI Division participates in external Performance Test (PT) studies under the National Environmental Accreditation Program (NELAP) through the New Jersey Department of Environmental Protection (Primary Accreditation Authority). The QA department administers the Performance Evaluation Samples for Wastewater/Solid Waste (WW/SHW). Additionally, performance samples are administered for test methods not certified through the New Jersey program, such as specific state methods. PT samples are handled (i.e., managed, analyzed, and reported) in the same manner as real environmental samples utilizing the same staff, methods as used for routine analysis of that analyte, procedures, equipment, facilities, and frequency of analysis. When analyzing a PT sample, a laboratory shall employ the same calibration, laboratory quality control and acceptance criteria, sequence of analytical steps, number of replicates and other procedures as used when analyzing routine samples. PT samples are reported electronically via the vendor's website (ERA, RTC…), and results are sent directly to all applicable state or agency certification programs.

Clients also send performance evaluation samples (PES) to Spectrum Analytical, Inc. RI Division as part of their own quality control program. Spectrum Analytical, Inc. RI Division is blind to the true values of the PES. The USEPA CLP program provides quarterly blind (QB) studies for all tests and matrices. The lab is informed of their performance after the study has been graded through an Individual Laboratory Summary Report. When results in any section are less than 90.0%, the lab is required to complete a formal corrective action report to the EPA.

Spectrum Analytical, Inc. RI Division also participates in external electronic data QA monitoring audits and data package audits through the USEPA CLP program. On request, the Spectrum Analytical, Inc. RI Division CLP Project Manager submits instrument data tapes and all applicable documentation for tape audits, including a copy of the data package. All original documentation generated during sample analyses may be requested. The results of the tape audit are sent to Spectrum Analytical, Inc. RI Division in report format in the same manner as an on-site audit (see below). A formal response is required.

Several times a year outside agencies (federal, state, or private) may schedule an audit at Spectrum Analytical, Inc. RI Division in order to check the laboratory's processes. Most often these audits begin and end with a meeting between auditors and laboratory management. Each individual laboratory is examined. The QA Director and/or Senior Management Staff are most likely to remain with the auditors at all times during the audit.

Sometime after the audit, the lab receives a formal audit report to which it must respond. The audit report is initially reviewed by the QA Director who copies and distributes the report to each laboratory supervisor. The supervisors are required to respond in writing to the findings that pertain to his or her department. The QA Officer compiles the formal response that could be tweaked several times before the auditing authority accepts the results. A specific timeframe is set by the individual agency involved.

The QA Officer then sends a memo to each supervisor to detail what needs to be done in each department within a specific timeframe. The QA Department then follows up with the labs to ensure procedures have been modified and the corrective actions are in place.

Internally, performance is monitored on a daily basis at Spectrum Analytical, Inc. RI Division through the use of surrogate and internal standards, and LCS and MS/MSD samples. Check samples from independent commercial sources are employed routinely in each of the Spectrum Analytical, Inc. RI Division laboratory departments and ensure continuing high-level performance. The QA

Director may distribute internal blind PE samples to each laboratory department as needed. These blind PE samples can also be used to show on-going analyst proficiency in lieu of 4 LCS studies.

13.3. Peer Review:

Peer review is used as a vital quality control tool within all areas of the laboratory, and at all levels. Peer review allows defects in the acquisition, evaluation and reporting of sample data to be identified before moving on to the next step in the process of preparing and analyzing samples. Several steps of peer review are included at Spectrum Analytical, Inc. RI Division to prevent and catch mistakes, whether caused by human error or a system malfunction. As soon as samples enter the laboratory they are logged into the LIMS system and given unique sample identifiers that correspond to the client's IDs listed on the chain of custody. The individual jars or bottles are labeled and the technician employs a peer review of this labeling process. A project manager or peer technician visually inspects each jar or bottle for proper identification and matching lab/client IDs. Once the samples are sent into the labs for test preparation, they again undergo peer review as they are set up for extraction, digestion or distillation... This time the samples are inspected to confirm the samples at the bench match the identifications written into the lab preparation logbooks. Once the concentrated extract, digestate or distillate is ready for analysis and set up on the analytical instrument, an analyst will perform another peer review of the autosampler set up to avoid any misplacements of sample vials. In some lab areas this review may occur after instrument analysis, to verify all sample data were acquired electronically. Every analytical instrument sequence (GC/ECD, GC/FID, GC/MS, ICP/MS, ICP/AES, CVAA, FIA, IC) undergoes a technical peer review by a qualified analyst to verify positive and false positive results as well as manual integrations. Data reports are also reviewed at length according to the 5 level review processes described in Section 11 of the QAP as well as in SOP No. 110.0028 Data Validation/Self Inspection Procedures. At each point in the process, the peer review is documented.

Figure 13.1-1
QA Systems Audit Checklist

Quality Assurance Department
Spectrum Analytical, Inc. RI Division
.

Quality Review of Laboratory Department

Auditor:
Date:

Purpose

The Quality Review is a necessary tool to assess a department's quality and service functions. Each department will undergo a review of their process and procedures to evaluate their needs and areas of possible improvement. Each department will be tracked for quality, safety, compliance, reoccurring errors and process improvement.

Process

Each department will be broken down into several categories or areas of review. Each category will be reviewed and assessed for compliance. The categories will include at a minimum:

Personnel Training and Knowledge
Equipment
SOP Updates and Review
Logbook Review and Control
Chemicals/Standard Storage and Preparation
Sample Procedures and Method Compliance
QA/QC Procedures
Corrective Actions in process

Each category will be reviewed and a listing of any deficiency or findings will be documented for response and correction. The department Supervisor (s) will be required to respond to each deficiency or finding within 30 days of receipt of this report. All deficiencies or findings must have its correction(s) documented. For example, logbook deficiencies will require a photocopy of the correction(s). All other responses will require a written response or adequate explanation. Deficiencies will be tracked for reoccurrence. All documentation should be forward to the QA department for evaluation. A follow up audit may be scheduled.

Findings:

Personnel Training and Knowledge

Equipment

SOP Updates and Review

Logbook Review and Control

Chemicals/Standard Storage and Preparation

Sample Procedures and Method Compliance

QA/QC Procedures

Corrective Actions in process

Items marked with an* asterisk will require a written response by the lab supervisor or his designee to the QA Dept. This response must be submitted to the QA Department by *mm/dd/yyyy*. The response can be entered directly into this document in a different font color. Please note date that the CA was completed.

Auditor ____________________________________ Date ____________________

14.0 PREVENTIVE MAINTENANCE

Preventive maintenance is a routine practice at Spectrum Analytical, Inc. RI Division for all instrumentation. Scheduled preventive maintenance minimizes instrument downtime and subsequent interruption of analysis.

Only those equipment items meeting or exceeding applicable performance requirements are used for data collection. This includes items such as laboratory balances as well as major analytical instruments such as ICPs, ICP/MS, GCs and GC/MSs. All major instrumentation and equipment, as well as backup alternatives, are listed in Appendix A. Spectrum Analytical, Inc. RI Division SOP No. 110.0040, Instrument Maintenance, describes routine maintenance in detail. Individual analytical standard operating procedures describe maintenance as well (See Figure 11.7-1 for SOP listing).
When new software is purchased or developed, it is loaded onto one workstation with copies of data that have been previously processed using older software, and known to be correct. The data is then reprocessed using the new software and then the new results are compared to the original results for defects. If the software was purchased and found to contain a defect, the vendor is contacted and a solution and/or patch are requested. If the software was developed in-house, the problems are identified and corrected. This process is applicable to all software including enhancements made to customize the LIMS and network servers.

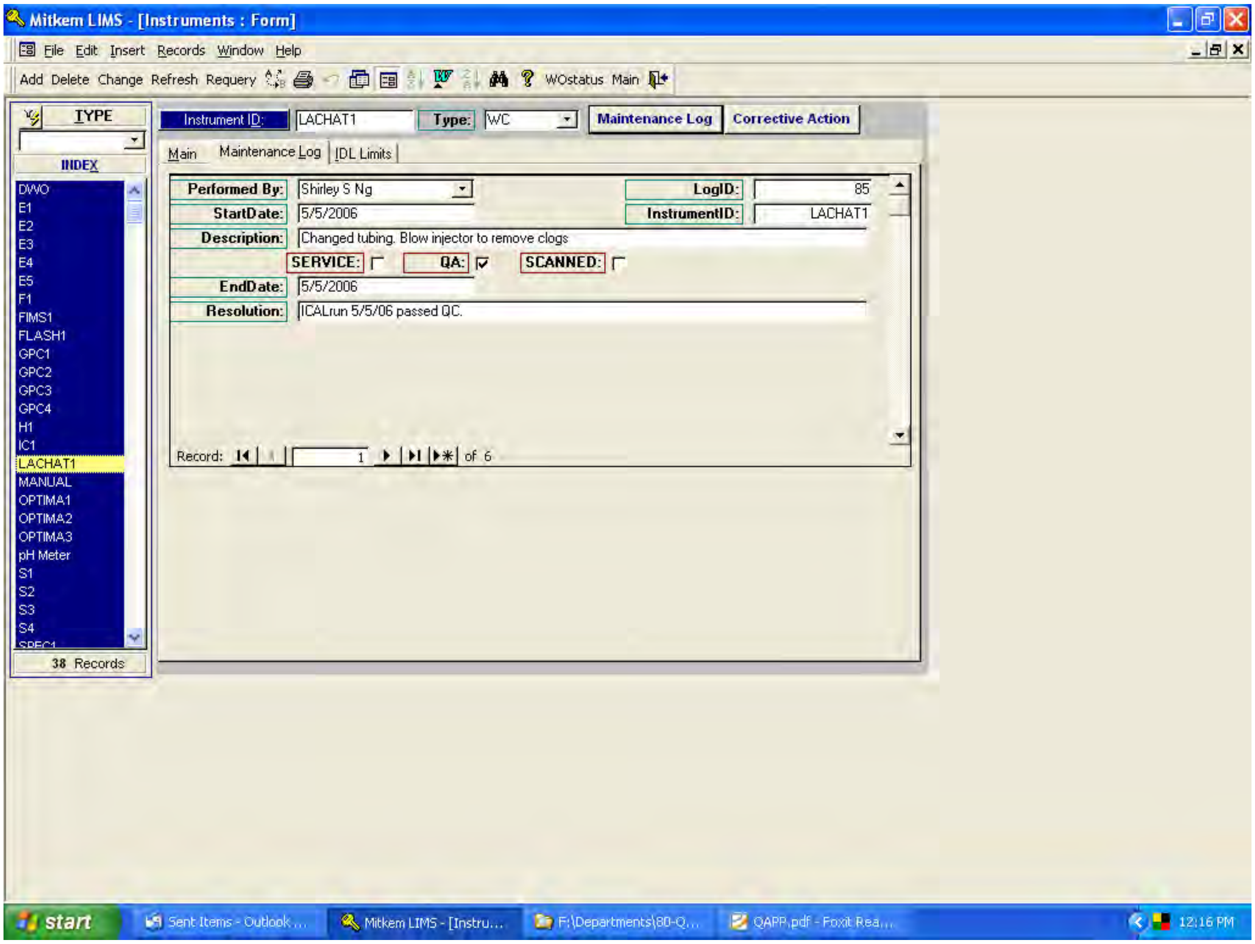
Spectrum Analytical, Inc. RI Division's laboratory personnel are familiar with the routine and non-routine maintenance requirements of the instruments they operate. This familiarity is based on education, hands-on experience and manufacturer's training courses. As needed, major equipment may under-go extensive maintenance or service by a contracted technician.

Instrument maintenance logs are kept for each instrument in the LIMS (figure 14-1). All employees have password protected access to the LIMS. The person performing the maintenance is required to provide the following information in the online log:

- Equipment identifier
- The inspection, maintenance, calibration or corrective action(s) performed.
- The trigger(s) for the maintenance action(s)
- The identity of the person(s) performing the maintenance
- The date on which the work was performed
- The need for a service call
- The condition of the equipment upon completion of the work (may include resolution of problems, date and type of ICAL run or other method of determining that the system is in good working order), and
- The presence of any scanned paperwork associated to the maintenance

Spectrum Analytical, Inc. RI Division maintains an inventory of replacement parts required for preventive maintenance and spare parts that often need replacement, such as filaments for GC/MS systems and the more mundane electrical fuses and GC column ferrules. To control cost, the appropriate supervisor shall decide the types and numbers of spare parts kept on hand for each equipment item.

Figure 14-1



Instrument ID: LACHAT1
Type: WC

Performed By: Shirley S Ng
LogID: 85
StartDate: 5/5/2006
InstrumentID: LACHAT1
Description: Changed tubing. Blow injector to remove clogs
SERVICE: ☐ QA: ☑ SCANNED: ☐
EndDate: 5/5/2006
Resolution: ICALrun 5/5/06 passed QC.
Record: 1 of 6

Example of Instrument Maintenance Log

15.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, COMPLETENESS, METHODS DETECTION LIMIT AND LINEAR DYNAMIC RANGE

These mathematical equations represent the means of calculating analytical figures of merit on a routine basis at Spectrum Analytical, Inc. RI Division. However, they may be supplanted with other calculations if requested by the client. Precision, accuracy and completeness are also discussed in Section 6.

15.1 Precision:

Precision is frequently determined by the comparison of replicates, where replicates result from an original sample that has been split for identical analyses. Standard deviations, *s*, of a sample are commonly used in estimating precision.

Sample standard deviation, *s*:

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}$$

where a quantity, x_i (e.g. a concentration), is measured *n* times with a mean, $\bar{x}$.

The relative standard deviation, *RSD* (or sample coefficient of variation, *CV*), which expresses standard deviation as a percentage of the mean, is generally useful in the comparison of three or more replicates (although it may be applied in the case of n = 2).

$$\%RSD = 100\ (s\ /\ \bar{x})$$

or

$$CV = 100\ (s\ /\ \bar{x})$$

In which: *RSD* = relative standard deviation, or
CV = coefficient of variation
s = standard deviation
$\bar{x}$ = mean

For duplicates (samples that result when an original sample have been split into two for identical analyses), the relative percent difference (*RPD*) between the two samples may be used to estimate precision.

$$RPD = \frac{2(D_1 - D_2)}{(D_1 + D_2)} \times 100\%$$

In which: D_1 = first sample value
D_2 = second sample value (duplicate)

15.2 Accuracy:

The determination of accuracy of a measurement requires knowledge of the true or accepted value for the signal being measured. Accuracy may be calculated in terms of bias as follows:

$$Bias = X - T$$

$$\%Bias = 100\frac{(X - T)}{T}$$

In which: X = average observed value of measurement
T = “true” value

Accuracy also may be calculated in terms of the recoveries of analytes in spiked samples:

$$\%\mathrm{Re}\,\mathrm{cov}\,ery(\%R) = 100 \times \frac{(SSR - SR)}{SA}$$

where: SSR = spikes sample result
SR = sample result
SA = spike added

15.3 Completeness:

Determine whether a database is complete or incomplete may be quite difficult. To be considered complete, the data set must contain all QC check analyses verifying precision and accuracy for the analytical protocol. Less obvious is whether the data are sufficient to achieve the goals of the project. All data are reviewed in terms of goals in order to determine if the data set is sufficient.

Where possible, the percent completeness for each set of samples is calculated as follows:

$$\%\text{Completeness} = \frac{\text{valid data obtained}}{\text{total data planned}} \times 100$$

15.4 Method Detection Limit:

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is not zero. It is computed as follows from data obtained by repeatedly determining an analyte in a given sample matrix:

1. Analyze at least seven samples of a homogeneous matrix spike that contains the analyte(s) of interest at concentrations of three to five times the expected MDL. The entire sample preparation and analysis protocol must be applied in each analysis; simply preparing one sample and repeating a measurement three or more times on the sample in not acceptable.

2. Upload the acceptable data into LIMS.

3. The LIMS will compute the standard deviation of the results for each analyte using the following equation:

$$\mathrm{MDL} = t_{(n\text{-}1,\ \alpha=0.99)}\,(s)$$

Where t is the one-sided student's t value appropriate for the number of samples analyzed, n; α is the statistical confidence level; and s is the standard deviation.

The one-sided t-values are presented below:

Number of samples	t-value
7	3.14
8	2.996
9	2.90
10	2.82

4. The MDL is then checked against 40CFR136 requirements by the QA Department. If the MDL is acceptable then it is uploaded into the LIMS by either the QA Department or LIMS Administrator.

5. Immediately following the determination of the MDL, MDL check samples are analyzed at a concentration approximately equal to 2-3 x the new MDL for SW846 tests. The analyte of interest must be detected at this concentration, or the raising the MDL may be required. Once the MDL check is acceptable, the detection limit (DL) has been established.

6. An elevated MDL can be uploaded if necessary into the LIMS as long as documentation is available to show that the applicable method can produce an MDL at least that low. This can commonly occur for ICP

analysis in which extremely low MDLs can cause method compliance issues. When appropriate, the MDL study may be prepared and analyzed over several days to increase the variability of the preparation and/or analytical steps.

7. More detail on MDLs can be found in SOP 80.0005 Method Detection Limit Determination.

15.5 Linear Dynamic Range:

The linear dynamic range is the concentration range over which the instrument response is linear. It is determined by analyzing a series of standard solutions that extends beyond the non-linear calibration region at both the low and high extremes, and selecting that range of standards which demonstrates a linear relationship between instrument response and concentration.

For ICP analysis, the linear dynamic range is determined by analyzing each metal at 3 different concentrations. The concentration which produces results within a 10% error is determined to be the linear dynamic range. This procedure must be performed per individual method requirements.

ILM5.4 requires the analysis of the linear dynamic range be determined quarterly, with a 5 % error.

16.0 CORRECTIVE ACTION

An essential element of the QA Program, Corrective Action provides systematic, active measures taken in the resolution of problems and the restoration of analytical systems to their proper functioning.

Corrective actions for laboratory problems are described in Spectrum Analytical, Inc. RI Division's laboratory standard operating procedures (SOP). Personal experience often is most valuable in alerting the bench scientist to questionable results or the malfunctioning of equipment. Specific QC procedures are designed to help the analyst determine the need for corrective actions (see Section 11, Data Reduction, Validation and Reporting). Corrective actions taken by scientists in the laboratory help avoid the collection of poor quality data. The lab's corrective action program divides these issues into routine and non-routine corrective actions as described below.

Routine Corrective Action – A routine corrective action is taken when the out-of-control event encountered is one that is detected at the appropriate level in the QA process. Routine corrective actions are defined in the analytical SOP with specific steps to be taken as corrective action (i.e., low surrogate recovery, continuing calibration verifications, project specific protocols that do not meet acceptance criteria, etc.) Routine corrective actions must be documented as described in the analytical SOP, but do not require further documentation in the corrective action logbook. Examples of routine corrective action situations: surrogate/surrogates out, LCS out, CCV out, ICV out, IS area/areas out, typographical errors, random blank contamination, or false positive hit/spectral ID match corrected during data review.

Non-Routine Corrective Action – A non-routine corrective action is taken when the out-of-control event encountered is not typical for the method. For example, QC failures that passes through the final review to the client, procedural errors – not following the SOP, or a situation not being detected by normal QA procedures that could adversely impact the accuracy, precision, etc. of a result. Non-routine corrective actions must be documented in the Corrective Action Request (CAR) system, located within the LIMS. The analyst, using his/her own judgement, may deem any corrective action situation non-routine and formally document it in a CAR. When in doubt about a corrective action, the analysts are instructed to err on the side of formal CAR documentation. Examples of non-routine corrective action situations include: bad standard, expired standard mix being used, incorrect equation, "client-detected" problems, not following SOP protocols, using bad or contaminated lot of chemical/reagent/solvent, deciding to release data not conforming to SOP requirements, compound retention time outside of range, or improper library spectrum that leads to re-occurring mis-identification of compounds.

The essential steps in Spectrum Analytical, Inc. RI Division's corrective action system are:

1. Identify and define the problem.

2. Assign responsibility for investigating the problem. Usually this individual is the department supervisor.

3. Investigate and determine the root cause of the problem.

4. Determine a corrective action to eliminate the problem and prevent recurrence. Any changes that result from the corrective action investigation must be documented.

5. Assign and accept responsibility for implementing the corrective action.

6. Establish effectiveness of the corrective action and implement it.

7. Verify that the corrective action has eliminated the problem.

8. Both the laboratory and the QA Department need to monitor the corrective action to ensure it is effective.

9. Any corrective actions that cast doubt on the laboratory's compliance with its own policies and procedures may require an internal audit by the QA Department.

This scheme is generally accomplished through the use of Corrective Action Report Forms available to each of the laboratory areas within the LIMS system. Use of this report notifies the QA Department of a potential problem as described in SOP No. 80.0007. The QA Director initiates the corrective action by relating the problem to the appropriate laboratory managers and/or project managers who then investigate or assign responsibility for investigating the problem and determine its cause. Once determined, the QA Director will approve appropriate corrective action. Its implementation is later verified through an internal laboratory audit. Once the QA Director feels the system has returned to control, s/he will finalize the CAR using a password protected QA step.

Information contained on corrective action reports is kept confidential within Spectrum Analytical, Inc. RI Division and is generally limited to the individuals involved. Severe problems and difficulties may warrant special reports to the President of Spectrum Analytical Inc., who will ensure that the appropriate corrective actions are taken.

Nonconformance:

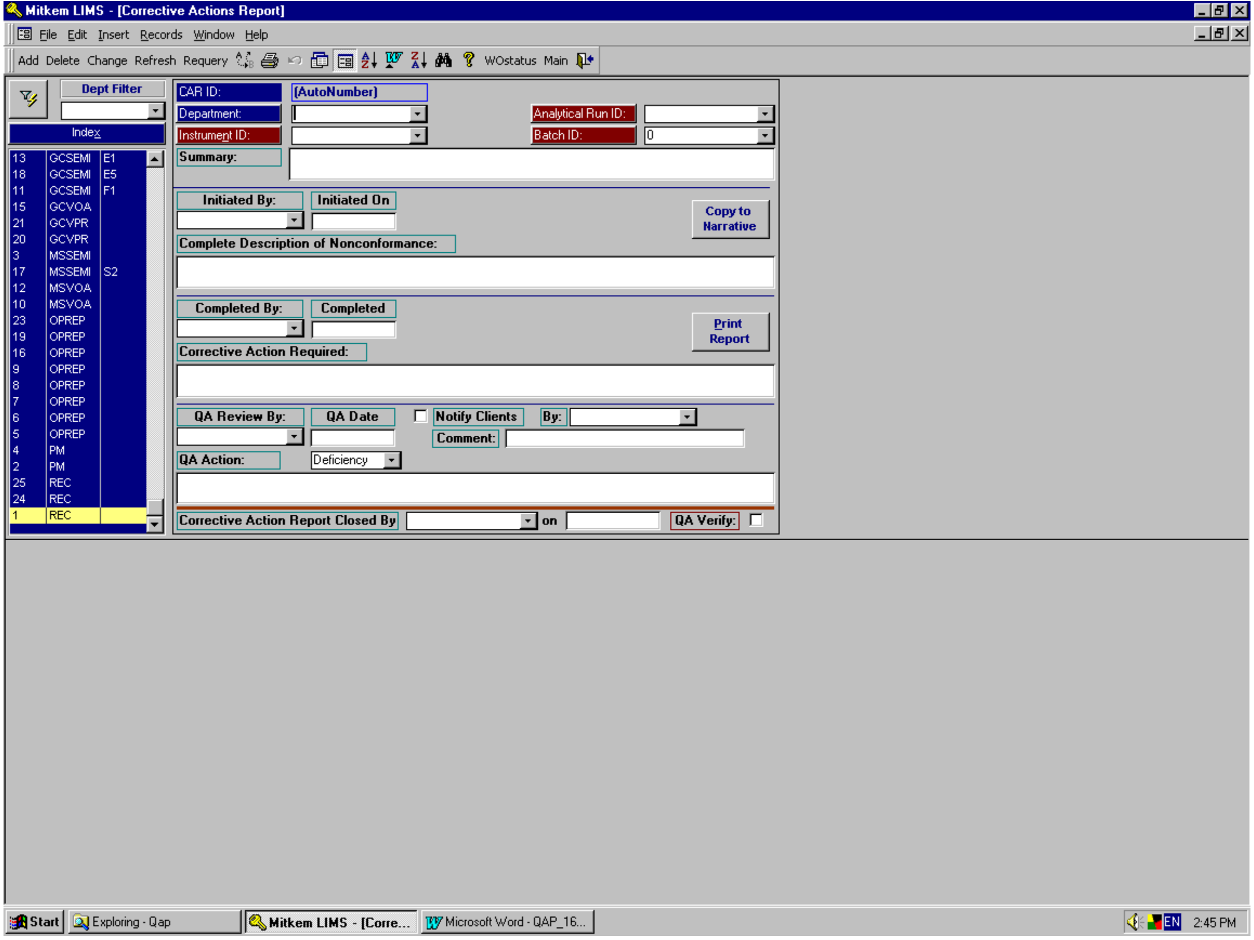
Any breech of standard protocols is a nonconformance item that is documented on the Corrective Action Request Form and management informed immediately. The following are nonconformance items:

1. Sample holding time exceeded.
2. Hoods, Class “1” weights, NIST Thermometers, balances, automatic pipettes, being used but not certified.
3. Expired standards being used.
4. Manual integration being misrepresented.

16.1 Client Complaints:

Spectrum Analytical, Inc. RI Division ensures client complaints are dealt with quickly and completely. The policies are stated in the laboratory Client Complaint Standard Operating procedure (SOP No. 80.0002).

Figure 16-1



13	GCSEMI	E1
18	GCSEMI	E5
11	GCSEMI	F1
15	GCVOA	
21	GCVPR	
20	GCVPR	
3	MSSEMI	
17	MSSEMI	S2
12	MSVOA	
10	MSVOA	
23	OPREP	
19	OPREP	
16	OPREP	
9	OPREP	
8	OPREP	
7	OPREP	
6	OPREP	
5	OPREP	
4	PM	
2	PM	
25	REC	
24	REC	
1	REC	

CAR ID: (AutoNumber)
Department:
Analytical Run ID:
Instrument ID:
Batch ID: 0
Summary:
Initiated By:
Initiated On
Complete Description of Nonconformance:
Completed By:
Completed
Corrective Action Required:
QA Review By:
QA Date
☐ Notify Clients
By:
Comment:
QA Action: Deficiency
Corrective Action Report Closed By
on
QA Verify: ☐

Quality Assurance Corrective Action Request Form

17.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Spectrum Analytical, Inc. RI Division Quality Assurance Director submits a QA report annually to upper management. The report should be completed and submitted no later than the 15th of July in any calendar year.

The report contains detailed laboratory information and QA activities during the previous twelve months. Items to include are the status of internal and external audits, client complaints, quality control activities, resources and staffing. See the following pages for the report format.

Management will review the QA report and respond to outstanding issues. Management will add a review of the suitability of policies and procedures, and any other relevant issues. The response report is due within 30 days of the QA Report receipt.

A copy of the report is kept on file in the QA department.

In case of a severe problem or difficulty, a special report is prepared by the QA Director and submitted immediately to management.

Figure 17-1

SPECTRUM ANALYTICAL, INC. RI DIVISION
Annual Quality Assurance Report to Management

1. Status of Internal Audits.

2. Status of External Audits.

3. Identification of Quality Control issues in the laboratory.

4. Discussion of corrective action issues.

5. Proficiency Testing.

6. Changes in volume and type of work undertaken.

7. Client Feedback.

8. Reports from management and supervisory personnel.

18.0 SAFETY

Spectrum Analytical, Inc. RI Division maintains safety through a program managed by the Safety Officer and the Safety Committee. Responsibilities include many activities needed to comply with the Right-to-Know Laws.

- Training seminars with information on OSHA safety instruction for new employees.
- Introductory training to include location of fire extinguishers, first aid supplies, etc.
- Health and Safety manual review when hired.
- Annual Health and Safety Manual review and revision as needed.
- Monthly Safety Committee meetings.
- Centralized MSDS information.
- Maps with safety equipment and all exits noted.
- Posted safety rules.

If a chemical spill occurs, proper actions are described in Spectrum Analytical, Inc. RI Division’s Contingency Plan. Additionally, the local fire department (North Kingstown) and hospital (Kent County) also have a copy in case a need arises. Each new hire is required to read the Contingency Plan and sign off on this. An annual meeting is held as a refresher for all employees. A copy of the Contingency Plan is located on the company Intranet and is available to all personnel.

Emergency equipment, such as spill control kits, fire extinguishers and fire blankets are located throughout the laboratory areas. The Contingency Plan has instructions for evacuation, notification of emergency authorities and regulatory personnel in the event of a chemical accident.

19.0 WASTE MANAGEMENT

19.1 Pollution Prevention

The waste management option of choice is to prevent pollution by minimizing the amount or types of chemical wastes that are generated. Spectrum Analytical, Inc. RI Division's ability to minimize waste generation is limited by the chemical analysis techniques that are required by the EPA or other authors of test methods. As new test methods are utilized in the laboratory, the type and volume of chemical waste generated by the new test is considered. Analysts and Supervisors are encouraged to look for ways to reduce the amount of chemical waste, or the type of chemical waste generated during the testing process; HOWEVER, no method is allowed to be modified without discussion among the Laboratory and/or Technical Director, QA Director and other management personnel to determine the affect of the change on the resulting data.

19.2. Waste Management

Spectrum Analytical, Inc. RI Division has identified and routinely disposes of chemical wastes in several hazardous waste streams. In general these are acids, caustics, solvent wastes and various laboratory waste solids. No laboratory chemical waste is disposed in the trash or dumped down the drain. All remaining sample volume following testing, and after contract-required disposal date has past, are disposed in one of these waste streams. These wastes are fully described in Spectrum Analytical Inc., RI Division's Contingency/Waste Management Plan and in the lab's Profile Log. New England Disposal Technologies is Spectrum Analytical, Inc. RI Division's waste hauler. Other hazardous wastes are identified and properly disposed according to these documents.

Continued compliance is monitored monthly by an outside consultant to ensure all RI DEM regulations are met. Key personnel attend an annual RCRA Facility Training, which focuses on the requirements for hazardous waste disposal and its proper documentation.

20.0 DEFINITIONS, ACRONYMS, ABBREVIATIONS:

ACCURACY: The closeness of agreement between an observed value and an accepted reference value.

ALIQUOT: A measured portion of a field sample, standard, or solution taken for sample preparation and/or analysis.

ANALYTICAL SERVICES BRANCH (ASB): The division of United States Environmental Protection Agency’s (USEPA) Office of Superfund Remediation and Technology Innovation (OSRTI) responsible for the overall management of the Contract Laboratory Program (CLP).

ASTM: American Society for Testing and Materials, a developer and provider of voluntary consensus standards.

BATCH: A group of samples of the same matrix that are processed as a unit at the same time in the same location using the same method.. Unless defined differently by a specific analytical method (such as Oil & Grease by Method 1664), the maximum batch size is 20 samples.

BIAS: The deviation due to analytical or matrix effects of the measured value from a known spiked amount.

BLANK: A “clean” matrix analysis. Such as: Equipment Blank, Method Blank, and Trip Blank.

BREAKDOWN: A measure of the decomposition of certain analytes (DDT and Endrin) into by-products.

CAS: Chemical Abstracts Service, a registry where chemicals are assigned identification numbers.

CCB: Continuing Calibration Blank

CCV: Continuing Calibration Verification standard.

CLP: Contract Laboratory Program. A contract used by EPA to purchase analytical services. Also refers to the test protocols described in that contract. The CLP analyses can be used for EPA or for other clients. CLP-format data reports are arranged as described in the EPA CLP contract, including specified data report pages and all raw data.

CONTROL SAMPLE:	A QC sample introduced into a process to monitor the performance of the system.
DL:	Dilution, not used when the initial analysis is performed at dilution, but is used for a secondary dilution.
DoD:	Department of Defense.
DUPLICATE:	See Matrix Duplicate, Field Duplicate, and Matrix Spike Duplicate.
EQUIPMENT BLANK:	A sample of analyte-free water that has been used during sample collection to measure any contamination introduced during sample collection.
ICB:	Initial Calibration Blank
ICV:	Initial Calibration Verification standard
IDL:	Instrument Detection Limit. Statistical value similar to MDL, but with analyses performed on standards that have not been through the sample preparation process.
FIELD DUPLICATES:	Independent samples that are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These duplicates are useful in documenting the precision of the sampling process.
HT	Holding Time. The maximum times that samples may be held prior to analysis and still be considered valid or not compromised (40CFR Part 136). DoD also clarifies the HT to mean the time elapsed from the time of sampling to the time of extraction or analysis , or from extraction to analysis…
LAB CONTROL SAMPLE (LCS):	A blank spiked with compound(s) representative of the target analytes. This is used to document laboratory performance in a "clean" matrix.
LOD:	Limit of Detection. The smallest amount of concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%), per DoD.
LOQ:	Limit of Quantitation (LOQ). The lowest concentration that produces a quantitative result within specified limits of precision and bias. The LOQ

is typically set at or above the concentration of the lowest initial calibration standard.

MATRIX: The component or substrate (e.g., water, soil, air, and oil) which contains the analyte of interest.

MATRIX DUP (DUP): A sample split by the laboratory that is used to document the precision of a method in a given sample matrix.

MATRIX SPIKE (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

MATRIX SPIKE DUP (MSD): Laboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

MCL: Maximum Contaminant Level (MCL) is the highest concentration of a contaminant that is allowed in drinking water.

METHOD BLANK(MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process.

METHOD DETECTION LIMIT (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte. For operational purposes, when it is necessary to determine the MDL in the matrix, the MDL should be determined by multiplying the appropriate one-sided 99% t-statistic by the standard deviation obtained from a minimum of seven analyses of a matrix spike containing the analyte of interest at a concentration estimated to be three to five times the MDL, where the t-statistic is obtained from standard references.

MSA: Method of Standard Additions

ND: Not Detected. Used in conjunction with the reporting limit.

ORGANIC-FREE REAGENT WATER: For volatiles, all references to water in the methods refer to water in which an interferent is not observed at the reporting limit of the compounds of interest. Organic-free reagent water can be generated by passing tap water through a carbon filter bed containing about 1 pound of activated carbon. A water purification system may be used to generate organic-free deionized water. For semivolatiles and nonvolatiles, all references to water in the methods refer to water in which an interferent is not observed at the reporting limit of the compounds of interest.

PPB: Parts Per Billion, ug/L, ug/Kg

PPM: Parts Per Million, mg/L, mg/Kg

PQL: Practical Quantitation Limit. Equivalent to Reporting Limit.

PRECISION: The agreement among a set of replicate analyses.

PS: Post Spike. Spike added at the analysis level (as opposed to at the beginning of sample preparation) to determine interferences.

REPORTING LIMIT (RL): The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The RL is generally 5 to 10 times the MDL. However, it may be nominally chosen other than these guidelines to simplify data reporting. For many analytes the RL concentration is selected as the lowest non-zero standard in the calibration curve. Sample RLs are matrix-dependent, and are adjusted by the amount of sample analyzed, dilution, and percent moisture. Also see LOQ.

RE: Reextraction or Reanalysis

RPD: Relative Percent Difference, used to determine precision.

RRF: Relative Response Factor. Used for quantification with the internal standard procedure.

RT: Retention Time for a chromatographic peak, as calculated from the time of injection.

SAMPLE: A portion of material to be analyzed that is contained in single or multiple containers and identified by a unique sample number.

SAMPLE DELIVERY GROUP (SDG): A unit within a sample Case that is used to identify a group of samples for delivery.

SERIAL DILUTION (SD): A five-fold dilution of a sample. When corrected by the dilution factor, the diluted sample must agree with the original undiluted sample within specified limits. Serial dilution may reflect the influence of interferents.

SAMPLE MANAGEMENT OFFICE (SMO) - A Contractor-operated facility operated under the SMO contract, awarded and administered by USEPA.

SOP: Standard Operating Procedure.

STANDARD ADDITION: The practice of adding a known amount of an analyte to a sample immediately prior to analysis. It is typically used to evaluate interferences.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate method. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

SURROGATE: An organic compound that is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples.

TRIP BLANK: A sample of analyte-free media taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organics samples.

From EPA SW-846, Revision 4, 40CFR Part 136, DoD QSM and other sources.

SPECTRUM ANALYTICAL, INC. RI DIVISION

MAJOR INSTRUMENTATION and EQUIPMENT LIST

APPENDIX A

Laboratory Information System Equipment

1. **Data Collection**:

   1.1. Seventeen- Hewlett Packard (HP) chem station software for collecting GC and GC/MS data (below) and one Perkin Elmer (PE) Total Chrom for collecting data from the GC-TCD/SCD.

   - 5 GC-ECD (GCSEMI)
   - 1 GC-FID (GCSEMI)
   - 6 GC-MS (MSSEMI)
   - 5 GC-MS (MSVOA)
   - 1 GC-Hall/PID (GCVOA)
   - 1 GC-FID/NPD (GCVOA)

   1.2. Hardware varies but is x86 compatible

   1.3. OS is Windows, Various Versions (9x, NT, 2000,Xp)

2. **Data Storage**:

   2.1. Dell Poweredge servers (Windows 2003 server)

   2.1.1. Bernoulli (primary file server, non-organic instrument data)
   - Dual core Xeon processor
   - 4 GB RAM
   - 1 TB storage
   - Symantec Backup Exec 12.5
   - Tape drive Tandberg Data LTO-5 (1500-3000 GB)

   2.1.2. Avogadro (organic instrument data)
   - Dual P IV Xeon processors
   - 2 GB RAM
   - 105 GB storage
   - Tape drive Tandberg LTO-2 (200-400 GB)

   2.1.3. Planck (database server)
   - Dual P IV Xeon processors
   - 2 GB RAM
   - 450 GB storage
   - Tape drive Seagate LTO-1 (100-200 GB) not currently used

   2.2. Tapes are for daily backup, long term archiving and data restoration

3. **Compound Identification**:

    3.1. Fourteen - Target 4.14 chromatographic software

    3.2. Hardware is Intel based for Target 4.14

    3.3. OS is Windows Xp

4. **Forms Generation**:

    4.1. In-house forms generation LIMS modules for SW-846, ILM and ISM metals

    4.2. In-house forms generation LIMS modules for SW-846, OLC, OLM/ASP and SOM organics

    4.3. Hardware varies but is x86 compatible

    4.4. OS is Windows, Various Versions (2000 and Xp)

Spectrum RI
Equipment List

Department: Inorganics : Metals& Wet Chemistry

Equipment	Manufacturer	Serial #	Date Received	Date in Service	Condition New/Used	Equipment ID	Location
ICP/OES	Perkin Elmer	077N3102302	Nov-03	Nov-03	New	Optima3	Metals
ICP/AES	Perkin Elmer	069N8060801	Nov-98	Nov-98	New	Optima2	Metals
ICP/MS	ThermoScientific	SN01407C	Oct-08	Dec-09	New	X1	Metals
Mercury Analyzer	Perkin Elmer	1131	Mar-00	Mar-00	Used	FIMS1	Metals
Mercury Analyzer	Perkin Elmer	101S7071002	Feb-11	Feb-11	new	FIMS2	Metals
GPR Centrifuge	Beckman Instruments	7M149	Apr-02	Apr-02	Used	Centrifuge	WC
Conductivity Meter	WTW Inolab Cond Level 1	3370010	Apr-02	May-02	New	COND-1	WC
Total Organic Carbon Analyzer	Tekmar/Dohrmann	US03035002	Apr-03	Apr-03	Used	TOC1	WC
Flow Injection Analyzer	Lachat Instruments	A83000-1020	Apr-96	Apr-96	New	Lachat1	WC
Ion Chromatograph	Dionex	95030498E980802	May-03	May-03	New	IC1	WC
Spectrophotometer	Spectronic Instruments	3SGD332010	Apr-02	Apr-02	New	SPEC2	WC
Spectrophotometer	Milton Roy Company	3310004028	Mar-06	Mar-06	New	SPEC3	WC
Pensky Marten	Koehler 16200	5539	June-95	June-95	New	FLASH1	WC
Turbidity Meter	VWR® Model 800	Tur800 2326	April-12	Feb-13	Used	Turb1	WC

COD Reactor	Hach Company	990900019429	Nov-03	Nov-03	New	COD1	WC
COD Reactor	Hach Company	950200012193	Apr-02	Apr-02	New	COD2	WC
Deionized Water Generator	Barnstead E-Pure D4641	1090001208384	Jun-95	Jun-95	New	DI2	WC
pH meter	Oakton Instruments	875001	Jun-12	Jun-12	new	WC-03	WC

Spectrum RI
Balance List

Equipment	Manufacturer	Serial #	Date Received	Date in Service	Condition New/Used	Equipment ID
TOP-LOADING Balance	OHAUS	1121230069	2000	2000	New	TL10
Analytical Balance	Denver A-250	0070742	2010	2010	Used	AB-3
TOP-LOADING Balance	OHAUS Voyager	F2921120391055	2001	2001	New	TL9
TOP-LOADING Balance	Denver	0079896	2000	2000	New	TL1
TOP-LOADING Balance	OHAUS Precision Std.	C22427176	2002	2007	New	TL6
TOP-LOADING Balance	OHAUS Navigator	1121122373	2002	2002	New	TL11
TOP-LOADING Balance	OHAUS	CD8910	2000	2000	New	TL4
TOP-LOADING Balance	OHAUS Navigator	1122173423	2003	2003	New	TL12
TOP-LOADING Balance	OHAUS Scout Pro	7126212230	2007	2007	New	TL13

Spectrum RI
Equipment List **Department: Organic Prep**

Equipment	Manufacturer	Serial #	Date Received	Date in Service	Condition new/used	Equipment ID
TurboVap II	Caliper	TV0845N14899	Jan-09	Jan-09	New	TV-4
TurboVap II	Caliper	TV0902N15012	Jan-09	Jan-09	New	TV-3
TurboVap II	Caliper	4364	Mar-08	Mar-08	Used	TV-2
TurboVap II	Caliper	Unable to view	Mar-08	Mar-08	Used	TV-1
Shaker	Glas-Col	412383	Mar-08	Mar-08	New	N/A
Water Bath	Precision Scientific	9508-005	Dec-95	Jan-96	Used	N/A
Nitrogen Concentrator Bath	Organomations	16526	Jun-97	Jun-97	New	NZ1
Deionized Water Generator	Barnstead E-Pure D4641	582941018789	Jun-95	Jun-95	New	DI1
Pressurized Fluid Extractor	Dionex	98070129	Jun-00	Jun-00	New	PFE1
Gel Permeation Chromatograph	J2/AccuPrep	P26D031	Jun-05	Jul-05	New	GPC3
Gel Permeation Chromatograph	J2/AccuPrep	06D-1196-4.1	Jul-07	Aug-06	New	GPC4
Misonex Ultrasonic Disruptor	Sonic Dismembrator Fisher Model 550	Unable to view			New	OPH1
Misonex Ultrasonic Disruptor	Sonic Dismembrator Fisher Model 550	Unable to view			New	OPH2
Misonex Ultrasonic Disruptor	Sonic Dismembrator Fisher Model 500	Unable to view			New	OPH3

Misonex Ultrasonic Disruptor	Sonic Dismembrator Fisher Model 500	Unable to view			New	OPH4
Ultrasonic Cleaner FS30H	Fisher Scientific	RTB030721702	Apr-07	Apr-07	New	N/A
Centrifuge Centra CL-2	International Equipment Company	42606943			Used	N/A

Spectrum RI

Equipment List **Department: GC-Semivolatiles**

Equipment	Manufacturer	Serial #	Date Received	Date in Service	Condition New/Used	Equipment ID	Location
GC/ECD	Hewelett Packard	3336A59890	Oct-94	Oct-94	New	E2	GC-SVOA
GC/ECD	Hewelett Packard	US00032017				E4	GC-SVOA
GC/ECD	Hewelett Packard	US00037060				E5	GC-SVOA
GC/ECD	Hewelett Packard	US00029100	13-Feb	13-Feb	used	E6	GC-SVOA
GC/FID	Hewelett Packard	US00001898				F1	MS-SVOA

Spectrum RI
Equipment List **Department: Receiving**

Equipment	Manufacturer	Serial #	Date Received	Date in Service	Condition New/Used	Equipment ID	Location
Dry Weight Oven	Thello	600011006			used	DWO	REC
Walk in Cooler		Not Applicable			new	R1	REC
Gyrotary Shaker table	New Brunswick Sci. Co.	unable to read			used	n/a	REC
pH meter	Oakton Instruments	1446253	Dec-08	Dec-08	new	WC-02	REC
Kiln model TNF24-3	Paragon Touch n Fire	324341				n/a	WC
Stoppering tray dryer	FTS Systems Dura-Stop M	TD-12-90-133				n/a	WC
Freeze Dryer	FTS Systems Dura-Dry MP	unable to see				n/a	WC
Dessicator	Sanplatec Corp	none	June-06	June-06	New	DryKeeper	REC

Spectrum RI

Equipment List **Department: SVOA**

Equipment	Manufacturer	Serial #	Date Received	Date in Service	Condition New/Used	Equipment ID	Location
GC/MS	Hewelett Packard	US00011367 / US72821130	Nov-99	Nov-99	Used	S3	MS-SVOA
GC/MS	Hewelett Packard	CN10315002/ VS30945365	May-03	May-03	New	S4	MS-SVOA
GC/MS/FID	Hewelett Packard	CN107223014 / US73317299	Jan-08	Jan-08	New	S5	MS-SVOA
GC/MS	Hewelett Packard	CN10261100	Nov-10	Nov-10	Used	S6	MS-SVOA

Spectrum RI
Equipment List **Department: VOA**

Equipment	Manufacturer	Serial #	Date Received	Date in Service	Condition New/Used	Equipment ID	Location
GC/MS	Hewelett Packard	3336A55963				V1	VOA
Auto sampler	OI	13193				V1	VOA
Concentrator	OI	J651460769				V1	VOA
GC/MS	Hewelett Packard	3336A58222				V2	VOA
Auto sampler	OI	13091				V2	VOA
Concentrator	OI	H340460074				V2	VOA
GC/FID/PID	Hewelett Packard	2843A21041				V4	VOA
Auto sampler	Tekmar/Dohrmann	90312004				V4	VOA
Concentrator	Tekmar/Dohrmann	88341012				V4	VOA

Spectrum RI
Equipment List **Department : VOA**

Equipment	Manufacturer	Serial #	Date Received	Date in Service	Condition New/Used	Equipment ID	Location
GC/MS	Hewelett Packard	US00007055				V5	VOA
Auto sampler	OI	13462				V5	VOA
Concentrator	OI	J651460769				V5	VOA
GC/MS	Hewelett Packard	US00031343				V6	VOA
Auto sampler	OI	B03745A407				V6	VOA
Concentrator	OI	J651460769				V6	VOA
GC	Hewelett Packard	3140A37463				V7	VOA
Auto sampler	Tekmar/Dohrmann	US01170015				V7	VOA
GC/MS	Hewelett Packard	CN10411124	Oct-10	Nov-10	NEW	V10	VOA
Auto sampler	Tekmar/Dohrmann	US01157003	Oct-10	Nov-10	USED	V10	VOA
Concentrator	Tekmar/Dohrmann	US02021003	Oct-10	Nov-10	NEW	V10	VOA

Weight Sets

Laboratory weights for daily calibration use:

1. WT1-Organic Prep Weight Set
2. WT2-Organic Prep 100g
3. WT3-Organic Prep 300g
4. WT4-Organic Prep 1kg
5. WT5-Inorganics Weight Set
6. WT6-VOA Weight Set
7. WT7-Unit 3 Weight Set

NIST Class 1 Weight sets:

1. W-01 Denver Instrument set: Serial number 98-121303 Class 1
2. W-03 Troemner set: Serial number 7283 Class 1

Spectrum Analytical, Inc. Rhode Island Division

CONFIDENTIALITY, ETHICS, and DATA INTEGRITY AGREEMENT

APPENDIX B

CONFIDENTIALITY, ETHICS, AND DATA INTEGRITY

The confidentiality, ethics, and data integrity agreement attached must be signed and dated by all new personnel associated with the data generated by Spectrum Analytical, Inc. Rhode Island Division. All said personnel will complete a training course and understand the information stated in the agreement. The course must include the ethical and legal responsibilities including the potential punishments and penalties for improper, unethical, or illegal actions. In addition, personnel are instructed on the importance of data confidentiality in both hard copy and digital forms. All personnel must fully understand this information before signing the agreement. A separate form is used for subcontractors and external auditors that request data for review.

Data Integrity training will be done on an annual basis. All employees are required to attend a training session or read a refresher document and sign off in hardcopy or through the digital SOP Database. All hard copy documents are stored in the employee’s personnel file located in the QA Department.

All upper management personnel are required to sign a Non-disclosure Agreement which covers protecting confidentiality and proprietary rights. This Agreement is kept on file at the Spectrum Analytical, Inc., main offices in Agawam, Massachusetts.

SPECTRUM ANALYTICAL, INC.
FEATURING HANIBAL TECHNOLOGY
Rhode Island Division

CONFIDENTIALITY, ETHICS AND DATA INTEGRITY AGREEMENT

I. I, ____________________________ *(Name)*, state that I understand the standards of confidentiality, ethics and data integrity required of me with regard to the duties I perform and the data I report in connection with my employment at Spectrum Analytical, Inc. Rhode Island Division.

II. I agree that in the performance of my duties at Spectrum Analytical, Inc. Rhode Island Division.
:

A. I shall not improperly use manual integrations to meet calibration or method QC criteria, such as peak shaving or peak enhancement.

B. I shall not intentionally misrepresent the date or time of analysis by resetting computer or instrument date/time.

C. I shall not falsify analytical results.

D. I shall not report analytical results without proper analysis documentation to support the results; dry-labbing.

E. I shall not selectively exclude data to meet QC criteria, such as calibration points, without technical or statistical justification.

F. I shall not misrepresent laboratory performance by presenting calibration data or QC limits within data reports that are not linked to the data set reported.

G. I shall not represent matrix interference as basis for exceeding acceptance criteria in interference-free matrices, such as method blanks and Laboratory Control Standards (LCS).

H. I shall not manipulate computer software for improper background subtraction or chromatographic baseline manipulations.

I. I shall not alter analytical conditions such as EM voltage, GC temperature program, etc. from standards analysis to sample analysis.

J. I shall not misrepresent QC samples such as adding surrogates after sample extraction, omitting sample preparation steps, or over-spiking/under-spiking.

K. I shall not report analytical results from the analysis of one sample for those of another.

L. I shall not intentionally represent another individual's work as my own.

III. I agree to report immediately any accidental or intentional reporting of non-authentic data by myself. Such report must be made to any member of Spectrum Analytical, Inc. Rhode Island Division Management or the QA Director (Hanibal Tayeh, Yihai Ding, Edward Lawler, Cinde Gomes, Sharyn Lawler) both orally and in writing.

IV. I agree to report immediately any accidental or intentional reporting of non-authentic data by other employees. Such report must be made to any member of Spectrum Analytical, Inc. Rhode Island Division Management or the QA Director (Hanibal Tayeh, Yihai Ding, Edward Lawler, Cinde Gomes, Sharyn Lawler) both orally and in writing.

V. Questions pertaining to confidentiality, ethics, and integrity may be posed to any of the above individuals.

VI. I agree not to divulge any pertinent confidential information including but not limited to data and any other information about a project to outside sources without the prior consent from the client.

I understand that failure to comply with the above confidentiality, ethics and data integrity agreement can result in my immediate dismissal from Spectrum Analytical, Inc. Rhode Island Division.
.

________________________________ ____________________
(Signature) *(Date)*

____
(Print Name)

Training Session Record

Please read, sign and follow the instruction (s) below.

Subject: Confidentiality, Ethics and Integrity Training to include proper laboratory practices with an understanding of examples and consequences for falsifying data or sharing confidential information. Falsifying data can lead to written warning, termination, business closure, and/or civil or criminal prosecution. It is my responsibility to report to my supervisor (anonymously if I prefer) any acts that could lead to the falsifying of data.

I agree that I understand the procedure referenced above and have attended a training session for its proper implementation.

Staff Member Name	Date	Signature	Staff Member Name	Date	Signature

SUBCONTRACTORS

CONFIDENTIALITY, ETHICS AND DATA INTEGRITY AGREEMENT

I. I, ______________________________ *(Name)*, authorized representative of

______________________________(Subcontractor) state that I understand the standards of integrity required of me and the Subcontractor with regard to the duties performed and the data reported in connection with the analysis/analyses contracted by Spectrum Analytical, Inc. Rhode Island Division.

II. Subcontractor agrees that in the performance of analysis for Spectrum Analytical, Inc. Rhode Island Division:

A. Subcontractor shall not intentionally report data values or results that are not the actual values measured or observed;

C. Subcontractor shall not modify data values unless the modification can be technically justified through a measurable analytical process;

D. Subcontractor shall not intentionally report the dates and times of data analyses that are not the true and actual dates and times of analyses; and

D. Subcontractor shall not intentionally represent another's work as its own.

III. Subcontractor agrees to report immediately any accidental or intentional reporting of non-authentic data to Spectrum Analytical, Inc. Rhode Island Division.

IV. Subcontractor agrees not to divulge any pertinent information including but not limited to data and information about any Spectrum Analytical, Inc. Rhode Island Division projects to outside sources without the prior consent from Spectrum or its clients.

I understand that failure to comply with the above ethics and data integrity agreement can result in immediate termination of the subcontract relationship with Spectrum Analytical, Inc. Rhode Island Division.

______________________________ ______________________________
(Signature) *(Date)*

____
(Name)

____
(Title)

Confidentiality Agreement for External Audits

During the course of the laboratory audit/assessment certain information may become available to the auditor/assessor that is confidential.

All sample-related and project-related information at Spectrum Analytical, Inc. Rhode Island Division is confidential between Spectrum Analytical, Inc. Rhode Island Division and its client.

Any information obtained during the course of this audit/assessment may be used for audit/assessment purposes only.

No information obtained during the course of this audit/assessment may be disclosed by the auditor/assessor to any outside party, regardless of affiliation with the auditor/assessor.

Auditor/Assessor (signature): ___________________________________

(Print name): _____________________________________

(Date):____

Company/organization name: ___________________________________

QAF.0014

Spectrum Analytical, Inc. RI Division
Resumes of Key Personnel

APPENDIX C

YIHAI DING

Laboratory Director

Mr. Ding has experience in a wide variety of analytical chemistry techniques, including GC, GC/MS, HPLC and FTIR. His expertise includes the operation, calibration and maintenance of sophisticated analytical instrumentation, and the efficient operation of state of the art environmental service laboratories.

Mr. Ding's responsibilities as Laboratory Director at Spectrum Analytical, Inc. Featuring Hanibal Technology Rhode Island Division, involves the daily coordination of all laboratory sections to insure the production of high quality data meeting customer's technical and schedule requirements. His duties in this role include overseeing department supervisors and analysts in the daily calibration, maintenance and troubleshooting of analytical instruments, monitoring schedules and holding times, analysis of samples, review of sample and QC data. He also is involved with the implementation of Standard Operating Procedures, documentation of instrument and method QC criteria and development of new methods and implementation of new analytical technology.

Mr. Ding's prior experience includes research into the mechanisms and kinetics of various biochemical processes. A large portion of this research has required the analysis of reactants and products using state-of-the-art chemical instrumentation. Mr. Ding has also taught chemistry and biochemistry laboratory courses at the university level.

EDUCATION	**MIDDLE TENNESSEE STATE UNIVERSITY** Murfreesbro, Tennessee - Chemistry, MS
	JILIN UNIVERSITY Changchun, China - Biochemistry, BS

RELATED EXPERIENCE

2005-present	**Spectrum Analytical, Inc., Featuring Hanibal Technology, Rhode Island Division (formerly Mitkem)** - Laboratory Director

2005

STL LABORATORIES
Savannah, Georgia
- Supervisor of Semi-Volatile GC and GC/MS
- GC/MS Analyst
- GC/ECD Analyst

1998-2005

MITKEM CORPORATION
Warwick, Rhode Island
- GCMS Supervisor for both Volatile Organics and Semi-Volatile Organics Laboratories
- GC/MS Analyst

1994-1998

MIDDLE TENNESSEE STATE UNIVERSITY
Murfreesboro, Tennessee
- Researcher
- Laboratory Instructor, chemistry and biochemistry

1993-1994

NATIONAL ENZYME ENGINEERING LAB
Changchun, China
- Researcher

SHARYN B. LAWLER

Quality Assurance Director

Ms. Lawler has over twenty years of experience in the environmental laboratory industry. She has experience in implementation, operation and management of QA systems operating under USEPA, US Army Corps of Engineers and NELAC programs.

Ms. Lawler's responsibilities as Quality Assurance Director include development and implementation of the Quality Assurance Plan and Standard Operating Procedures. Her duties include interacting with federal and state regulatory officials in the acquisition and maintenance of laboratory certifications. She is also responsible for managing Spectrum Analytical, Inc. Rhode Island Division's document control program. Ms. Lawler performs both internal and external audits as well as overseeing the corrective action system, training program and evaluating QC check samples.

Previously Ms. Lawler was a senior data reviewer, where she was responsible for final QA/QC review of organic, metals and wet chemistry data. She insured final data met all method and in-house QC criteria prior to release to the customer, and that any issues were documented and described for inclusion in case narratives. A significant portion of this work involved review of full CLP-format data deliverables packages, both for standard as well as non-routine analyses. Prior to Spectrum Analytical Inc., Ms. Lawler worked for two CLP laboratories where she held positions including senior data review specialist, CLP Organics Task Manager and analyst in several laboratory sections.

EDUCATION:

UNIVERSITY OF MASSACHUSETTS
Amherst, Massachusetts
Independent Conc., Coastal Plant Ecology, BS

RELATED EXPERIENCE:

1997-Present

Spectrum Analytical Inc., Featuring Hanibal Technology, RI Division (formerly Mitkem)
- QA Director
- Senior Data Reviewer

1988-1997 **NATIONAL ENVIRONMENTAL TESTING**
Bedford, Massachusetts
- Senior Data Reviewer
- CLP Organic Task Manager

1983-1988 **CAMBRIDGE ANALYTICAL ASSOCIATES**
Boston, Massachusetts
- CLP Organic Task Manager
- Semivolatiles Analyst
- Preparation Laboratory Analyst

EDWARD A. LAWLER

Business Development Coordinator /Sr. Project Manager

Mr. Lawler has over thirty years of experience in environmental laboratory operations. He has extensive experience in managing laboratory workflow and in establishing and maintaining customer relationships. He also has considerable experience in a wide range of environmental chemical analyses, with a concentration in trace level volatile organics analysis.

As Business Development Coordinator, Mr. Lawler is responsible for securing contracts and BOA agreements with clients as well as pursuing new contracts and bids. He also works closely with lab staff to ensure they are aware of specific data deliverable requirements for new projects.

As Senior Project Manager, Mr. Lawler manages certain significant analytical testing programs, acting as principal technical liaison with the client. His extensive experience in laboratory data review allows him to ensure QA/QC criteria have been achieved, as well as preparing project narratives detailing these findings to the client.

Mr. Lawler’s past responsibilities as Deputy Director for Quality Services included the prioritization of all analytical chemistry testing at Spectrum Analytical, Inc. Rhode Island Division. This included daily meetings with laboratory supervisors and managers to insure all technical and schedule requirements were met.

Mr. Lawler’s previous experience includes various staff, management and senior management positions at several environmental testing laboratories. Direct project experience includes EPA CLP, Army MRD, Navy NEESA and NFESC, DOD HAZWRAP and New York DEC ASP programs. Mr. Lawler has also provided expert testimony at several Superfund trials including pre-trial consulting and trial witness services.

EDUCATION: **UNIVERSITY OF MASSACHUSETTS**
Amherst, Massachusetts
Environmental Sciences, BS 1977

RELATED EXPERIENCE:

1997- Present	**Spectrum Analytical Inc., Featuring Hanibal Technology, Rhode Island Division (formerly Mitkem)** - Business Development Coordinator - Senior Project Manager - Deputy Director for Quality Services - Operations Manager
1989-1997	**NATIONAL ENVIRONMENTAL TESTING, CAMBRIDGE DIVISION** Bedford, Massachusetts - Division Manager - Proposal/Contract Manager - Director of Project Management
1983-1989	**CAMBRIDGE ANALYTICAL ASSOCIATES, INC.** Boston, Massachusetts - Project Manager - Volatile Organic Laboratory Manager
1978-1983	**ENERGY RESOURCES COMPANY, INC. - ERCO** Cambridge, Massachusetts - Volatile Organics (GC) Manager - Analytical Chemist-Volatile Organics Lab - Analytical Chemist-Organic Preparation Lab
1978	**LAPUCK LABORATORIES, INC.** Watertown, Massachusetts - Analytical Chemist-Wet Chemistry & Metals - Microbiologist

SCOTT P. HUNTLEY

IT Manager

Mr. Huntley has over twenty years experience in the environmental testing field. He has considerable experience in computer sciences and had been involved, throughout his career, in the setup and implementation of several Laboratory Information Management Systems (LIMS) and automated data reduction systems. Mr. Huntley's responsibilities include the set-up and validation of automated data transfer, reduction, storage, evaluation and reporting programs within Spectrum Analytical, Inc. RI Division's LIMS. He also is responsible for set-up of the electronic data delivery capabilities as well as the control charting capabilities of this system.

Previously Mr. Huntley has held several supervisory positions in environmental laboratories focusing on CLP and other DOD analytical programs. He has a wide range of experience in routine and state of the art analytical programs and methods. Mr. Huntley is experienced in the use of automated data transfer and reduction systems and laboratory automation techniques.

EDUCATION:	**RHODE ISLAND COLLEGE** Providence, Rhode Island Chemistry, BS Computer Science, BS

RELATED EXPERIENCE:

1999-Present	**Spectrum Analytical, Inc., Featuring Hanibal Technology, RI Division (formerly Mitkem)** MIS Senior Systems Analyst
1996-1999	**MITKEM CORPORATION** Warwick, RI - Senior Chemist - Organic Lab Manager
1991-1996	**EA LABORATORIES** Sparks, MD

	- Supervisor of Organic Chemists
1989-1991	**CEIMIC CORPORATION** Narragansett, RI - Night shift supervisor
1986-1989	**RI ANALYTICAL LABORATORIES** Providence, RI - GC Chemist

Catherine L. Mosher

Organics (SVOA/VOA) Department Manager

Ms. Mosher has experience in a wide variety of analytical chemistry techniques, including GC/FID and GC/MS. Her expertise includes the operation, calibration and maintenance of sophisticated, computer controlled instrumentation. Her expertise also includes analyses and QA review of forensics extended alkylated PAH and Biomarker analyses.

Ms. Mosher is employed as the Organics Department Manager in Spectrum Analytical Inc. Rhode Island Division, and oversees both the Volatile and Semivolatile departments. Ms. Mosher's responsibilities involve the coordination of organics analyses using GC/MS and GC instrumentation following both US EPA CLP and SW846 protocols. Her duties in this role include supervising analysts in the daily calibration, maintenance and troubleshooting of analytical instruments, monitoring schedules and holding times, analysis of samples, review of sample and QC data. She is involved with the implementation of Standard Operating Procedures, documentation of instrument and method QC criteria and development of new methods and implementation of new analytical technology. Ms. Mosher also insures the production of organic data is coordinated with other laboratory sections.

EDUCATION	**Community College of Rhode Island** Warwick, Rhode Island Certificate of Chemical Technology - 1991
RELATED EXPERIENCE	
02/2007-Present	**Spectrum Analytical Inc., Featuring Hanibal Technology, Rhode Island Division (formerly Mitkem)** - Manager, SVOA Department - Senior Scientist, SVOA Laboratory
05/2005 – 12/2006	**Alpha Woods Hole Laboratories** Raynham, MA - Development of Volatile Air Laboratory

	- Supervisor for Organics analyses including GC/MS VOA and SVOA, ECD's and FIDs - Forensic Team Leader
03/1997 – 05/2005	**Woods Hole Group Laboratories** Raynham, MA - Forensic Team Leader - GC/MS Group Leader
04/1996 – 03/1997	**Inchcape Testing** New Bedford and Raynham, MA - Semivolatile analyst - Volatile analyst
09/1991 – 04/1996	**Energy and Environmental Engineering Inc.** Somerville, MA - Semivolatile GC/MS Supervisor - GC-Pesticide/PCB analyst
01/1989 – 09/1991	**New England Testing Laboratory** North Providence, RI - Senior Chemical Technician - including Organic, Inorganic, Metals, and Microbiology analyses
10/1987 – 09/1988	**Rhode Island Analytical Laboratory** Warwick, RI - Chemical Technician

HUIYAN HEATHER ZHAO-ANDERSON
Inorganics Department Manager

Ms. Zhao-Anderson is employed as the Manager in Spectrum Analytical Inc. Rhode Island Division's Inorganics Department. Ms. Zhao-Anderson's responsibilities involve the coordination of metals and wet chemistry analyses using ICP/MS, ICP/AES and a variety of other instrumentation following both US EPA CLP and SW846 protocols. Her duties in this role include supervising analysts in the daily calibration, maintenance and troubleshooting of analytical instruments, monitoring schedules and holding times, analysis of samples, review of sample and QC data. She is involved with the implementation of Standard Operating Procedures, documentation of instrument and method QC criteria and development of new methods and implementation of new analytical technology. Ms. Zhao-Anderson also insures the production of inorganics organic data is coordinated with other laboratory sections. Prior to managing the inorganic department, Ms Zhao-Anderson was the department manager of our volatile organics laboratory for several years.

EDUCATION

Yale University
New Haven, CT
School of Forestry and
Environmental Study, MS 2005

Peking University
Beijing, China
Environmental Science and Economics
BS 2002

RELATED EXPERIENCE

09/2005 -Present

Spectrum Analytical Inc., Featuring Hanibal Technology, Rhode Island Division (formerly Mitkem)
- Manager, Inorganic Department
- Manager, VOA Department
- GC/MS Chemist, VOA Laboratory

DAWNE SMART

Data Reviewer, Project Manager, Data Reporting Supervisor

Ms. Smart's responsibilities as project manager involve the management of Spectrum Analytical Inc. Rhode Island Division's EPA Contract Laboratory Program (CLP) analytical services contract for ISM. This includes the daily oversight of incoming samples, maintenance of chain of custody documentation and communication records and resolution of any discrepancies or other issues involving CLP ISM sample assignments. Her responsibilities also include ongoing communication with EPA, sampler and CSC personnel, as well as monitoring data delivery schedules, writing project narratives and finalizing case communication.

Ms. Smart also is currently supervising the Data Reporting staff. She oversees the staff that generates data packages for all inorganic and organic fractions for different levels of report packages that will then go to data review personnel. Additionally, she and her staff are responsible for final report generation when all fractions of a project are completed, including bookmarking, pagination, final package posting to the website and hard copy report mailing if applicable.

Ms Smart also reviews sample and QC data, and completed CLP data packages for both organic and inorganic programs. Ms. Smart has extensive experience in Data Review as well as Quality Assurance. A significant portion of her previous employment included management of the Data Review department as well as the on-site QA Specialist for a major specialized laboratory.

EDUCATION

COMMUNITY COLLEGE of RHODE ISLAND
Warwick, Rhode Island
Certificate of Chemical Technology - 1991
Associate in Applied Science - 1997

RELATED EXPERIENCE

2007-Present

Spectrum Analytical Inc., Featuring Hanibal Technology, Rhode Island Division (formerly Mitkem)
- Data Reporting Supervisor
- ISM Contract manager

-Manager, Metals Department
-Supervisor, Inorganic Department

1999 – 2007
ALPHA WOODS HOLE LABORATORIES
Raynham, Massachusetts
-QA Specialist
-Manager, Data Review Department

1996 – 1999
ANALYTICAL BALANCE COMPANY
Middleboro, Massachusetts
- Department Head, Metals Analysis

1995 – 1996
FOXBORO COMPANY
West Bridgewater, Massachusetts
- Chemist

1988 – 1995
NEW ENGLAND TESTING LABORATORY
North Providence, RI
- Senior Laboratory Technician
- Laboratory Technician

1987 – 1988
RHODE ISLAND ANALYTICAL LABORATORIES
Warwick, RI
- Metals Preparation Technician
- Laboratory Assistant
-

AGNES R. HUNTLEY

Project Manager

Ms. Huntley has gained extensive and diversified experience in environmental laboratories using U.S. EPA CLP and SW846 methodologies, as well as participating in US Navy and Army analytical services programs.

Ms. Huntley's responsibilities involve the management of Spectrum Analytical Inc. Rhode Island Division's EPA Contract Laboratory Program (CLP) analytical services contracts. This includes the daily oversight of incoming samples, maintenance of chain of custody documentation and communication records and resolution of any discrepancies or other issues involving CLP sample assignments. Her responsibilities also include ongoing communication with EPA, sampler and CSC personnel, as well as monitoring data delivery schedules, writing project narratives and finalizing case communication. Ms. Huntley has managed four contracts with the EPA, which included one Organics Low Concentration (OLC), two Organics Low/Medium Concentration (OLM) and one Inorganics Low/Medium Concentration (ILM) analytical services contracts. At present Ms. Huntley manages the Organics Multi-Media, Multi-Concentration (SOM01.2) Analytical Services Contract.

Previously, Ms. Huntley held the position of QA/QC Manager where her responsibilities included the development and implementation of Standard Operating Procedures, documentation of instrument and method performance using Method Detection Limit studies, and routine review of final laboratory data reports, review of analyst training and performance data and management of the corrective action system. Her duties also included interaction with federal and state regulatory officials in the acquisition and maintenance of laboratory certifications.

Prior experience includes management of the daily operations of the Organic Preparation Laboratory. Duties in this position included monitoring sample backlog, holding times, process work flow, and delivery due dates. Ms. Huntley also developed and implemented new test methods, trained laboratory staff, performed instrument maintenance and reviewed sample and QC data. Prior to joining Spectrum Analytical Inc. Ms. Huntley worked as an analytical chemist at NET Cambridge Division performing analyses under a wide variety of programs including Army COE, Navy NEESA, DOE HAZWRAP and EPA CLP.

EDUCATION	**SIMMONS COLLEGE** Boston, Massachusetts - Chemistry, BS - Mathematics, BS

RELATED EXPERIENCE

1997-Present	**Spectrum Analytical, Inc., Featuring Hanibal Technology, Rhode Island Division (formerly Mitkem)** - Project Manager, SOM Contract manager - Supervisor, Sample Receiving Department
1997-2008	**MITKEM CORPORATION** Warwick, Rhode Island - CLP Project Manager - QA/QC Manager - Manager, Sample Preparation Laboratory
1995-1997	**NATIONAL ENVIRONMENTAL TESTING** Bedford, Massachusetts - Chemist, Organic Preparation
1992-1995	**SIMMONS COLLEGE CHEMISTRY DEPT.** Boston, Massachusetts - Teaching Assistant, Chemistry Department

QAP Revision Page:

Rev 1 (02/01/2013): Included Facility floor plan, Updated Org Chart, updated equipment list, DW metals reporting requirements per 310 CMR 42

ATTACHMENT 3

Beacon Quality System Manual

BEACON Environmental's Quality System Manual

Beacon Environmental Services, Inc.
2203a Commerce Road, Suite 1
Forest Hill, MD 21014 USA

Responsible Parties

Name	Function (Unit)	Phone	Signature	Date
Harry O'Neill	President	410-838-8780		
Steven Thornley	Laboratory Director	410-838-8780		
Patti Riggs	Quality Manager	410-838-8780		

Revision Number:	6	**Effective Date:**	
Distribution List:	QA Manager's Office beacon ((//file-server)(/Z:)/BEACON Administration/QA Documents/Quality Manual		

SECTION 2- TABLE OF CONTENTS

Appendices

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SECTION 3 – INTRODUCTION AND SCOPE

The purpose of this *Quality System Manual* is to outline the quality system for the laboratory analysis of sorbent packed tubes following U.S. EPA Air Toxics - Monitoring Method TO-17 and Method TO-15 and passive soil gas samples following U.S. EPA Method 8260C. The *Quality System Manual* defines the policies, procedures, and documentation that assure analytical services continually meet a defined standard of quality that is designed to provide clients with data of known and documented quality and, where applicable, demonstrate regulatory compliance.

The Quality System Manual sets the standard under which all laboratory operations are performed including the laboratory's organization, objectives, and operating philosophy.

3.1 Scope of Testing

The laboratory scope of analytical testing services includes U.S. EPA Methods TO-17 and 8260C using thermal desorption-gas chromatography/mass spectrometry (TD-GC-MS) instruments in accordance with BEACON's standard operating procedures (SOPs).

3.2 Table of Contents, References and Appendices

The table of contents is in Section 1 of this *Quality System Manual*, which uses the references from Department of Defense, Quality Systems Manual for Environmental Laboratories (latest edition), The NELAC Institute Standard, Environmental Laboratory Sector (2009) and International Standard/International Electrotechnical Commission, General Requirements for the competence of Testing and Calibration Laboratories, 17025:2005. These and additional references can be found in Appendix 26.1.5. Appendix 26.1.1 contains a table of the method detection limits, 26.1.2 the chain of custody form, and Appendix 26.1.3 contains a correlation between the requirements of the DoD ELAP QSM and BEACON's quality system documents.

3.3 Glossary and Acronyms Used

Quality control terms are generally defined within the section that describes the activity. Appendix 26.1.6 2 contains the acronyms used in this document, and Appendix 25.1.4 contains the glossary.

3.4 Additional Terms and Definitions

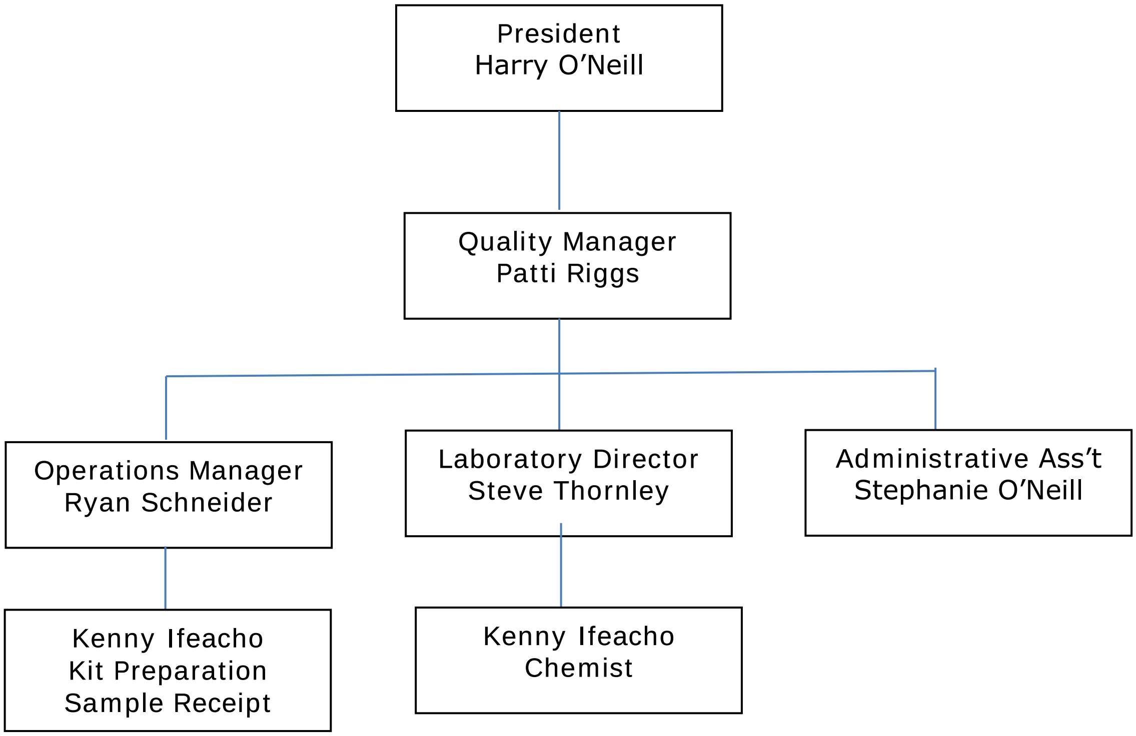
Additional terms and definitions can be found in Appendix 25.1.4.

SECTION 4 – ORGANIZATIONAL ROLES AND RESPONSIBILITIES

The laboratory is a legally identifiable organization. Through application of the policies and procedures outlined in this chapter, the laboratory assures that it is impartial and that personnel are free from undue commercial, financial, or other undue pressures that might influence their technical judgment. The laboratory is responsible for carrying out testing activities that meet the requirements stated in The NELAC Institute Standard, Environmental Laboratory Sector (2009), Chapter 5, and International Standard/International Electrotechnical Commission, General Requirements for the Competence of Testing and Calibration Laboratories, 17025:2005 and Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Testing Laboratories and that meet the needs of the client.

4.1 Laboratory Organizational Structure

The organizational structure indicated minimizes the potential for conflicting or undue interests that might influence the technical judgment of analytical personnel.



The President of BEACON has overall responsibility for the operation of the laboratory. The specific responsibilities include:

- providing support and resources for the QA Program
- maintaining laboratory staffing
- approving equipment acquisition
- developing the laboratory budget
- maintaining and implementing the marketing program
- reviewing data requirements

When the Quality Manager is not present for more than one week, the Laboratory Director serves as the deputy.

The Laboratory Director reports to the President of BEACON. The Laboratory Director is primarily responsible for on-schedule completion of assigned laboratory work and for supervising all laboratory activities, including implementation of the quality assurance program. The Laboratory Director enlists and encourages the cooperation of all the staff in the program. Specific responsibilities of the Laboratory Director include:

- ensuring that all analyses are performed according to the methods and client's contractual requirements;
- reviewing all analytical data by (i) checking documentation for completeness and proper sample identification, (ii) checking raw data for calculation, interpretation, or clerical errors, (iii) assuring that produced quality control data are acceptable;
- ensuring laboratory data quality;
- coordinating analytical work to ensure that all tasks are completed within established time frames;
- overseeing preventative maintenance activities;
- establishing analytical priorities and reviewing data requirements for each project
- reviewing initiated corrective actions and recommending additional measures, if necessary;
- ensuring corrective actions are implemented;
- reviewing quality control data to determine if test data are acceptable;
- scheduling accuracy, precision, and LOD/LOQ demonstrations;
- evaluating and implementing changes in methodology and quality control measures;
- identifying quality control problems and taking measures to correct or eliminate the problem source; and
- validating all data and assuring that data sets are accurate before reporting.

If the Laboratory Director is absent for a period of time exceeding 15 consecutive calendar days, he/she will designate another full-time staff member meeting the qualifications below to temporarily perform this function. If this absence exceeds 65 (35 for the NELAC Institute) consecutive calendar days, the Accreditation Body will be notified in writing.

The position of Laboratory Director requires a Bachelor's degree in the chemical, environmental, biological or physical sciences, or engineering, with at least 24 college credit hours in chemistry and at least two years of experience in the environmental analysis of representative inorganic and organic analytes for which the laboratory seeks or maintains accreditation. A master's or doctoral degree in one of the above disciplines may be substituted for one year of experience. This will be documented on their resume or job description. The Laboratory Director is also responsible for maintaining the laboratory's compliance with the quality assurance program in accordance with ISO/IEC 17025:2005, DoD Quality Systems Manual for Environmental Laboratories 4.2, and TNI Field Sampling and Measurement Organization Sector Volume (FSMO-VI-2007) requirements (or the most recent versions of these documents).

Analysts report to the Laboratory Director. They are responsible for on-schedule performance and documentation of all analyses assigned. Moreover, their responsibilities include:

- performing required analyses according to test methods specified;
- assuring that all analytical equipment has been properly calibrated before beginning the analyses;
- assuring that all identifying information (including sample control numbers, project numbers, and client information) have been accurately transcribed into records or computer databases;
- assuring that appropriate confirmatory tests or procedures have been completed;
- quantifying raw data, performing QA checks, and tabulating analytical results for each sample batch;
- identifying, documenting, and reporting non-conforming work to the Laboratory Director; and
- maintaining equipment in working conditions and documenting all preventive maintenance and repairs.

The Operations Manager reports to the President and is responsible for the administrative aspects of the laboratory. Specific responsibilities include:

- coordinating the preparation of packed sorbent tubes and passive soil-gas samplers and the shipment of sample collection kits;
- supervising sample receipt as primary sample custodian;
- initiating paperwork for sample analyses on appropriate laboratory documents (including establishing project files and sample receipt records) as required for analysis;
- obtaining, filing, and distributing pertinent project information to laboratory staff;
- The Operations Manager is also responsible for compliance with the quality assurance program in accordance with ISO/IEC 17025:2005, DoD Quality Systems Manual for Environmental Laboratories 4.2 (as applicable), and TNI Field Sampling and Measurement Organization Sector Volume (FSMO-VI-2007) (or the most recent versions of these documents).
- reporting laboratory results to the client;
- managing BEACON central file system, which includes project statements of work or proposals, quality assurance plans, chain-of-custody records, and final data reports; and
- initiating and tracking archives for all laboratory documents

BEACON has appointed a Quality Manager, who, irrespective of other duties and responsibilities, has defined responsibility and authority for ensuring that the quality system is implemented and followed at all times. The Quality Manager has direct access to the highest level of management at which decisions are made on laboratory policy or resources. The specific authorities and responsibilities associated with this position include:

- Implementing and maintaining a quality assurance program in accordance with ISO/IEC 17025:2005, DoD Quality Systems Manual for Environmental Laboratories 4.2 (as applicable), and TNI Field Sampling and Measurement Organization Sector Volume (FSMO-VI-2007) (or the most recent versions of these documents).
- Serving as the focal point for QA/QC and be responsible for the oversight and/or review of quality control data;
- Implementing the operational aspects of the QA Program;
- Ensuring the laboratory data quality as the Quality Manager;
- Ensuring corrective actions specified by the Laboratory Director are implemented
- Functioning independent from laboratory operations for which they have quality assurance oversight;
- Evaluating data objectively and performing assessments without outside (e.g., managerial) influence;
- Documenting training and/or experience in QA/QC procedures and be knowledgeable in the quality system as defined under NELAC;
- Having a general knowledge of the analytical test methods for which data review is performed;
- Arranging for or conducting internal audits as per Section 4.13 of the Department of Defense Quality Systems Manual for Environmental Testing Laboratories annually;
- Notifying laboratory management of deficiencies in the quality system and monitoring corrective action;
- Implementing, maintaining, and improving the quality system;
- Ensuring that all personnel understand their contributions to the quality system;
- Ensuring communication takes place at all levels within the laboratory regarding the effectiveness of the quality system;
- Coordinating training of laboratory personnel, and evaluating the effectiveness of training; and
- Using available tools, such as audit and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in efforts to monitor trends and continually improve the quality system.

Beacon Environmental Services, Inc. is a commercial organization incorporated in the State of Maryland, with the laboratory located at 2203A Commerce Road, Suite 1, Forest Hill, MD 21050. The tax ID number is available upon request.

4.2 Responsibility and Authority

MANAGEMENT includes the positions of Laboratory Director, Quality Manager, President, and Operations Manager.

Management has overall responsibility for the technical operations and authority needed to generate the required quality of laboratory operations.

Management's commitment to quality and to the Quality System is stated in the Quality Policy, which is upheld through the application of related policies and procedures.

Management ensures technical competence of personnel operating equipment, performing tests, evaluating results, or signing reports, and limits authority to perform laboratory functions to those appropriately trained and/or supervised.

The assignment of responsibilities, authorities, and interrelationships of the personnel who manage, perform, or verify work affecting the quality of environmental tests is documented in section 18.

Management bears specific responsibility for maintenance of the Quality System. This includes defining roles and responsibilities to personnel, approving documents, providing required training, providing a procedure for confidential reporting of data integrity issues, and periodically reviewing data, procedures, and documentation.

Management ensures that audit findings and corrective actions are completed within required time frames.

Management is responsible for defining the minimal level of education, qualifications, experience, and skills necessary for all positions in the laboratory and assuring that technical staff have demonstrated capabilities in their tasks.

Training is kept up to date as described in Section 18.3 by periodic review of training records and through employee performance review.

SECTION 5 – QUALITY SYSTEMS

The laboratory's Quality System is documented in this *Quality Systems Manual* and associated quality system documents. Together they describe the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of the organization for ensuring quality in its work processes, products, and services.

5.1 Quality Policy

Quality Policy Statement

The objective of the quality system and the commitment of management is to consistently provide our customers with data of known and documented quality that meets their requirements and satisfies data quality as well as project objectives and to continually improve the quality system. Our policy is to use *good professional practices, to maintain quality, to uphold the highest quality of service, and to comply with the* Department of *Defense Quality Systems Manual, latest edition, The NELAC Institute Standard, Environmental Laboratory Sector (2009) and International Standard/International Electrotechnical Commission, General Requirements for the Competence of Testing and Calibration Laboratories, 17025:2005. The laboratory ensures that personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of work. This policy is implemented and enforced through the unequivocal commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this manual. However, the primary responsibility for quality rests with each individual within the laboratory organization. Every laboratory employee must ensure that the generation and reporting of quality analytical data is a fundamental priority. Every laboratory employee is required to familiarize him or herself with the quality documentation and to implement the policies and procedures in their work. All employees are trained annually on ethical principles and procedures surrounding the data that is generated. The laboratory maintains a strict policy of client confidentiality.*

Steven C. Thornley

___________________________________DATE 1/6/2012

Steven C. Thornley
Laboratory Director

Harry St. A O'Neill

___________________________________DATE 1/6/2012

Harry St. A. O'Neill
President

5.2 Quality Manual

All BEACON employees work to ensure that the laboratory's policies and objectives for quality are documented by reference or by inclusion in this *Quality Manual*, and that this *Quality Manual* is communicated to, understood by, and implemented by all personnel concerned. The Laboratory Director is ultimately held responsible for any discrepancies.

> Where this *Quality Manual* documents quality system or laboratory requirements, a separate SOP or policy is not required.
>
> All employees sign a form, kept with their personnel file that states that they have read and understood the *Quality Manual*, including the quality policy.
>
> The *Quality Manager maintains the Quality Manual current and up-to-date*.

SECTION 6 – DOCUMENT MANAGEMENT

This Section describes procedures for document management, which includes controlling, distributing, reviewing, and accepting modifications. The purpose of document management is to preclude the use of invalid and/or obsolete documents.

The laboratory manages four types of documents, 1) controlled, 2) approved, 3) external and 4) obsolete.

A CONTROLLED DOCUMENT is one that is uniquely identified, issued, tracked, and kept current as part of the quality system. Controlled documents may be internal documents or external documents.

APPROVED means reviewed and either (i) signed and dated or (ii) acknowledged in writing or secured by electronic means by the issuing authorities.

OBSOLETE DOCUMENTS are documents that have been superseded by more recent versions.

All documents that affect the quality of laboratory data are managed appropriate to the scope and depth required.

6.1 Controlled Documents

Documents will be reviewed and approved for use by the President, Laboratory Director, Quality Manager and/or other qualified individual prior to issue. This will be documented on front page of the document.

SOP 44 contains the requirements and procedures for BEACON’s document control system.

6.2 Standard Operating Procedures

STANDARD OPERATING PROCEDURES (SOPs) are used to ensure consistency of application of common procedures, are written procedures that describe in detail how to accurately reproduce laboratory processes, and are of two types: 1) test method SOPs, which have specifically required details, and 2) general use SOPs which document the more general organizational procedures.

General use SOPs do not have to be formal documents with predefined section headings and contents. They can be less formal descriptions of procedures described in this *Quality System Manual* or other documents.

Copies of all SOPs are accessible to all personnel and are kept on the BEACON Directory:

C:\BEACON\BEACON Administration\QA Documents\SOPs.

Each SOP indicates the effective date, the revision number, and its SOP number.

6.2.1 Test Method SOPs

The laboratory has SOPs for all test methods within its scope, located centrally in the Laboratory or Quality Manager’s Office [Hardcopy], and on the following directory:

C:\BEACON\BEACON Administration\QA Documents\SOPs

Separate SOPs are not required when procedures that are part of the Quality System are within the Quality System Manual and accurately reflect how the analytical process is performed. Also SOPs are not required where equipment manuals or published methods accurately reflect laboratory procedures in detail.

Any deviation from a test method is documented in the relevant report, including both a description of the change made and a technical justification. The deviation from a test method is reported to the client.

When applicable, each Test Method SOP includes or references the following:

- identification of the test method;
- applicable matrix or matrices;
- detection limit;
- scope and application, including components to be analyzed;
- summary of the test method;
- definitions;
- interferences;
- safety;
- equipment and supplies;
- reagents and standards;
- sample collection, preservation, shipment and storage;
- quality control, including acceptance criteria (5.4.10.6);
- calibration and standardization;
- procedure;
- data analysis and calculations;
- method performance;
- pollution prevention;
- data assessment and acceptance criteria for quality control measures;
- corrective actions for out-of-control ;
- contingencies for handling out-of-control or unacceptable data;
- waste management;
- references; and,
- any tables, diagrams, flowcharts and validation data.

SECTION 7 – REVIEW OF REQUESTS, TENDERS AND CONTRACTS

The review of all new work assures that oversight is provided so that requirements are clearly defined, the laboratory has adequate resources and capability, and the test method is applicable to the customer's needs. This process assures that all work will be given adequate attention without shortcuts that may compromise data quality.

Contracts for new work may be formal bids, signed documents, verbal, or electronic.

7.1 Procedure for the Review of Work Requests

SOP 45 summarizes the requirements and processes for review of work requests.

7.2 Documentation of Review

SOP 45 summarizes the requirements and processes for review of work requests.

SECTION 8 – SUBCONTRACTING OF TESTS

A SUBCONTRACT LABORATORY is defined as a laboratory external to this laboratory, or at a different location than the address indicated on the front cover of this manual, that performs analyses for this laboratory.

BEACON will not subcontract Methods TO-17 or 8260C analytical work. Other work, such as fabrication of parts that are used in the BeSure Kit manufactured by BEACON, may be subcontracted. A list of subcontractors will be maintained. SOP 35 contains the requirements and procedures associated with subcontracting.

SECTION 9 – PURCHASING SERVICES AND SUPPLIES

The laboratory ensures those purchased supplies and services that affect the qualities of environmental tests are of the required or specified quality by using approved suppliers and products.

The laboratory has procedures for purchasing, receiving, and storage of supplies that affect the quality of environmental tests.

SOP 34 contains the requirements related to purchasing services and supplies, and the procedures used to fulfill those requirements.

SECTION 10 – SERVICE TO THE CLIENT

The laboratory collaborates with clients and/or their representatives in clarifying their requests and in monitoring the laboratory performance related to their work. Each request is reviewed to determine the nature of the request and the laboratory's ability to comply with the request within the confines of prevailing statutes and/or regulations without risk to the confidentiality of other clients.

10.1 Client Confidentiality

The laboratory confidentiality policy is to not divulge or release any information to a third party without proper authorization.

All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limits, as required by client or regulation.

Information on the services provided to the client can be found in SOP 45.

SECTION 11 – COMPLAINTS

The purpose of this section is to assure that customer complaints are addressed and corrected. This includes requests to verify results or analytical data.

The Quality Manager reviews all complaints and determines appropriate action.

SOP 36 contains the requirements and procedures associated with the effective handling of complaints.

SECTION 12 – CONTROL OF NON-CONFORMING WORK

NON-CONFORMING WORK is work that does not meet acceptance criteria or requirements. Non-conformances can include unacceptable quality control results (see Section 24 -- Assuring the Quality of Results) or departures from standard operating procedures or test methods. Requests for departures from laboratory procedures are approved by the Quality Manager and documented.

The policy for control of non-conforming work is to identify the non-conformance, determine if it will be permitted, and take appropriate action. All employees have the authority to stop work on samples when any aspect of the process does not conform to laboratory requirements.

SOP 38 contains the requirements for, and procedures associated with control of non-conforming work.

SECTION 13 – CORRECTIVE ACTION

CORRECTIVE ACTION is the action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence (NELAC, 2003).

Deficiencies cited in external assessments, internal quality audits, data reviews, complaints, or managerial reviews are documented and require corrective action. Corrective actions taken are appropriate for the magnitude of the problem and the degree of risk.

SOP 41 contains the requirements and procedures used for effective corrective actions.

SECTION 14 – PREVENTIVE ACTION

PREVENTIVE ACTION, rather than corrective action, aims at minimizing or eliminating inferior data quality or other non-conformance through scheduled maintenance and review, before the non-conformance occurs.

Preventive action includes, but is not limited to, review of QC data to identify quality trends, regularly scheduled staff quality meetings, annual budget reviews, annual managerial reviews, scheduled column trimming, and other actions taken to prevent problems.

All employees have the authority to recommend preventive action procedures; however, management is responsible for implementing preventive action. Further information on the requirements related to preventive action and the associated procedures can be found in SOP 47.

SECTION 15 – CONTROL OF RECORDS

RECORDS are a subset of documents, usually data recordings that include annotations (*e.g.*, refrigerator temperatures posted to a laboratory form), lists, spreadsheets, or analyst notes on a chromatogram. Records may be on any form of media, including electronic and hard copy. Records allow for the historical reconstruction of laboratory activities related to sample handling and analysis.

The laboratory maintains a record system appropriate to its needs, records all laboratory activities, and complies with applicable standards or regulations as required.

The laboratory retains all original observations, calculations and derived data, calibration records, and a copy of the test report for a minimum of five (5) years.

Records of all procedures to which a sample is subjected while in the possession of the laboratory are kept.

> Storage: All records stored on electronic media are supported by the hardware and software required for retrieval and have hard-copy or write-protected backup copies.
>
> Filing: Records are filed promptly and in an organized fashion.
>
> Access: Access to archived information is documented with an access log.
> Disposal: Records are disposed of according to applicable regulation, client request, or after five (5) years.

Additional information on the requirements and procedures for control of records can be found in SOP 42.

SECTION 16 – INTERNAL AUDITS

AUDITS measure laboratory performance and verify compliance with accreditation/ certification and project requirements. Audits specifically provide management with an on-going assessment of the quality system. They are also instrumental in identifying areas where improvement in the quality system will increase the reliability of data. Audits are of four main types: internal, external, performance, and system.

Notification to clients of events that cast doubt on the validity of any issued data is completed as quickly as possible, once any event has been identified by an audit.

The laboratory conducts internal audits of its quality systems activities, including data integrity, and the use of trained and qualified personnel at least annually. Personnel may not audit their own activities except when it can be demonstrated that an effective audit will be carried out.

Annually, the laboratory prepares a schedule of internal audits to be performed during the year. These audits verify compliance with the requirements of the quality system, including analytical methods, SOPs, ethics policies, other laboratory policies, and the quality standard accreditations held by BEACON.

It is the responsibility of the Quality Manager to plan and organize audits as required by the schedule and requested by management.
Management ensures that corrective actions are carried out within the timeframe specified by the auditor(s).

SOP 39 provides more information on the requirements and procedures specific to internal auditing.

16.1 Performance Audits

> Performance audits may be Proficiency Test Samples, internal single-blind samples, double-blind samples through a provider or client, or anything that tests the performance of the analyst and method.
>
> The policy and procedures for Proficiency Test Samples are discussed in SOP 23.

SECTION 17 MANAGEMENT REVIEWS

Management reviews the quality system and maintains records of review findings and actions.

The quality system is reviewed annually, and findings are recorded. Managers assure that actions are performed within agreed time frames.

These items are reviewed:

- The suitability of policies and procedures;
- Reports from managerial and supervisory personnel;
- The outcome of recent internal audits;
- Corrective and preventive actions;
- Assessments by external bodies;
- The results of inter-laboratory comparisons or Proficiency Tests;
- Changes in the volume and type of the work;
- Client feedback;
- Complaints;
- Quality control activities;
- Resources; and
- Staff training.

Additional information on the conduct of management reviews can be found in SOP 43.

SECTION 18 – PERSONNEL, TRAINING, AND DATA INTEGRITY

18.1 Job Descriptions

Job descriptions are available for all positions that manage, perform, or verify work affecting data quality, and are located on a file in the Quality Manager's office.

Job descriptions are maintained for each employee and include the specific tasks, minimum education and qualifications, skills, and experience required for each position. See SOP 48 for more information on the requirements and procedures relating to job descriptions.

18.2 Data Integrity and Ethics

DATA INTEGRITY is the result of the processes that together assure valid data of known and documented quality.

Data integrity and ethics procedures in the laboratory include training, signed and dated integrity documentation for all laboratory employees, periodic monitoring of data integrity, and documented data integrity procedures.

Technical managers uphold the spirit and intent by supporting integrity procedures, by enforcing data integrity procedures, and by signing and dating the data integrity procedure training forms.

Data integrity procedures and evidence of inappropriate actions are reviewed annually or through regularly scheduled internal audits, and are updated by management.

The mechanism for confidential reporting of ethics and data integrity issues is (1) unrestricted access to senior management, (2) an assurance that personnel will not be treated unfairly for reporting instances of ethics and data integrity breaches, and (3) anonymous reporting.

Employees are required to understand, through training and review of quality systems documents, any infractions of the laboratory data integrity procedures will result in a detailed investigation that could lead to very serious consequences such as immediate termination, or civil/criminal prosecution.

Any potential data integrity issue is handled confidentially until a follow-up evaluation, full investigation, or other appropriate actions have been completed and the issues clarified. Inappropriate activities are documented, including disciplinary actions, corrective actions, and notifications of clients, if applicable. These documents are maintained for a minimum of five (5) years.

See SOP 49 for more information on the requirements and procedures relating to data integrity and ethics, and the training provided to inform employees on the requirements of the overall ethics program.

18.3 General Training

All personnel are appropriately trained and competent in their assigned tasks before they contribute to functions that can affect data quality. It is management's responsibility to assure personnel are trained.

Only trained personnel are authorized to perform specific tasks.

Training records are kept on individual training forms.

SOP 48 contains more information on the procedures related to general training.

SECTION 19 – ACCOMMODATIONS & ENVIRONMENTAL CONDITIONS

Laboratory facilities are designed and organized to facilitate testing of environmental samples. Environmental conditions are monitored to ensure that conditions do not invalidate results or adversely affect the required quality of any measurement.

Environmental tests are stopped when the environmental conditions jeopardize the results.
Access to, and use of areas affecting the quality of the environmental tests is controlled by restriction of areas to authorized personnel only.
The laboratory workspaces are adequate for their use, and appropriately clean to support environmental testing and ensure an unencumbered work area.

Additional information describing how BEACON meets these requirements can be found in SOP 37.

SECTION 20 – TEST METHODS AND METHOD VALIDATION

A method is validated before it is put into use. All methods are published or documented.

20.1 Demonstration of Capability (DOC)

A DEMONSTRATION OF CAPABILITY (DOC) is a procedure to establish the ability of the analyst to generate data of acceptable accuracy and precision.

WORK CELLS consist of analysts with specifically defined tasks who together perform the method. Work cells together meet specified acceptance criteria and demonstrations of capability.

The laboratory confirms that it is capable of generating data of acceptable accuracy and precision on all methods before employing them.

The DOC is documented on the form in Appendix C of the Department of Defense Quality Systems Manual for Environmental Testing Laboratories and these completed forms are kept in the training files for each analyst.

A DOC is performed for each analyte whenever the method, analysts, analytes, or instrument type is changed.

The Laboratory Director and Quality Manager certify that technical staff members in their area of expertise are trained and authorized to perform all tests for which BEACON is accredited by signing the DOC form.

The process for DOC is described in SOP 23.

20.2 On-Going (or Continued) Proficiency

After the demonstration of capability is completed, on-going proficiency is maintained and demonstrated at least annually through the analysis of either single-blind samples, performing another DOC, or use of four consecutive laboratory control samples compared to pre-determined acceptance limits for precision and accuracy. This is documented in the training file of each analyst.

20.3 Initial Test Method Evaluation

For chemical analyses, the INITIAL TEST METHOD EVALUATION involves the determination of the Limit of Detection (LOD), confirmation of the Limit of Quantitation (LOQ), an evaluation of precision and bias, and an evaluation of the selectivity of the method.

20.3.1 Limit of Detection (LOD)

The LIMIT OF DETECTION (LOD) is an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte-and matrix specific and may be laboratory-dependent. (The NELAC Institute, Management and Technical Requirements for Laboratories Performing Environmental Analysis, Module 2, Quality Systems General Requirements, Glossary 2009). More information on the process of performing a LOD study can be found in SOP 40.

20.3.2 Limit of Quantitation (LOQ)

The LIMIT OF QUANTITATION (LOQ) is an estimate of the minimum amount of a substance that can be reported with a specified degree of confidence. (The NELAC Institute, Management and Technical Requirements for Laboratories Performing Environmental Analysis, Module 2, Quality Systems General Requirements, Glossary 2009). More information on the process of performing a /LOQ study can be found in SOP 40.

If an annual LOD study is performed, concentrations less that the Limit of Quantitation are not reported without denotation. If results are not reported outside of the calibration range (low), the LOD determination is not required.

The lowest calibration standard is equal to or less than the LOQ.

The LOQ will always be greater than the LOD.

20.3.3 Precision and Bias

PRECISION is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms.

BIAS is the systematic error that contributes to the difference between the mean of a significant number of test results and the accepted reference value.

Precision and bias are determined for standard and non-standard methods. More information on the procedure associated with precision and bias studies can be found in SOP 40.

20.3.4 Selectivity

SELECTIVITY The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (The NELAC Institute, Management and Technical Requirements for Laboratories Performing Environmental Analysis, Module 2, Quality Systems General Requirements, Glossary 2009).

The laboratory evaluates selectivity through evaluation of retention time windows, background subtraction, and ion chromatography. More information can be found in SOP 40.

20.4 Estimation of Uncertainty

ESTIMATION OF UNCERTAINTY consists of the sum (combining the components) of the uncertainties of the numerous steps of the analytical process, including, but not limited to, sample plan variability, spatial and temporal sample variation, sample heterogeneity, calibration/calibration check variability, extraction variability, and weighing variability.

The laboratory estimates uncertainty using the standard deviation calculated from routine quality control samples. More information can be found in the method SOPs, such as SOPs 7 and 18, and SOP 51.

20.5 Laboratory-Developed or Non-Standard Method Validation

Laboratory developed, modified standard methods, and non-standard methods require method validation.

Where applicable, the laboratory validates non-standard methods, laboratory-designed/developed methods, standard methods used outside their published scope, and amplifications and modifications of standard methods to confirm that the methods are fit for the intended use.

The range and accuracy of the values obtainable from validated methods (e.g. the uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object), is assessed for the intended use and whether it is relevant to the clients' needs.

The procedure for validating methods is contained in SOP 40.

20.6 Control of Data

All calculations and all relevant data are subject to appropriate checks in a systematic manner.

Commercial off-the-shelf software (*e. g.*, word processing, database and statistical programs) used within the designed application range is considered sufficiently validated when in-house programming is not used.

The laboratory assures that computers and software are protected, maintained, and secure through measures such as documentation, locked access, and control of the laboratory environment.

All computers at BEACON require a password to log onto windows. No software is created at BEACON.

The laboratory procedure to ensure that reported data are free from transcription and calculation errors is to manually review the hard copy of the data against the tabular data generated from custom reports, then tabulated in excel prior to printing the data for review. See SOP 17 (Analytical Data Review) for more information.

SOP 30 describes the procedures used when manual integration is performed.

SOP 20 describes the means of controlling the equipment and instruments in the laboratory.

SECTION 21 – EQUIPMENT

21.1 General Equipment Requirements

The laboratory provides all the necessary equipment required for the correct performance of the scope of environmental testing presented in this *Quality Manual*.

All equipment and software used for testing and sampling is capable of achieving the accuracy required and complies with the specifications of the environmental test method as specified in the laboratory SOP.

Only authorized personnel operate equipment.

The laboratory procedure for safe handling, transport, storage, use and planned maintenance of measuring equipment to ensure proper functioning and in order to prevent contamination or deterioration is found in the manual for the instrument and all manuals are found at the desk of the Laboratory Director.

Information on the processes relating to control of equipment and instrumentation can be found in SOP 20, and certain equipment related documents, including SOP 9, and the method SOPs, including SOP 7 and SOP 18.

21.2 Support Equipment

SUPPORT EQUIPMENT includes, but is not limited to: balances, ovens, refrigerators, freezers, water baths, temperature measuring devices, volumetric dispensing devices, and thermal/pressure sample preparation devices.

All support equipment is maintained in proper working order and records are kept of all repair and maintenance activities, including service calls.

Procedure

All raw data records are retained to document equipment performance. These records include logbooks, data sheets, or equipment computer files.

All support equipment are calibrated or verified annually over the entire range of use using NIST traceable references where available. The results of the calibration of support equipment are within specifications or (1) the equipment is removed from service until repaired or (2) records are maintained of correction factors to correct all measurements.

Support equipment such as balances, ovens, and freezers, are checked with a NIST traceable reference, if available, each day prior to use, to ensure they are operating within the expected range for the application for which the equipment is to be used.

Glass micro-liter syringes have a certificate attesting to the established accuracy. If the certificate of accuracy for glass micro-liter syringes is not available, the accuracy of the syringe is demonstrated upon receipt and documented gravimetrically.

Table 21.2-1 Acceptance Criteria for Support Equipment

Equipment Identification	Use	Acceptance Criteria
FREEZER 2	Sample storage	$\leq$10°F
FREEZER 3	Standards Storage	$\leq$10°F
Conditioning oven #1	Conditioning and cleaning passive adsorbent traps	Pressurized with inert gas and temperature controller operational, checked with thermocouple
Conditioning oven #2	Conditioning and cleaning passive adsorbent traps	Pressurized with inert carrier and temperature controller operational, periodically checked with thermocouple
Tube conditioning Unit TC-20	Conditioning and cleaning packed tubes	Pressurized with inert carrier and temperature controller operational, semiannually checked with thermocouple
Mettler H51 Scale, Serial Number 613240	Weighing adsorbent, general analytical balance	Balanced, Zeroed, Deflection and calibration set with ASTM class 6 weights (Serial No. 68233)
Mettler H51AR Scale, Serial Number 720267	Weighing adsorbent, general analytical balance	Balanced, Zeroed, Deflection and calibration set with ASTM class 6 weights (Serial No. 68233)

21.2.1 Support Equipment Maintenance

Maintenance on support equipment, such as ovens, refrigerators, and thermometers is conducted on an as needed basis.

Records of maintenance to support equipment are documented in Instrument Maintenance Logs. Each piece of support equipment does not necessarily have its own logbook. Maintenance logbooks may be shared with equipment that is housed in the same laboratory area. SOP 20 contains additional information on this process.

21.2.2 Support Equipment Calibration

Calibration requirements for analytical support equipment are found in the table below. For analytical instrumentation, the calibration requirements are found in section 20.3.2.

Table 21.2-2 Calibration And Maintenance

Instrument	Activity	Frequency	Documentation
Balance	1. Clean 2. Check alignment 3. Check deflection 4. calibrate using weights	Before use	Worksheet
ASTM Class 6 Weights	1. Only use for the intended purpose 2. Use plastic forceps to handle 3. Keep in case 4. Re-calibrate	Once every 5 years	Keep certificate
Freezers	1. Thermometers are dial/spring type 2. The thermometers are graduated in increments of 1°F or less 3. The thermometers are verified using a thermocouple digital thermometer that is NIST certified and calibrated annually.	Daily for dial/spring type Annually or when maintenance occurs for digital thermocouple type.	Worksheet/log book
Conditioning oven #1	1 Verify oven temperature	Once at highest set temperature each usage cycle	Worksheet/log book
Conditioning oven #2	1 Verify oven temperature	Once at highest set temperature each usage cycle	Worksheet/log book

21.3 Analytical Equipment

21.3.1 Maintenance for Analytical Equipment

All equipment is properly maintained, inspected, and cleaned.

Maintenance of analytical instruments and other equipment may include regularly scheduled preventive maintenance or maintenance on an as-needed basis due to instrument malfunction and is documented in Instrument Maintenance Logs, which become part of the laboratory's permanent records.

Table 21.3-1 Analytical Equipment Maintenance

Instrument	Procedure	Frequency
GC/MS	Ion gauge tube degassing	As required
	Pump oil-level check	Monthly
	Pump oil changing	As required
	Analyzer bake-out	As required
	Analyzer cleaning	As required
	Resolution adjustment	
	COMPUTER SYSTEM AND PRINTER:	As required
	Air filter cleaning	As required
	Change data system air filter	As required
	Printer head carriage lubrication	As required
	Paper sprocket cleaning	As required
	Drive belt lubrication	
Gas Chromatograph	Compare standard response to previous day or since last initial calibration	Daily
	Check carrier gas flow rate in column	Daily via use of known compound retention
	Check temp. of detector, inlet, column oven	Daily
	Septum replacement	As required
	Glass wool replacement	As required
	Check system for gas leaks with SNOOP	W/cylinder change as required
	Check for loose/fray wires and insulation Bake	Monthly
	injector/column	As required
	Change/remove sections of guard column	As required
	Replace connectors/liners	As required
	Change/replace column(s)	As required
Markes Equipment Ultra Recollection Ultra Unity Mass flow controller split Mass flow controller trap	Replace o-rings	As required
	Bake out	As required
Balances	Class "6" traceable weight check	when used
	Clean pan and check if level	when used
Refrigerators/ Freezers	Temperature monitoring	Daily
	Temperature adjustment	As required
	Defrosting/cleaning	As required
Ovens	Temperature monitoring If failure is experienced, replace	Each usage

21.3.2 Initial Instrument Calibration

Initial instrument calibration and continuing instrument calibration verification are an important part of ensuring data are of known and documented quality. If more stringent calibration requirements are included in a mandated method or by regulation, those calibration requirements override any requirements outlined here or in laboratory SOPs. Generally, instrument calibrations are provided in test methods.

All initial instrument calibrations are verified with a standard obtained from a second source traceable to a national standard when commercially available. If a second source is not available, a standard prepared from a separate lot may be used as long as the manufacturer can demonstrate the lot was prepared independently from other lots purchased.

The method SOPs (such as SOPs 7 and 18) contain specific information regarding initial instrument calibrations.

21.3.3 Continuing Instrument Calibration

The validity of the initial calibration is verified prior to sample analysis using continuing calibration verification (CCV) analyses.

Corrective action is initiated for continuing instrument calibration verification results that are outside of acceptance criteria.

Methods SOPs (such as SOPs 7 and 18) contain the information specific to BEACON's continuing calibration verification samples requirements and execution.

21.3.4 Unacceptable Continuing Instrument Calibration Verifications

If routine corrective action for continuing instrument calibration verification fails to produce a second consecutive (immediate) calibration verification within acceptance criteria, then a new calibration is performed or acceptable performance is demonstrated after corrective action with two consecutive calibration verifications.

For any samples analyzed on a system with an unacceptable calibration, some results may be useable if qualified and under the following conditions:

a) If the acceptance criteria are exceeded high (high bias) and the associated samples are below detection, then those sample results that are non-detects may be reported as non-detects.

b) If the acceptance criteria are exceeded low (low bias) and there are samples that exceed the maximum regulatory limit, then those exceeding the regulatory limit may be reported.

SECTION 22 – MEASUREMENT TRACEABILITY

Measurement quality assurance comes in part from traceability of standards to certified materials, and continues through the ability to trace every aspect of sample handling from sample receipt to sample destruction.

All equipment used that affects the quality of test results are calibrated prior to being put into service and on a continuing basis. These calibrations are traceable to national standards of measurement, where available.

Measurements from laboratory equipment provide the uncertainty required by test method or client.

If traceability of measurements to SI units is not possible or not relevant, evidence for correlation of results through inter-laboratory comparisons, proficiency testing, or independent analysis is provided.

All equipment that affects the quality of test results are calibrated according to the minimum frequency suggested by the manufacturer, by regulation, by method, or as needed.

Clients can verify that required uncertainty is achieved by reviewing the internal quality control data, if requested, and by visiting the laboratory for an audit.

22.1 Reference Standards

REFERENCE STANDARDS are standards of the highest quality available at a given location, from which measurements are derived.

Reference Standards, such as ASTM Class 1 weights, are used for calibration only and for no other purpose unless it is shown that their performance as reference standards will not be invalidated.

Reference standards, such as ASTM Class 1 weights, are calibrated by an entity that can provide traceability to national or international standards.

The following reference standards are calibrated using NIST traceable standards by an outside source:

a) Class 6 weights are sent out for calibration every five years;
b) Reference thermometers are sent out for calibration annually ; and

Reference standards are kept near their point of use, and used only for calibrations.

22.2 Reference Materials

REFERENCE MATERIALS are substances that have concentrations that are sufficiently well established to use for calibration or as a frame of reference.

Reference materials, where commercially available, are traceable to national standards of measurement, or to Certified Reference Materials, usually by a Certificate of Analysis.

Internal reference materials, such as working standards or intermediate stock solutions, are checked as far as technically and economically possible.

Purchased Reference Materials require a Certificate of Analysis where available. Otherwise, purchased reference materials are verified by application to a certified reference material, inter-laboratory comparison, and/or demonstration of capability.

Internal Reference Materials, such as working standards and intermediate stock solutions, are checked with a demonstration of capability, and proficiency tests.

Internal thermometers are checked against the NIST certified reference thermometer.

22.3 Transport and Storage of Reference Standards and Materials

The laboratory handles and transports reference standards and materials in a way that protects their integrity.

Reference standard and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials.

Reference standards and materials are stored according to manufacturer’s recommendations and separately from working standards or samples.

22.4 Labeling of Reference Standards, Reagents, and Materials

Reference standards and materials are tracked from purchase, receipt, and storage through disposal.

Expiration dates can be extended if the reference standard or material's integrity is verified. No reference standard has ever expired, because of the limited quantities employed in the operation of BEACON's laboratory.

Reagent quality is verified during routine blank analysis**.** BEACON's requirements for labeling of reference standards, reagents and materials are described in SOP 19.

SECTION 23 – SAMPLE MANAGEMENT

23.1 Sample Receipt

Sample receipt procedures can be found in SOP 14.

23.2 Sample Acceptance

The minimum conditions a sample must meet on receipt are: sample ID, location, job number, date received, sample type and analysis, time of collection, collector's name, flow rate, proper seals.

If these conditions are not met, the client is contacted prior to any further processing.

The procedures associated with sample acceptance are contained in SOP 14.

23.3 Sample Identification

Samples are uniquely identified in a permanent chronological record (in a sample receipt log book and database file) to prevent mix-up and to document receipt of all samples.

Information on sample identification requirements can be found on SOP 14.

23.4 Sample Storage

Storage conditions are monitored for any required criteria, verified, and the verification recorded in logbooks. This includes temperature monitoring and holding times, but for packed tubes it is best to keep them at room temperature and keep the air as free as possible from any contamination.

Samples are held secure, as required. Samples are stored apart from standards, reagents, food or potentially contaminating sources, and such that cross-contamination is minimized.

23.5 Sample Disposal

Samples are disposed of according to Federal, State and local regulations. SOP 14 contains more information regarding the disposal of samples.

23.6 Sample Transport

Samples that are transported under the responsibility of the laboratory, where necessary, are done so safely and according to storage conditions. TO-17 samples are contained within packed stainless steel tubes. No precautions are necessary for handling. Bubble wrap and securing the end caps of the tubes as properly sealed is all that is necessary. Each sample is given its own plastic re-sealable individual sampling bag that may be labeled for further identification and shipping protection.

Passive soil gas samples are trapped in cartridges containing adsorbent material over-packed in glass vials, individually bagged, and shipped in re-sealable return shipping bags; and no further precautions are necessary for sample stability.

23.7 Sampling Records

Sampling plans are based, whenever it is reasonable or requested by the client, on appropriate statistical sampling methods.

No sub-sampling within the laboratory is performed as it is not possible with samples collected on sorbents.

Recollection of the sample is possible using packed tubes, and is standard procedure, when re-analysis may be required.

Relevant sampling data are recorded, including 1) the sampling procedure used, 2) the identification of the sampler, 3) environmental conditions (if relevant), 4) the sampling location, and 5) the statistics upon which the sampling procedures are based (or that the requirements are regulation based according to the Request for Proposal (RFP) or Statement of Work (SOW), to be found in the job folder, hardcopy and/or electronic).

SECTION 24 – QUALITY OF TEST RESULTS

24.1 Essential Quality Control Procedures

All essential quality control elements are collected and assessed on a continuing basis.

The qualities of test results are recorded in such a way that trends are detectable, and where practicable, are statistically evaluated.

The QA-QC check report function from ChemStation is printed out and kept with data set. When continuing calibration and calibration verification fail, a new calibration is performed prior to sample analysis.

The quality control procedures specified in test methods are followed by laboratory personnel. The most stringent of control procedures is used in cases where multiple controls are offered. If it is not clear which is the most stringent, that which is mandated by the test method or regulation is followed.

Method SOPs (7 and 18), and SOPs 7, 17 and 46 contain information on the monitors and requirements related to the quality control requirements relating to sample analysis.

24.2 Internal Quality Control Practices

Analytical data generated with QC samples that fall within prescribed acceptance limits indicate the test method is IN CONTROL**.**

QC samples that fall outside QC limits indicate the test method is OUT OF CONTROL (non-conforming) and that corrective action is required or that the data are qualified.

Detailed QC procedures and QC limits are included in test method standard operating procedures (SOPs), or where unspecified in the SOPs, are detailed elsewhere.

All QC measures are assessed and evaluated on an on-going basis, so that trends are detected.

SOP 46 describes the quality control requirements for internal quality control. It includes a discussion on positive and negative controls, internal quality control samples, and other quality controls.

The following tables summarize the key elements of a quality control system for a laboratory performing chemistry testing.

24.3 Method Blanks

Contaminated blanks are identified according to the acceptance limits in the test method SOPs or laboratory documentation.

Samples associated with a contaminated blank are evaluated as to the appropriate corrective action for the samples (*e.g*. reprocessing or data qualifying codes).

Information on the requirements related to method blanks can be found in SOP 46.

Table 24.2-1 **Essential Quality Control Elements for Chemistry**

Item	Frequency	Acceptance Criteria	Corrective action
Negative Control (Method Blank)	1/batch	Method specific or reporting limit	Qualify data and take corrective action
Positive Control (Laboratory Control Sample)	1/batch	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Surrogate spikes	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data
Continuing Calibration Verification	Per method requirement	Method specific or determined by the laboratory	Reanalyze standard immediately; Corrective action
Initial calibration Verification	Immediately after a successful initial calibration	Method specific or determined by laboratory	Reanalyze standard immediately; Corrective action

24.4 Laboratory Control Samples

LABORATORY CONTROL SAMPLES/INITIAL CALIBRATION VERIFICATION (LCS) are prepared from a second source standard different from the initial calibration from either a different vendor or a different lot and this also acts as the calibration verification sample, for the purpose of establishing precision or bias measurements. It is a blank sorbent tube (same sorbents as samples) that is spiked with a known amount of standard solution.

Laboratory control samples are analyzed at a frequency mandated by method, regulation, or client request.

Information on the requirements related to laboratory control sample can be found in SOP 46.

24.5 Matrix Spikes and Matrix Spike Duplicates

MATRIX SPIKES (MS and MSD [duplicates]) are prepared from the same source as the LCS (MS/MSD is not performed unless specifically required in a contract agreement). The requirements for MS/MSD are not applicable to all methods (including certain air-testing samples).

The use of MS/MSD is discussed in SOP 46.

24.6 Surrogate Spikes

SURROGATES are substances with chemical properties and behaviors similar to the analytes of interest used to assess method performance in individual samples.

Surrogates are added to all samples, control samples, blanks, and calibrations (in test methods where surrogate use is appropriate) prior to sample preparation or extraction.

SOP 46 contains the requirements for surrogate spikes.

24.7 Proficiency Test Samples or Inter-laboratory Comparisons

The laboratory participates in proficiency test (PT) samples twice a year.

The laboratory institutes corrective action procedures for failed PT samples.

The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain prior to analysis the assigned value of any PT sample from the PT provider.

Information on BEACON’s Proficiency testing program can be found in SOP 23.

24.8 Data Review

The laboratory reviews all data generated in the laboratory for compliance with requirements of the method, the laboratory, and, where appropriate, the client.

All data review is documented, and the process for review in described in SOP 17.

SECTION 25 – REPORTING OF RESULTS

The result of each test carried out is reported accurately, clearly, unambiguously, and objectively and complies with all specific instructions contained in the test method.

Data are reported without qualification if they are greater than the lowest calibration standard, lower than the highest calibration standard, and without compromised sample or method integrity. Beacon does report values above the calibration range without flagging, as the information from these analyses provide valuable input to the maps BEACON generates illustrating the hot spots and spread of contamination at a specific site.

25.1 Test Reports

The report format has been designed to accommodate each type of test performed and to minimize the potential for misunderstanding or misuse.

BEACON's requirements for reporting are contained in SOP 50.

25.2 Supplemental Test Report Information

SOP 50 contains information on the information that may be provided to the client as supplemental test report information, when appropriate.

25.3 Environmental Testing Obtained from Subcontractors

SOP 50 contains information on the information that may be provided to the client when subcontractors provide analytical support; however, BEACON has not used subcontractors for this service.

25.4 Electronic Transmission of Results

All test results transmitted by telephone, fax, e-mail, or other electronic means comply with the requirements of this *Quality System Manual* and associated procedures to protect the confidentiality and proprietary rights of the client.

SOP 50 contains information regarding the electronic transmission of results.

25.5 Amendments to Test Reports

Material amendments to a test report after it has been issued are made only in the form of another document or data transfer. All supplemental reports meet all the requirements for the initial report and the requirements of this *Quality System Manual*.

SOP 50 contains information regarding amendments to test reports.

SECTION 26 – APPENDICES

26.1 TABLES

26.1-1 BFB Tuning Criteria (Based on the more stringent requirements of 8260c)

Table 26.1-1 REQUIRED BFB KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria (See Note)
50	15 to 40.0 Percent of m/e 95
75	30.0 to 60.0 Percent of m/e 95
95	Base Peak, 100 Percent Relative Abundance
96	5.0 to 9.0 Percent of m/e 95 (See note)
173	0 to 2.0 Percent of m/e 174
174	50.0 to 120.0 Percent of m/e 95
175	5 to 9.0 Percent of m/e 174
176	95 to 101.0 Percent of m/e 174
177	5.0 to 9.0 Percent of m/e 176

[1] If these 8260c criteria are met, the criteria for TO-15 and TO-17 are also met.

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

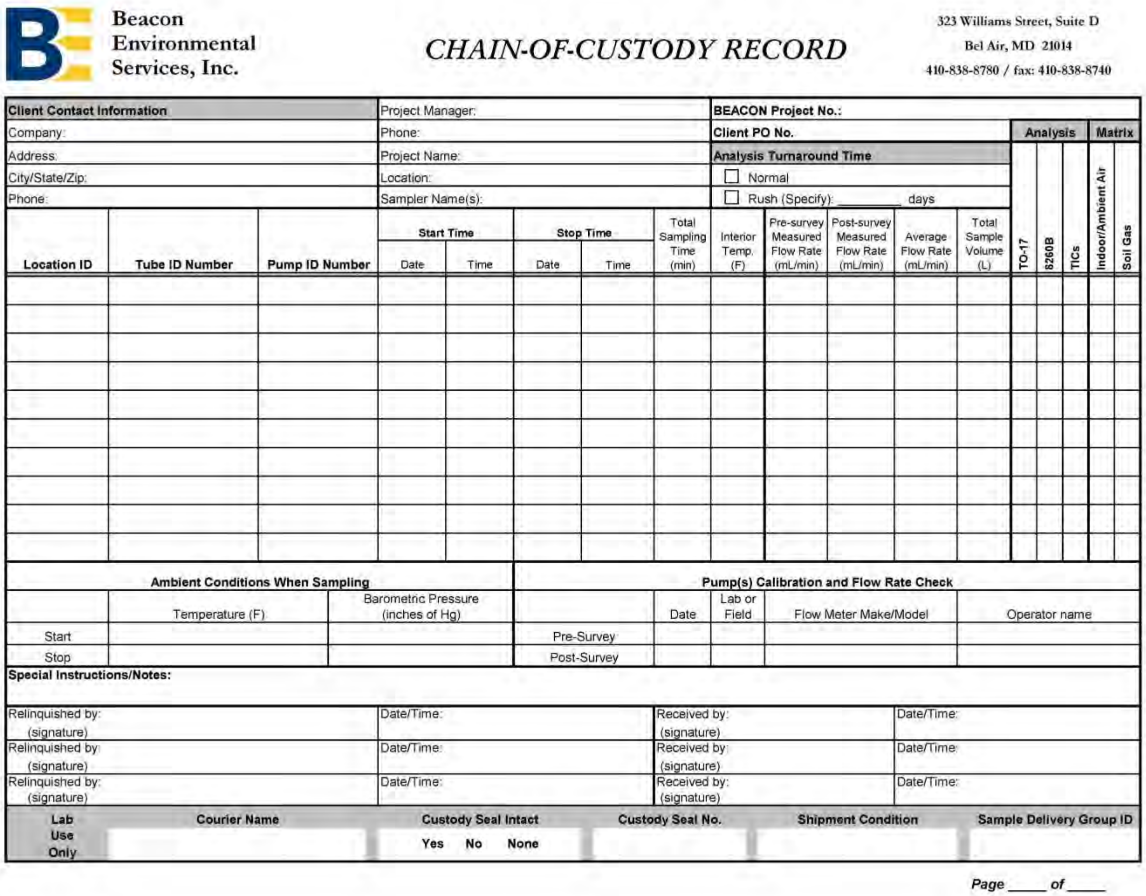
26.1-2 Method Detection Limits

Method detection limits are updated semi-annually, and can be found on beacon (\\File-server) (Z:)/GC/MS/cal mdl lod loq pt duplicate/mdl.

26.1.2 Forms

26.1.2-1 Chain of Custody

BEACON has three separate chain-of-custody forms, one for Passive Soil Sampling, one for Passive Diffusion Sampler, and one for TO-17 Active Tube Sample Collection. All three can be found under Beacon Administration/QA Documents/QA Forms. One example is shown below.



Beacon
Environmental
Services, Inc.

CHAIN-OF-CUSTODY RECORD

323 Williams Street, Suite D
Bel Air, MD 21014
410-838-8780 / fax: 410-838-8740

Client Contact Information	Project Manager:	**BEACON Project No.:**
Company:	Phone:	**Client PO No.**
Address:	Project Name:	**Analysis Turnaround Time**
City/State/Zip:	Location:	☐ Normal
Phone:	Sampler Name(s):	☐ Rush (Specify): ________ days

Location ID	**Tube ID Number**	**Pump ID Number**	**Start Time**		**Stop Time**		Total Sampling Time (min)	Interior Temp. (F)	Pre-survey Measured Flow Rate (mL/min)	Post-survey Measured Flow Rate (mL/min)	Average Flow Rate (mL/min)	Total Sample Volume (L)	**Analysis**			**Matrix**	
			Date	Time	Date	Time							**TO-17**	**8260B**	**TICs**	**Indoor/Ambient Air**	**Soil Gas**

Ambient Conditions When Sampling			**Pump(s) Calibration and Flow Rate Check**				
	Temperature (F)	Barometric Pressure (inches of Hg)		Date	Lab or Field	Flow Meter Make/Model	Operator name
Start			Pre-Survey				
Stop			Post-Survey				

Special Instructions/Notes:

Relinquished by: (signature)	Date/Time:	Received by: (signature)	Date/Time:
Relinquished by: (signature)	Date/Time:	Received by: (signature)	Date/Time:
Relinquished by: (signature)	Date/Time:	Received by: (signature)	Date/Time:

Lab Use Only	**Courier Name**	**Custody Seal Intact**	**Custody Seal No.**	**Shipment Condition**	**Sample Delivery Group ID**
		Yes No None			

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26.1.3 Correlation Between DoD ELAP QSM Requirements And BEACON's Quality Documents

DoD ELAP QSM	Beacon's Documentation
4.0 Management	Quality Manual
4.1 Organization	Quality Manual
4.2 Quality System	Quality Manual
4.3 Document Control	SOP 44
4.3.1 General	
4.3.2 Document Approval and Issue	
4.3.3 Document Changes	
4.4 Review of Requests, Tenders and Contracts	SOP 45
4.5 Subcontracting of Environmental Tests	SOP 35
4.6 Purchasing Services and Supplies	SOP 34
4.7 Service to the Client	SOP 45
4.8 Complaints	SOP 36
4.9 Control of Nonconforming Environmental Testing Work	SOP 38
4.10 Corrective Action	SOP 41
4.10.1 General	
4.10.2 Cause Analysis	
4.10.3 Selection and Implementation of Corrective Actions	
4.10.4 Monitoring of Corrective Actions	
4.10.5 Additional Audits	
4.10.6 Technical Corrective Action	
4.11 Preventive Action	SOP 47
4.12 Control of Records	SOP 42
4.12.1 General	
4.12.2 Technical Records	
4.13 Internal Audits	SOP 39
4.14 Management Reviews	SOP 43
5.0 Technical Requirements	
5.1 General	SOP 48
5.2 Personnel	
5.3 Accommodation and Environmental Conditions	SOP 37
5.4 Environmental Test Methods and Method Validation	
5.4.1 General	Via network, header of SOPs, this manual, method SOP format
5.4.2 Selection of Methods	US EPA 8260C (SOP 18) and TO-15/TO-17 (SOP 7)
5.4.3 Laboratory-Developed Methods	Not applicable
5.4.4 Non-Standard Methods	Not applicable
5.4.5 Validation of Methods	SOP 40
5.4.6 Estimation of Uncertainty of Measurement	Method SOP (7 & 18), SOP 51
5.4.7 Control of Data	SOP 17
5.5 Equipment	SOPs 20 & 54, method SOPs
5.6 Measurement Traceability	
5.6.1 General	SOP 7 & 18
5.6.2 Testing Laboratories	SOP 7 & 18
5.6.3 Reference Standards and Reference Materials	SOP 19
5.6.4 Documentation and Labeling of Standards, Reagents, and Reference Materials	SOP 19
5.7 Sampling	SOPs 10 & 11, Methods 1 & 2
5.8 Handling of Samples	SOPs 10, 11 & 14, Methods 1& 2
5.9 Assuring the Quality of Environmental Test and Calibration Results	

5.9.1 General	SOP 23
5.9.2 Essential Quality Control Procedures	SOPs 7, 18, , 40, 46
5.10 Reporting the Results	
5.10.1 General	SOP 50
5.10.2 Test Reports	
5.10.3 Supplemental Information for Test Reports	
5.10.4 Opinions and Interpretations	
5.10.5 Environmental Testing Obtained from Subcontractors	
5.10.6 Electronic Transmission of Results	
5.10.7 Format of Reports	
5.10.8 Amendments to Test Reports	
Appendices	
Appendix C – Demonstration of Capability	
C.1 Procedure for Demonstration of Capability	SOP 23
C.2 Certification Statement	Form DOC
C.3 Initial Test Method Evaluation	SOP 40
C.3.1 Limit of Detection (LOD)	
C.3.2 Limit of Quantitation (LOQ)	
C.3.3 Evaluation of Precision and Bias	
C.4 Evaluation of Selectivity	
Appendix D – Essential Quality Control Requirements	
D.1 Chemical Testing	SOPs 40, 46, SOPS 7 & 18
D.1.1 Positive and Negative Controls	
D.1.2 Limit of Detection and Limit of Quantitation	
D.1.3 Data Reduction	
D.1.4 Quality of Standards and Reagents	
D.1.5 Selectivity	
D.1.6 Constant and Consistent Test Conditions	
D.5 Air Testing.	
D.5.1 Negative and Positive Controls	
D.5.2 Analytical Variability/Reproducibility	
D.5.3 Method Evaluation	
D.5.4 Limit of Detection	
D.5.5 Data Reduction	
D.5.6 Quality of Standards and Reagents	
D.5.7 Selectivity	
D.5.8 Constant and Consistent Test Conditions	
Appendix E – SW 846 Reporting Requirements	SOP 50
Appendix F – SW 846 Quality Control Requirements	
Appendix G – SW 846 LCS Control Limits	Method SOPs (7 & 18)
G.1 Generated LCS Control Limits	SOP 46
G.2 Marginal Exceedance	SOP 46
G.3 LCS Failure	SOP 46
G.4 Corrective Action	SOP 46
G.5 Poor Performing Analytes	Na
G.6 Surrogates	SOP 46
G.7 In-House LCS Control Limits	Method SOPs (7 & 18)

26.1.4 Glossary

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation).

Audit: A systematic and independent examination to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. A thorough, systematic, on-site qualitative audit of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system.

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same quality systems matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) that are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples.

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

> Blanks include:
> Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Field Blank: A sample used to provide information about contaminants that may be introduced during sample collection, storage, and transport; also a clean sample exposed (not opened) to sampling conditions, transported to the laboratory, and treated as an environmental sample.

Preparation Blank: A sample used to provide information about the contaminants that may be introduced during sample preparation and storage in the laboratory.

Calibration: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.

Calibration Standard: A substance or reference material used for calibration.

Certified Reference Material (CRM): Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute (Term is not always used in Capital Letters in the standard).

Chain of Custody Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: Second column confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors; or Additional cleanup procedures.

Corrective Action: Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy.

Finding: An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement.

Holding Times: The maximum time that can elapse between various stages of any analysis.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Limit(s) of Detection (LOD): An estimate of the minimum amount of a substance that an analytical process can reliably detect (99% confidence level). An LOD is analyte-and matrix-specific and may be laboratory-dependent.

Limit(s) of Quantitation (LOQ): The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.

Matrix: The substrate of a test sample.

Matrix Spike (spiked sample or fortified sample): A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of Target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

May: Denotes permitted action, but not required action.

Measurement System: A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).

Measurement Uncertainty: Parameter characterizing the dispersion of the quantity values being attributed to a quantity intended to be measured based on the information used. The parameter may be, for example, a standard deviation called standard measurement uncertainty (or a specified multiple of it), or the half-width of an interval, having a stated coverage probability. An expanded measurement uncertainty associated with a measurement result, based on the standard uncertainty and a stated coverage factor, gives a coverage interval thought to encompass the set of true quantity values of the quantity intended to be measured with high probability. The choice of the coverage factor depends on the intended use of the measurement result.

Method: A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Must: Denotes a required action.

National Institute of Standards and Technology (NIST): A federal agency of the US Department of Commerce’s Technology Administration that is designed as the United States national metrology institute (NMI).

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.

Proficiency Testing Provider: Any person, private party, or government entity that meets stringent criteria to produce and distribute PT samples, evaluate study results against published performance criteria and report the results to the laboratories and primary accreditation bodies.

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory or analyst, which is provided to that laboratory or analyst to assess capability to produce results within acceptable criteria.

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality.

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control.

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC) activities.

Quality System Matrix: These matrix definitions are an expansion of the field of Accreditation matrices and shall be used for purposes of batch and quality control requirements:

Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records.

Reference Material: Material or substance one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or at a given location.

Replicate(s): The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

Requirement: Denotes a mandatory specification; often designated by the term “shall” or “must”.

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure

Sample Tracking: Procedures employed to record the possession of the samples from the time of sampling until disposal.

Selectivity: The capability of a test method or instrument to respond to a target substance, constituent or organism in the presence of non-target substances, constituents or organisms.

Sensitivity: The capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.

Shall: Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

Should: Denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

Spike: A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.

Standard Operating Procedures (SOPs): A written document that details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks.

Supervisor (however named): The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/ quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.

Surrogate: A pure substance with properties that mimic the analyte of interest and is unlikely to be found in environmental samples. These analytes are added to samples to evaluate analytical efficiency by measuring recovery.

Technical Manager: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Test Method: An adoption of a scientific technique for a specific measurement process, as documented in a laboratory SOP or published by a recognized authority.

Test Sensitivity: The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

United States Environmental Protection Agency (EPA): The federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends.

Verification: Confirmation by examination and objective evidence that specified requirements have been met.

> NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.
>
> The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument’s individual record.

Working Range: The difference between the Limit of Quantitation and the upper limit of measurement system calibration

26.1.5 References

Department of Defense, Quality Systems Manual for Environmental Testing Laboratories, 2010

The NELAC Institute (TNI), Environmental Laboratory Sector, Modules 1, 2 and 4, 2009

International Organization for Standardization/International Electrochemical Commission (ISO/IEC), 17025, 2005

United States Environmental Protection Agency (USAEPA) Method 8260C, 1996

United States of America, Environmental Protection Agency (USAEPA) Method TO-17, 1997

26.1.6 Acronyms

A list of acronyms used in this document and their definitions are:

ASTM	-	American Standards for Testing and Measurement, also known as ASTM International
DOC	-	Demonstration of Capability
DoD ELAP QSM	-	Department of Defense Environmental Laboratory Accreditation Program Quality System Manual
EPA	–	U.S. Environmental Protection Agency
GC/MS	–	Gas chromatography/mass spectrometry
ID	-	Identification
ISO/IEC	–	International Organization for Standardization/International Electrochemical Commission
LCS	–	Laboratory control sample
LOD	-	Limit of Detection
LOQ	-	Limit of Quantification
MDL	–	method detection limit
MS/MSD	-	Matrix Spike/Matric Spike Duplicate
NEFAP	–	National Environmental Field Activities Program
NELAC	–	National Environmental Laboratory Accreditation Conference
NELAP	–	National Environmental Laboratory Accreditation Program
NIST	–	National Institute of Standards and Technology
PT	–	Proficiency Test(ing)
QA	–	Quality Assurance
QC	–	Quality Control
RFP	-	Request for Proposal
SOPs	–	Standard operating procedures
SOW	-	Statement of Work
TNI	-	The NELAC institute

ATTACHMENT 4

ASTM D6282-98(2005) Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations

Designation: D 6282 – 98 (Reapproved 2005)

Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations[1]

This standard is issued under the fixed designation D 6282; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide addresses direct push soil samplers, which also may be driven into the ground from the surface or through prebored holes. The samplers can be continuous or discrete interval units. Samplers are advanced by a combination of static push, or impacts from hammers, or vibratory methods, or a combination thereof, to the depth of interest. The guide does not cover open chambered samplers operated by hand such as augers, agricultural samplers operated at shallow depths, or side wall samplers. This guide does not address single sampling events in the immediate base of the drill hole using rotary drilling equipment with incremental drill hole excavation. Other sampling standards, such as Test Methods D 1586 and D 1587 and Practice D 3550 apply to rotary drilling activities. This guide does not address advancement of sampler barrel systems with methods that employ cuttings removal as the sampler is advanced. Other drilling and sampling methods may apply for samples needed for engineering and construction applications.

1.2 Guidance on preservation and transport of samples, as given in Guide D 4220, may or may not apply. Samples for chemical analysis often must be subsampled and preserved for chemical analysis using special techniques. Practice D 3694 provides information on some of the special techniques required. Additional information on environmental sample preservation and transportation is available in other references **(1, 2)**.[2] Samples for classification may be preserved using procedures similar to Class A. In most cases, a direct push sample is considered as Class B in Practice D 4220 but is protected, representative, and suitable for chemical analysis. The samples taken with this practice do not usually produce Class C and D (with exception of thin wall samples of standard size) samples for testing for engineering properties, such as shear strength and compressibility. Guide D 4700 has some information on mechanical soil sampling devices similar to direct push techniques, however, it does not address most direct push sampling methods. If sampling is for chemical evaluation in the Vadose Zone, consult Guide D 4700 for any special considerations.

1.3 Field methods described in this guide, include the use of discreet and continuous sampling tools, split and solid barrel samplers and thin walled tubes with or without fixed piston style apparatus.

1.4 Insertion methods described include static push, impact, percussion, other vibratory/sonic driving, and combinations of these methods using direct push equipment adapted to drilling rigs, cone penetrometer units, and specially designed percussion/direct push combination machines. Hammers providing the force for insertion include drop style, hydraulically activated, air activated and mechanical lift devices.

1.5 Direct push soil sampling is limited to soils and unconsolidated materials that can be penetrated with the available equipment. The ability to penetrate strata is based on hammer energy, carrying vehicle weight, compactness of soil, and consistency of soil. Penetration may be limited or damage to samplers and conveying devices can occur in certain subsurface conditions, some of which are discussed in 5.5. Successful sample recovery also may be limited by the ability to retrieve tools from the borehole. Sufficient retract force must be available when attempting difficult or deep investigations.

1.6 This guide does not address the installation of any temporary or permanent soil, ground water, vapor monitoring, or remediation devices.

1.7 The practicing of direct push techniques may be controlled by local regulations governing subsurface penetration. Certification, or licensing requirements, or both, may need to be considered in establishing criteria for field activities.

1.8 The values stated in SI units are to be regarded as standard: however, dimensions used in the drilling industry are given in inch-pound units by convention. Inch-pound units are used where necessary in this guide.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

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[1] This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigation.

Current edition approved Jan. 1, 2005. Published February 2005. Originally approved in 1998. Last previous edition approved in 1998 as D 6282–98.

[2] The boldface numbers in parentheses refer to the list of references at the end of this standard.

1.10 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a projects's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:* [3]

D 653 Terminology Relating to Soil, Rock and Contained Fluids

D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils

D 1587 Practice for Thin-Wall Tube Sampling of Soils

D 2488 Practice for Description and Identification of Soils (Visual-Manual Method)

D 3550 Practice for Ring-Lined Barrel Sampling of Soils

D 3694 Practices for Preparation of Sample Containers and for Preservation of Organic Constituents

D 4220 Practices for Preserving and Transporting Soil Samples

D 4700 Guide for Soil Sampling from the Vadose Zone

D 5088 Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites

D 5092 Practice for Design and Installation of Ground Water Monitoring Wells in Acquifers

D 5299 Guide for Decommisioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities

D 5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock

D 6001 Guide for Direct-Push Water Sampling for Geoenvironmental Investigations

3. Terminology

3.1 *Definitions*—General definitions for terminology used in this guide are in accordance with Terminology D 653. Definitions for terms related to direct push water sampling for geoenvironmental investigations are in accordance with Guide D 6001.

3.1.1 *assembly length*, *n*—length of sampler body and riser pipes.

3.1.2 *borehole*, *n*—a hole of circular cross-section made in soil or rock.

3.1.3 *casing*, *n*—pipe furnished in sections with either threaded connections or bevelled edges to be field-welded, which is installed temporarily or permanently to counteract caving, to advance the borehole, or to isolate the interval being monitored, or combination thereof.

3.1.4 *caving/sloughing*, *n*—the inflow of unconsolidated material into an unsupported borehole that occurs when the borehole walls lose their cohesive strength.

3.1.5 *decontamination*, *n*—the process of removing undesirable physical or chemical constituents, or both, from equipment to reduce the potential for cross-contamination.

3.1.6 *direct push sampling*, *n*—sampling devices that are advanced into the soil to be sampled without drilling or borehole excavation.

3.1.7 *extension rod*, *n*—hollow steel rod, threaded, in various lengths, used to advance and remove samplers and other devices during direct pushing boring. Also known as *drive rod*. In some applications, small diameter solid extension rods are used through hollow drive rods to activate closed samples at depth.

3.1.8 *incremental drilling and sampling*, *n*—insertion method where rotary drilling and sampling events are alternated for incremental sampling. Incremental drilling often is needed to penetrate harder or deeper formations.

3.1.9 *percussion driving*, *n*—insertion method where rapid hammer impacts are performed to advance the sampling device. The percussion normally is accompanied with the application of a static down-force.

3.1.10 *push depth*, *n*—the depth below a ground surface datum to which the lower end, or tip, of the direct-push sampling device is inserted.

3.1.11 *sample interval*, *n*—defined zone within a subsurface strata from which a sample is gathered.

3.1.12 *sample recovery*, *n*—the length of material recovered divided by the length of sampler advancement and stated as a percentage.

3.1.13 *soil core*, *n*—cylindrical shaped specimen of sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks and which may or may not contain organic matter recovered from a soil sampler.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *closed barrel sampler*, *n*—a sampling device with a piston or other secured device that is held to block the movement of material into the barrel until the blocking device is removed or released. Liners are required in closed barrel samplers. Also may be referred to as a *protected type sampler.*

3.2.2 *impact heads/drive heads*, *n*—pieces or assemblies that fit to top of the above ground portion of the direct push tool assembly to receive the impact of the hammering device and transfer the impact energy to sampler extensions.

3.2.3 *open barrel sampler*, *n*—sampling barrel with open end allowing material to enter at any time or depth. Also may be referred to as an *unprotected type sampler.*

3.2.4 *piston lock*, *n*—device to lock the sampler piston in place to prevent any entry of a foreign substance into the sampler chamber prior to sampling.

3.2.5 *single tube system*, *n*—a system whereby single extension/drive rods with samplers attached are advanced into the subsurface strata to collect a soil sample.

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[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2.6 *solid barrel sampler*, *n*—a soil sampling device consisting of a continuous or segmented tube with a wall thickness sufficient to withstand the forces necessary to penetrate the strata desired and gather a sample. A cutting shoe and a connecting head are attached to the barrel.

3.2.7 *split barrel sampler*, *n*—a soil sampling device consisting of the two half circle tubes manufactured to matching alignment, held together on one end by a shoe and on the other by a connecting head.

3.2.8 *two tube systems*, *n*—a system whereby inner and outer tubes are advanced simultaneously into the subsurface strata to collect a soil sample. The outer tube is used for borehole stabilization. The inner tube for sampler recovery and insertion.

4. Summary of Guide

4.1 Direct push soil sampling consists of advancing a sampling device into subsurface soils by applying static pressure, by applying impacts, or by applying vibration, or any combination thereof, to the above ground portion of the sampler extensions until the sampler has been advanced to the desired sampling depth. The sampler is recovered from the borehole and the sample removed from the sampler. The sampler is cleaned and the procedure repeated for the next desired sampling interval. Sampling can be continuous for full depth borehole logging or incremental for specific interval sampling. Samplers used can be protected type for controlled specimen gathering or unprotected for general soil specimen collection.

5. Significance and Use

5.1 Direct push methods of soil sampling are used for geologic investigations, soil chemical composition studies, and water quality investigations. Examples of a few types of investigations in which direct push sampling may be used include site assessments, underground storage tank investigations, and hazardous waste site investigations. Continuous sampling is used to provide a lithological detail of the subsurface strata and to gather samples for classification and index or for chemical testing. These investigations frequently are required in the characterization of hazardous waste sites. Samples, gathered by direct push methods, provide specimens necessary to determine the chemical composition of soils, and in most circumstances, contained pore fluids **(3)**.

5.2 Direct push methods can provide accurate information on the characteristics of the soils encountered and of the chemical composition if provisions are made to ensure that discrete samples are collected, that sample recovery is maximized, and that clean decontaminated tools are used in the sample gathering procedure. For purposes of this guide, “soil” shall be defined in accordance with Terminology D 653. Using sealed or protected sampling tools, cased boreholes, and proper advancement techniques can assure good representative samples. Direct push boreholes may be considered as a supplementary part of the overall site investigation or may be used for the full site investigation if site conditions permit. As such, they should be directed by the same procedural review and quality assurance standards that apply to other types of subsurface borings. A general knowledge of subsurface conditions at the site is beneficial.

5.3 Soil strata profiling to shallow depths may be accomplished over large areas in less time than with conventional drilling methods because of the rapid sample gathering potential of the direct push method. More site time is available for actual productive investigation as the time required for ancillary activities, such as decontamination, rig setup, tool handling, borehole backfill, and site clean-up is reduced over conventional drilling techniques. Direct push soil sampling has benefits of smaller size tooling, smaller diameter boreholes, and minimal investigative derived waste.

5.4 The direct push soil sampling method may be used as a site characterization tool for subsurface investigation and for remedial investigation and corrective action. The initial direct push investigation program can provide good soil stratigraphic information depending on the soil density and particle size, determine ground water depth, and provide samples for field screening and for formal laboratory analysis to determine the chemical composition of soil and contained pore fluids. Use of this method, results in minimum site disturbance and no cuttings are generated.

5.5 This guide may not be the correct method for investigations in all cases. As with all drilling methods, subsurface conditions affect the performance of the sample gathering equipment and methods used. Direct push methods are not effective for solid rock and are marginally effective in partially weathered rock or very dense soils. These methods can be utilized to determine the rock surface depth. The presence or absence of ground water can affect the performance of the sampling tools. Compact gravelly tills containing boulders and cobbles, stiff clay, compacted gravel, and cemented soil may cause refusal to penetration. Certain cohesive soils, depending on their water content, can create friction on the sampling tools which can exceed the static delivery force, or the impact energy applied, or both, resulting in penetration refusal. Some or all of these conditions may complicate removal of the sampling tools from the borehole as well. Sufficient retract force should be available to ensure tool recovery. As with all borehole advancement methods, precautions must be taken to prevent cross contamination of aquifers through migration of contaminants up or down the borehole. Regardless of the tool size, the moving of drilling and sampling tools through contaminated strata carries risks. Minimization of this risk should be a controlling factor in selecting sampling methods and drilling procedures. The user should take into account the possible chemical reaction between the sample and the sampling tool itself, sample liners, or other items that may come into contact with the sample **(3, 4)**.

5.6 In some cases this guide may combine water sampling, or vapor sampling, or both, with soil sampling in the same investigation. Guides D 6001 and D 4700 can provide additional information on procedures to be used in such combined efforts.

6. Criteria for Selection

6.1 Important criteria to consider when selecting sampling tools include the following:

6.1.1 Size of sample.

6.1.2 Sample quality (Class A,B,C,D) for physical testing. Refer to Practice D 4220.

6.1.3 Sample handling requirements, such as containers, preservation requirements.

6.1.4 Soil conditions anticipated.

6.1.5 Ground water depth anticipated.

6.1.6 Boring depth required.

6.1.7 Chemical composition of soil and contained pore fluids.

6.1.8 Probability of cross contamination.

6.1.9 Available funds.

6.1.10 Estimated cost.

6.1.11 Time constraints.

6.1.12 History of tool performance under anticipated conditions (consult experienced users and manufacturers).

6.2 Important criteria to consider when selecting direct push equipment include the following:

6.2.1 Site accessibility.

6.2.2 Site visibility.

6.2.3 Soil conditions anticipated.

6.2.4 Boring depth required.

6.2.5 Borehole sealing requirements.

6.2.6 Equipment performance history.

6.2.7 Personnel requirements.

6.2.8 Decontamination requirements.

6.2.9 Equipment grouting capability.

6.2.10 Local regulatory requirements.

7. Apparatus

7.1 *General*—A direct push soil sampling system consists of a sample collection tool, hollow extension rods for advancement, retrieval, and transmission of energy to the sampler, and an energy source to force sampler penetration. Auxiliary tools are required to handle, assemble and disassemble, clean, and repair the sample collection tools and impact surfaces. Necessary expendable supplies are sample containers, sample container caps, sample liners, sample retainers, appropriate lubricants, and personal safety gear.

7.2 *Direct Push Tool Systems*:

7.2.1 *Two Tube System*—An outer casing and an inner extension rod with a sampler attached (see Fig. 1) are advanced simultaneously into the soil for the length capacity of the sampler. The sampler is removed from the borehole and a new sampler barrel or plug bit is inserted for each increment of depth. Two-tube sampling systems also may incorporate sample gathering chambers that are fitted into the outer casing shoe. These sample barrels are designed to create a minimum of sample disturbance while gathering high quality specimens (see Fig. 2). Samplers are held in the proper position by different methods, such as extension rods, pneumatic or mechanical packers, spring activated latches, or other devices (see Figs. 1 and 2). Locking devices must be strong enough to hold the sampler while penetrating the sample strata. The outer casing supports the borehole wall. Sample retrieval is expedited by the cased hole and continuous sampling is simplified. Continuous sampling may be a benefit to lithological logging. A cased borehole can be sealed from the bottom up as the casing is extracted (see Section 10). A cased hole may reduce the risk of contamination migration down the borehole and sample cross contamination. The two-tube system is more susceptible to soil friction because of its larger diameter and may require larger direct push energy than single-tube systems. An oversized drive shoe is sometimes used to reduce friction and buckling but may increase the risk of contamination migration down the borehole.

7.2.2 *Single Tube System*—The single tube system (see Fig. 3), uses a hollow extension/drive rod to advance and retrieve the sampler. The sampler is attached to the bottom of the extension/drive rod. A drive cap is added to the top of the extension/drive rod and the sampler is pushed into the soil. Extension/drive rods generally are smaller in diameter than the sampler. The single tube system minimizes effort for discrete interval sampling under many subsurface conditions. Tool connection time per interval is reduced. Time of removal and reinsertion of samplers into the borehole is affected by soil conditions. Repeated movement of the sampler through contaminated subsurface strata may increase the risk of contamination migration down the borehole. Bottom up borehole sealing may require re-entry in soil formations that collapse (see Section 10).

7.3 *Samplers*:

7.3.1 *Split Barrel Samplers*—Split barrel samplers (see Fig. 4) are available for use with direct push drilling methods and are available in various sizes up to 3.0 in. (76.2-mm) inside diameter. The inside tolerance should allow for use of liners. Split barrel sampler shoes used in two tube systems must be of sufficient diameter to prevent the intrusion of soil between the outer diameter of the shoe and the inside wall of the outer tube. Split barrel shoes should be replaced when the leading edge is damaged. Damaged shoes can negatively affect sample recovery. Samplers can be used with or without ball check value fitted split barrel heads. The ball check prevents uphole fluids from flowing down through the sample. Where soil sampling will be performed below the water table, the split barrel head, equipped with a ball check, should be used. The open split barrel is best used with the two tube system because the outer casing protects the borehole against cave-in or sloughing, or in soils in which the borehole wall will not collapse. Split barrel sealing systems are available. Split barrel sections can be joined to create a sampler with a nominal sample length capacity of 48 in. (1.22 m). It is understood that samplers with usable lengths beyond 24 in. (0.61 m) are used to advantage in certain soil types; however, the added weight of the soil sample in the chamber and the added friction within the sampler may prevent loose soils from entering the sampler, affecting sample recovery and representativeness. Split barrel samplers can be fitted with a basket to improve recovery in cohesionless soils. Retainers are available in many styles and materials. Retainers should allow the passage of softer soils. Stiff retainers can reduce specimen recovery in soft soils.

7.3.2 *Solid Barrel Samplers*:

7.3.2.1 *Open Solid Barrel Samplers*—Open solid barrel (see Fig. 5) samplers are used with all types of direct push sampling systems. Solid barrels can have inside diameters ranging up to 3 in. (76.2 mm). Barrel lengths range from 6 in. (152.4 mm) to 5 ft (1.53 m). Solid barrel samplers may be one piece or segmented. Sample liners should be used to facilitate removal

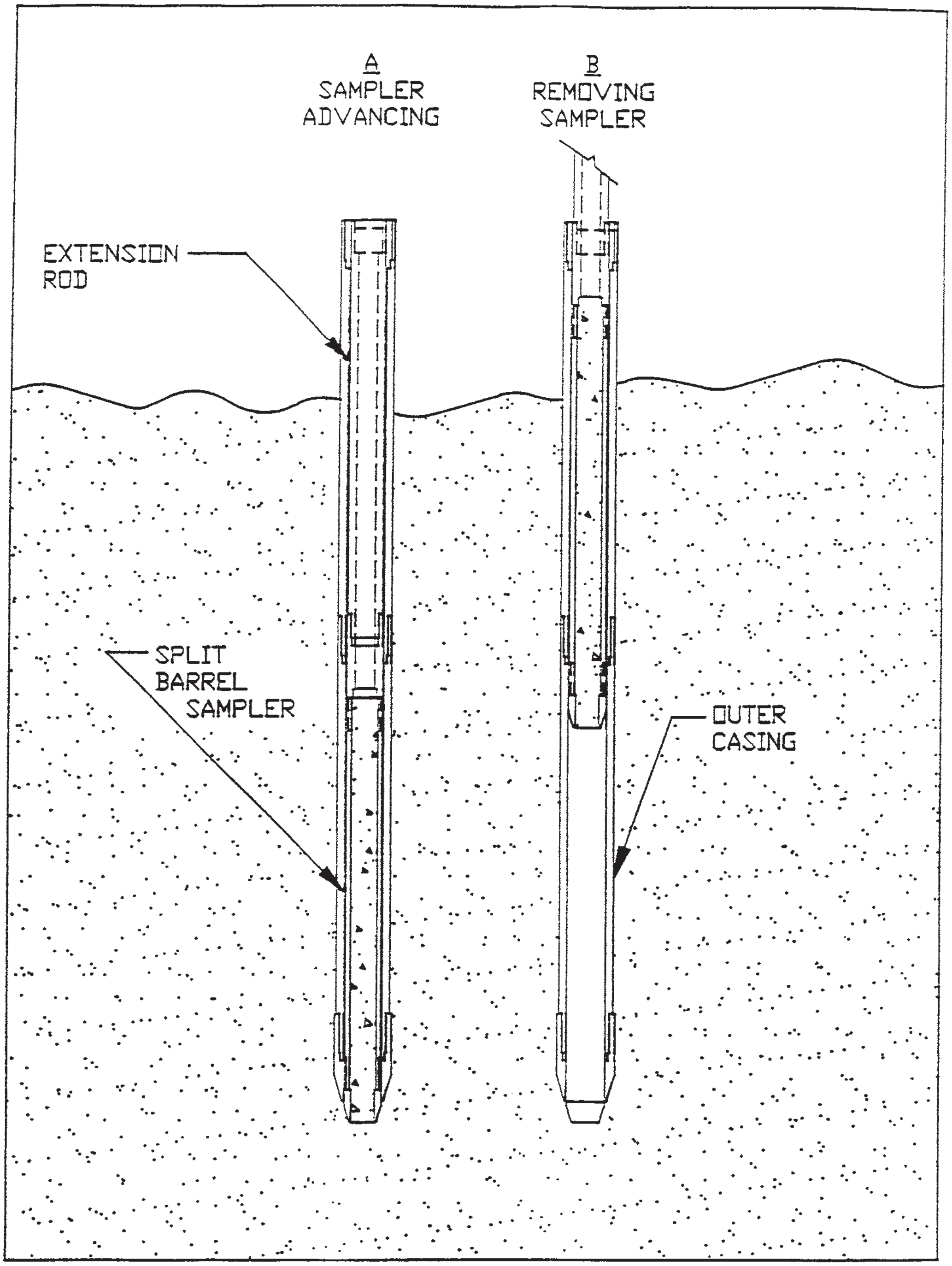

FIG. 1 Split Spoon Sampling, Two Tube System

of the sample from the solid barrel. Without the use of liners, samples are extruded mechanically. Liner lengths should fit sampler barrel lengths. Solid barrel samplers are generally assembled with a removable cutting shoe and a drive head (see Fig. 6). The head provides a backing to hold the liner stationary while the sampler is advanced and serves as a connector to the extension/drive rods. The shoe is manufactured to hold the liner stationary during the soil collection procedure. The liner should be slightly larger than the inner diameter of the cutting shoe. It may be slipped over the cutting shoe (see Fig. 6) or nested inside of the cutting shoe (see Fig. 7). The shoe is manufactured to cut the sample to a slightly undersized diameter allowing it to pass into the sample liner with a minimum of side friction to reduce sample disturbance. The amount of specimen contact with the inside of the shoe should be held to the minimum distance possible to aid in achieving the maximum amount of recovery.

7.3.3 *Closed Barrel Sampler*—Closed barrel samplers (see Figs. 2 and 3, Figs. 5-8) are devices, which remain sealed shut until an action is taken to open the sample receiving chamber. These samplers are used most often for single events (discrete point sampling) where a sealed sampler is required to avoid

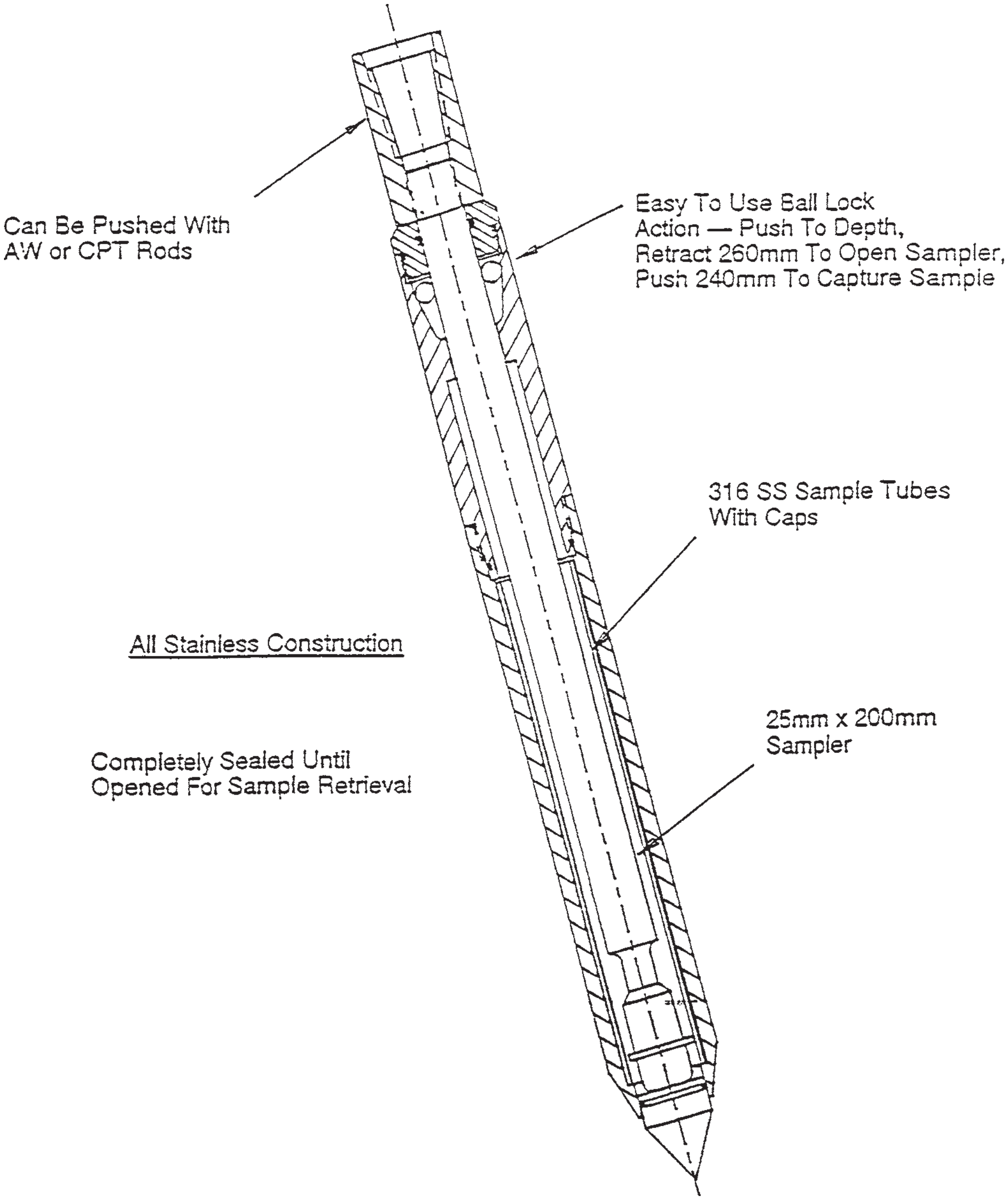

FIG. 2 Sealed Sample Barrel, Single Tube System

cross contamination or in circumstances where borehole wall stability cannot be assured. The shoe sealing device generally is a point designed to allow the continuous flow of soil around and past the sampler until such time as it is removed or released. The piston point can be fitted with seals, such as "O" rings at top and bottom to hold fluid out until sampling the desired interval. The piston rod extends through the sample retaining liner and must be released or removed for the soil to enter (see Fig. 3, Fig. 5, Fig. 7). The piston can be removed manually before sampling or be displaced by the soil entering the sampler chamber. Using the displacement method can result in reduced recovery if sampled soils do not have sufficient strength to displace the piston. Pistons are locked in place by several methods, such as a spring loaded latch. The latch holds several balls (see Fig. 2, Fig. 7, Fig. 8) into a groove in the latch coupling. When the latch is released by lifting up on the latch stem, the balls slip back into the latch chamber allowing the piston to be removed. Another method uses a locking screw. A reverse thread pin (Fig. 3, Fig. 6) is positioned in the sampler head to prevent the piston from being displaced by the soil when advancing the sampler. At the sampling interval, small diameter extension rods are inserted through the sampler extension/drive rods and rotated clockwise to unscrew the locking pin. A third method uses an inflated packer. An inflated packer (see Fig. 9) is attached to the top of the sampler barrel. The sample barrel is lowered into position in the drive casing and the packer inflated. The packer is deflated to release and the sample barrel is recovered after being advanced the sampling interval.

7.3.4 *Thin Wall Tube*—A 1.0-in. (25.4-mm) diameter thin wall tube (see Fig. 10) is available for use with direct push equipment and is manufactured according to Practice D 1587. Thin wall tubes can be effective when used with dual tube direct push systems as the borehole must be kept clear of

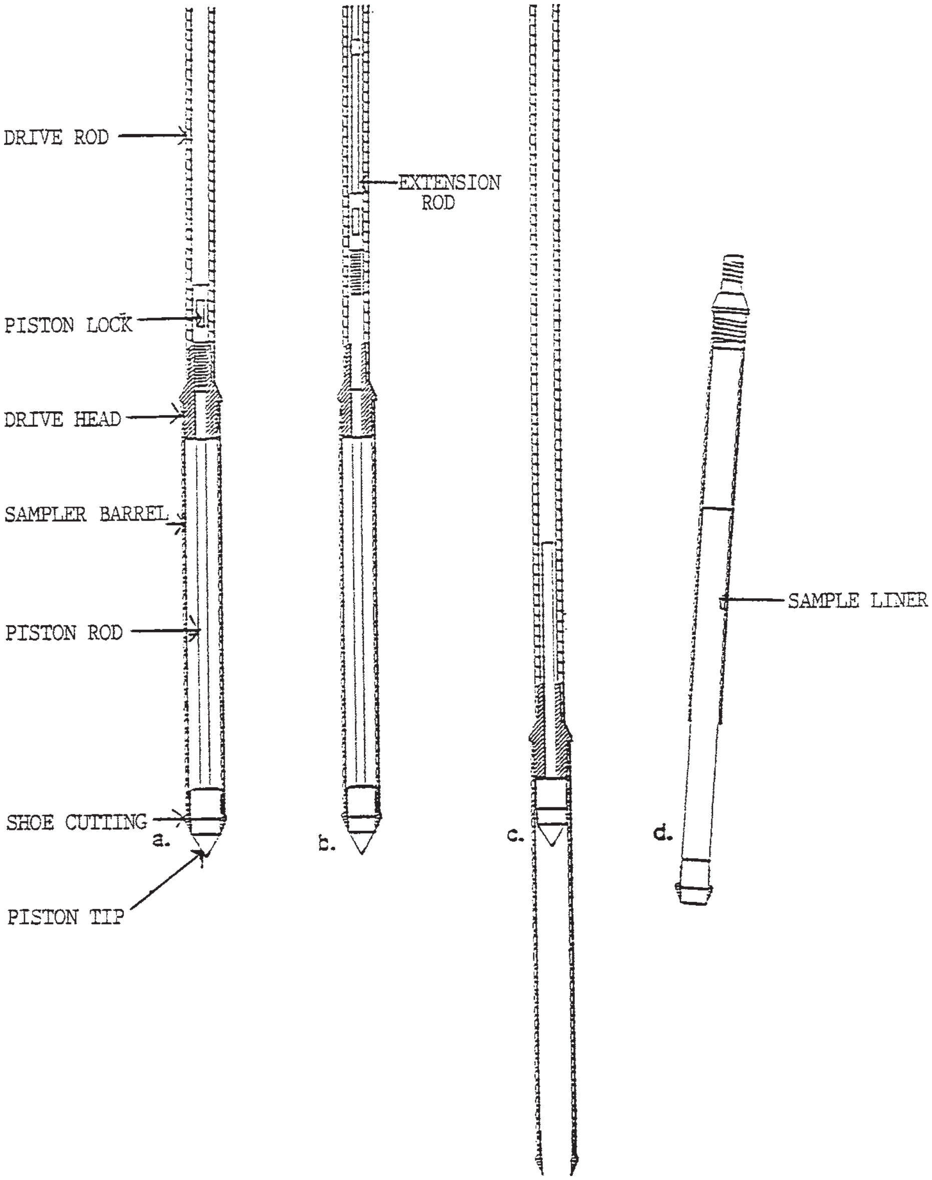

FIG. 3 Driving and Sampling, Single Tube System

(a) Driving the sealed sampler. (b) Removing the stop-pin.
(c) Collecting a sample (d) Recovering sample in liner.

disturbed soil prior to gathering a sample. Thin wall tubes may be effective in cohesive soils with single tube systems when the borehole can be kept clear of disturbed soil. Thin wall tubes must have an outside diameter that will allow passage through the outer casing. The thin wall tube can be operated in accordance with Practice D 1587, or it can be advanced using the percussion hammer of the direct push equipment. The primary use of the thin wall tube is to gather relatively undisturbed samples in cohesive soils. Sealing of thin wall tube ends should be completed in accordance with Practice D 4220. Fixed piston apparatus (see Fig. 10) also is available for use with thin walled tubes. The fixed piston action allows the sampling of very soft formations, which may not be retained in conventional samplers. In certain soil formations, the thin wall tube provides the best method to collect an undisturbed sample.

7.3.5 *Sampler Extension/Drive Rods*—Sampler extension/drive rods are lengths of rod or tube generally constructed of steel to withstand the pushing or percussion forces applied. Extension drive rods are available in various lengths. Rod lengths should be mated with casing and sampling equipment used. Thread types and classes vary between equipment manufacturers. Rod joints can be sealed to prevent fluid intrusion with “O” rings. Teflon™ washers or Teflon™ tape. Because of the percussive effort, joint seals should be checked for each sampling effort. Extension/drive rods should have sufficient inside diameter to accommodate the equipment necessary to perform the desired action.

7.3.6 *Sampler Liners*—Sampler liners are used to collect and store samples for shipment to laboratories, for field index testing of samples and for removing samples from solid barrel

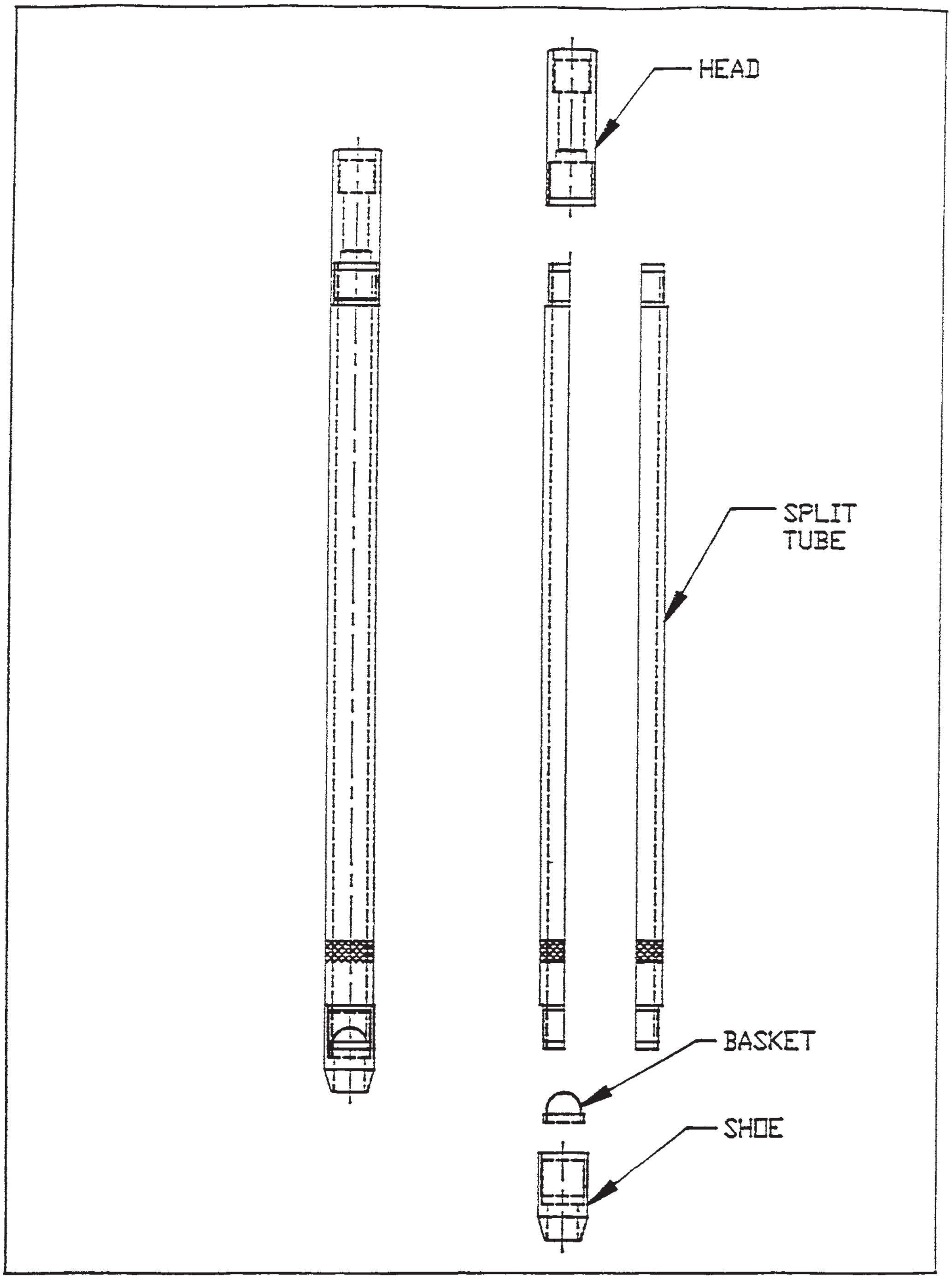

FIG. 4 Split Barrel Sampler, Two Tube System

type samplers. Liners are available in plastics, Teflon™, brass, and stainless steel. Other materials can be used as testing needs dictate. Liners are available in lengths from 6 in. (152.4 mm) to 5.0 ft (1.53 m). Liner material selection often is based on the chemical composition of liner/soil to minimize sample reaction with liner. Most liner use is short term as samples are subsampled and preserved immediately on site. A general rule for liner selection is stainless steel for organic compounds and plastic for metals. Teflon™ may be required for mixed wastes and for long time storage. Liners should be sealed in accordance with Practice D 4220 when samples are collected for physical testing. Other appropriate procedures must be used when samples are collected for environmental analysis (see Practices D 3694) (**1, 2**). Liners generally are split in the field for subsampling. Individually split liners are available in some sizes for field use. The liner should have a slightly larger inside diameter than the soil specimen to reduce soil friction and enhance recovery. When a slightly oversized liner is used, the potential for air space exists around the sample. Certain chemical samples may be affected by the enclosed air. Liners having less tolerance may be required and a shortened sampled interval used to reduce friction in the liner. Metal liners can be

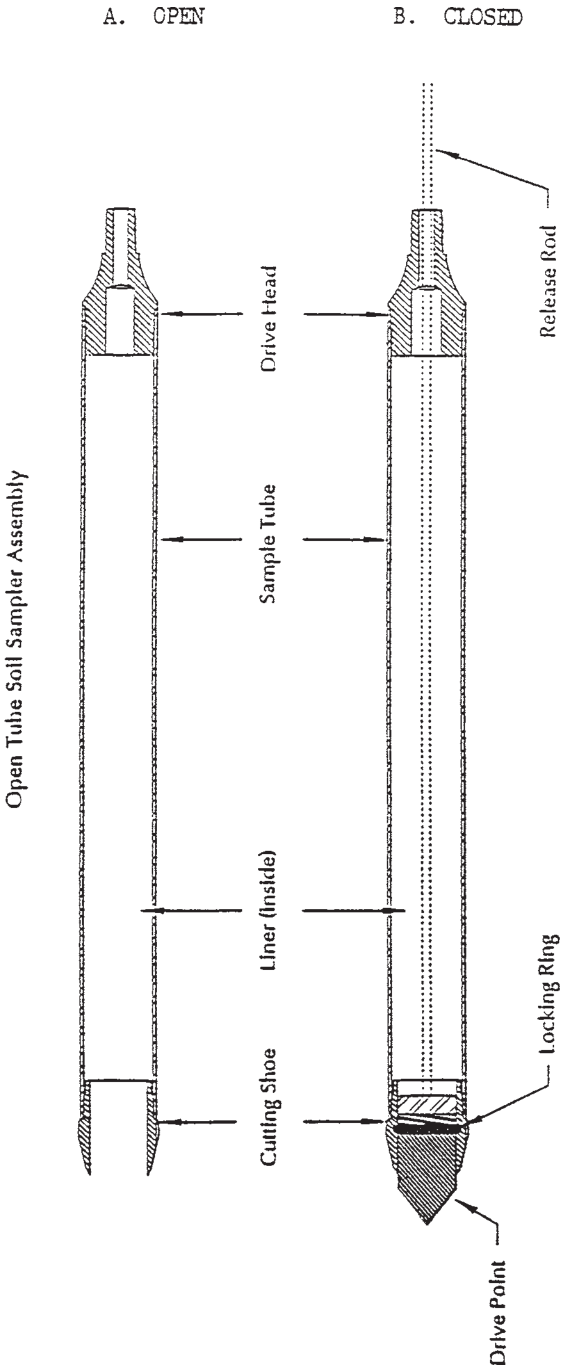

FIG. 5 (A) Open and (B) Closed Piston Sampler Assembly, Single Tube System

reused after proper cleaning and decontamination. Plastic liners should be disposed of properly after use.

7.3.7 *Sample Containers*—Sample containers should be prescribed according to the anticipated use of the sample specimen. Samples taken for chemical testing may require decontaminated containers with specific preservatives. Practice D 3694 provides information on some of the special containers and preservation techniques required (**1**, **2**). These containers generally will be decontaminated to specific criteria. Samples for geotechnical testing require certain minimum volumes and specific handling techniques. Practice D 4220 offers guidance for sample handling of samples submitted for physical testing.

7.4 *Direct Push Power Sources*—Soil probing percussion driving systems, penetrometer drive systems, and rotary drilling equipment may be used to drive casings and direct push soil sampling devices. The equipment should be capable of applying sufficient static force, or dynamic force, or both, to advance the sampler to the required depth to gather the desired sample. The system must have adequate retraction force to remove the sampler and extension/drive rods once the selected strata has been penetrated. Rotation of the drill string can be added during insertion, as well as during retraction if the drive system can impart rotation.

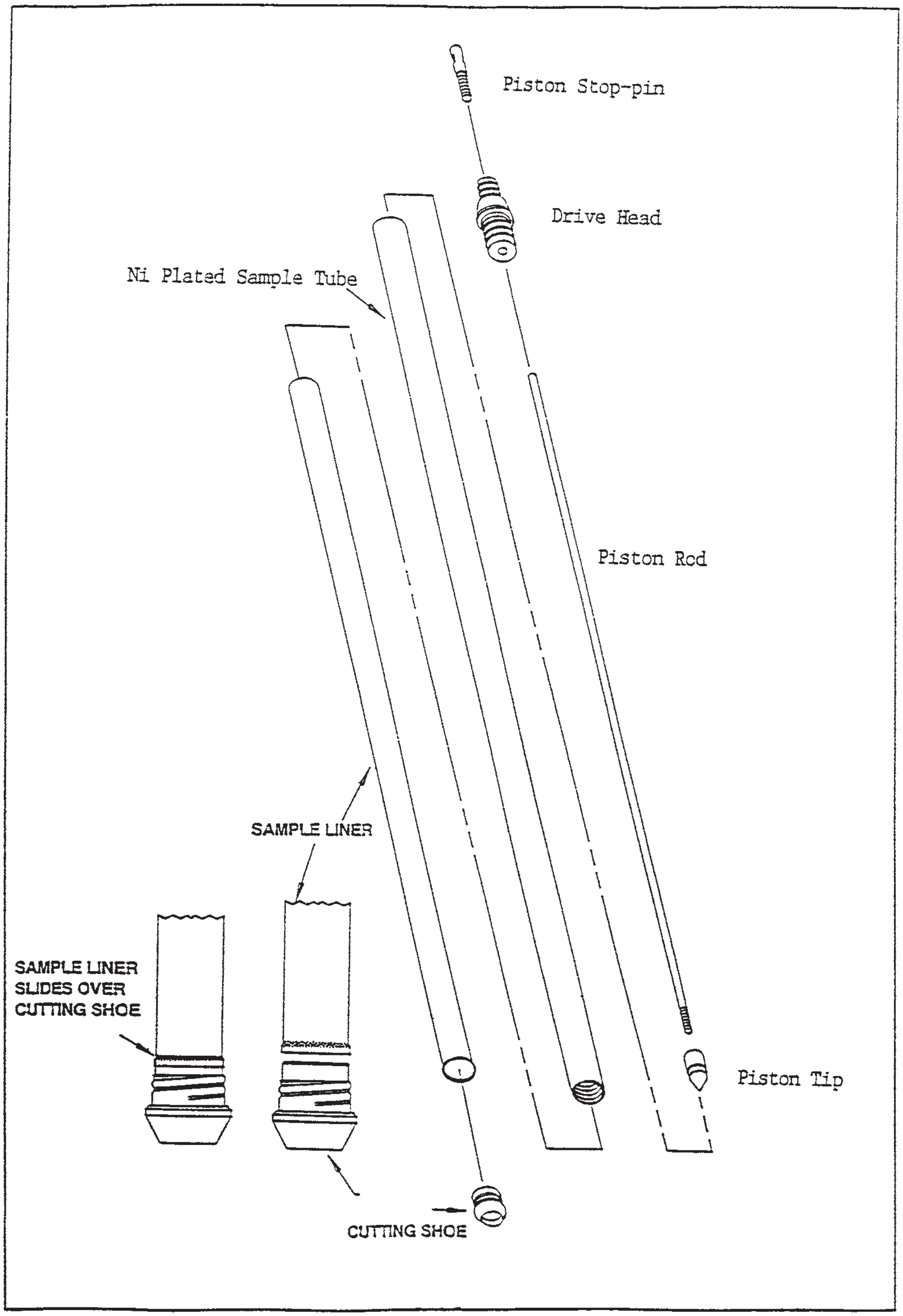

FIG. 6 Sampler Parts, Single Tube System

7.4.1 *Retraction Force*—The retraction force can be applied by direct mechanical pull back using the hydraulic system of the power source; line pull methods using mechanical or hydraulic powered winches, or cathead and rope windlass type devices. Winches used with direct push technology should have a minimum of 2000 lb (907 kg) top layer rating capacity and a line speed of 400 ft (121.96 m)/min to provide effective tool handling. Direct push sampling tools can be retracted by back pounding using weights similar to those of standard penetration testing practices. Backpounding to recover samples can affect recovery and cause disturbances to the sample. Other forms of extraction, such as jacking, that do not cause undue disturbance to the sample, are preferable.

7.4.2 *Percussion Devices*—Percussion devices for use with direct push methods are hydraulically-operated hammers, air-operated hammers, and mechanically-operated hammers. Hydraulically-operated hammers should have sufficient energy to be effective in moving the samplers through the subsurface

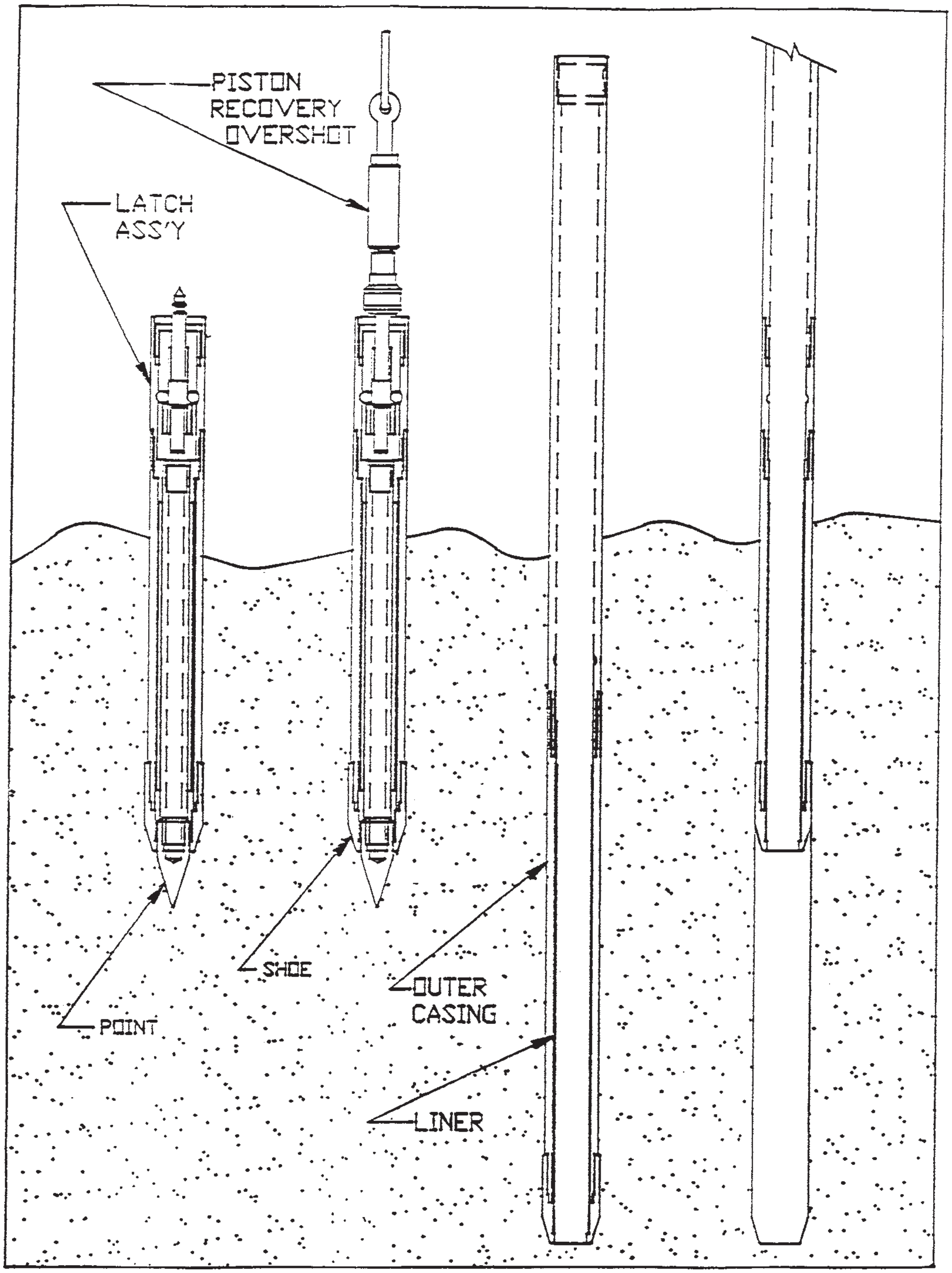

FIG. 7 Closed Solid Barrel Sampler, Single Tube System

strata. The maximum energy application is dependent on the tools used. Hammer energy that exceeds tool tolerance will result in tool damage or loss and will not achieve the goal of collecting high quality samples. Air-operated hammers should be capable of delivering sufficient energy, as well. Hammer systems utilizing hydraulic oil or air should be operated in the range specified by the manufacturer. Manually-operated hammers can be used to advance direct push tools. These hammers can be operated mechanically or manually using cathead and rope. These systems generally involve using 140 lb, standard penetration (see Test Method D 1586) hammers, which can work well for direct push sampling. In operation, these hammers tend to be slower than hydraulic hammers and can cause tool damage if direct push tools are not designed to take the heavy blows associated with these hammers. The hydraulic- and air-operated hammers strike up to 2000 blows/min. In addition to the energy transferred, the rapid hammer action sets up a vibratory effect, which also aids in penetration. This vibratory effect, along with the percussive effort, may disturb some soil samples.

7.4.3 *Static Push Systems*—Cone penetrometer systems are an example of static push systems. They impart energy to the

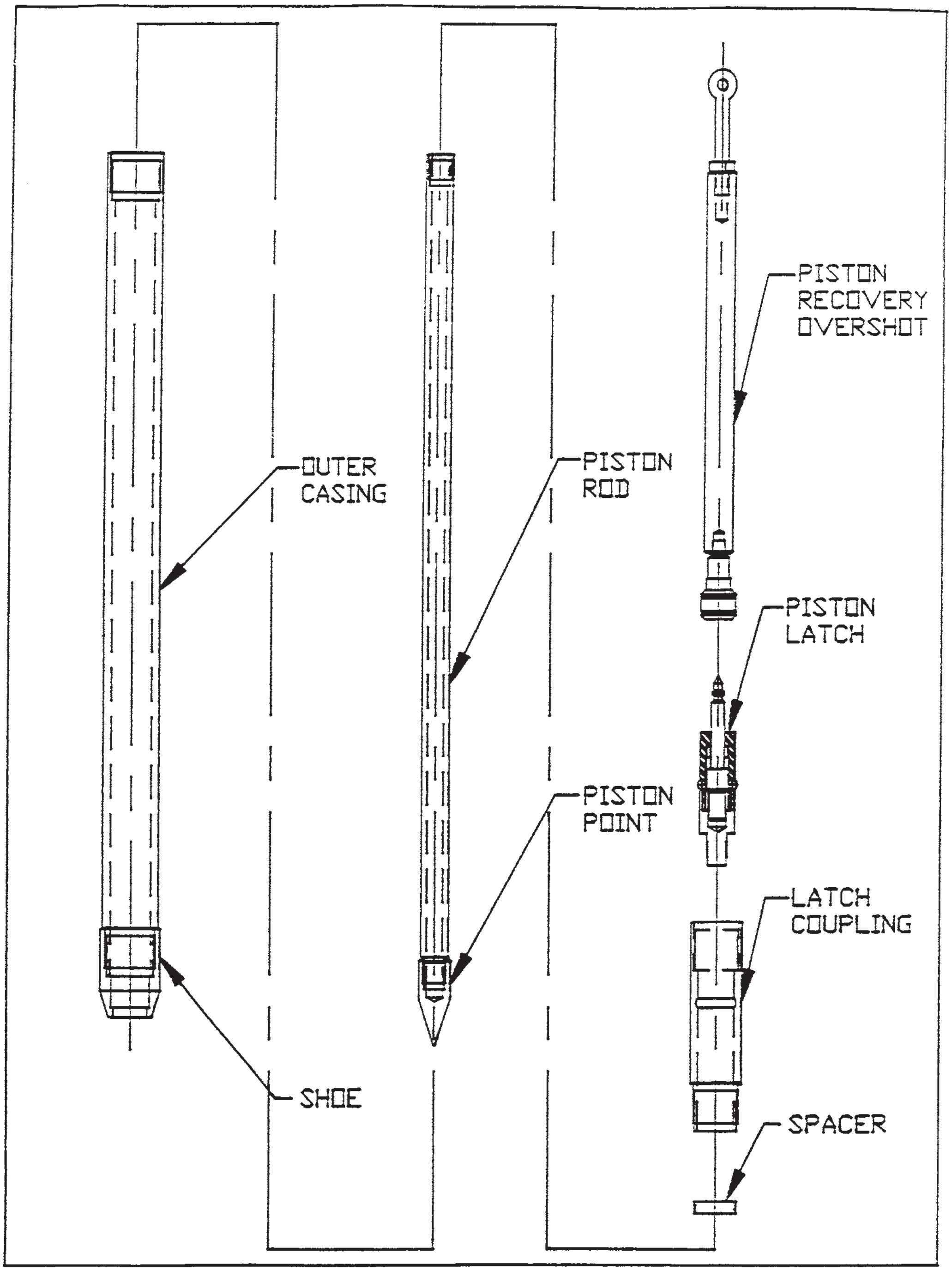

FIG. 8 Closed Solid Barrel Sampler, Single Tube System

sampler and extension rods by using hydraulic rams to apply pressure. The pressure applied is limited to the reactive weight of the drive vehicle. Retraction of the sampler and extension rods is by static pull from the hydraulic rams.

7.4.4 *Vibratory/Sonic Systems*—These systems utilize a vibratory device, which is attached to the top of the sampler extension rods. Reactive pressure and vibratory action are applied to the sampler extensions moving the sampler into the formation. In certain formations, sample recovery and formation penetration is expedited; however, all formations do not react the same to vibratory penetration methods.

7.4.4.1 *Sonic or Resonance Drilling Systems*—These are high powered vibratory systems that can be effective in advancing large diameter single or dual tube systems. They generally have depth capabilities beyond the smaller direct push systems.

7.4.5 *Rotary Drilling Equipment*—Direct push systems are readily adaptable to rotary drill units. The drill units offer a ready hydraulic system to operate percussion hammers, as well as reactive weight for static push. Because most drills are equipped with leveling jacks, better weight application is achieved. Vertical pushing is improved because of the ability to

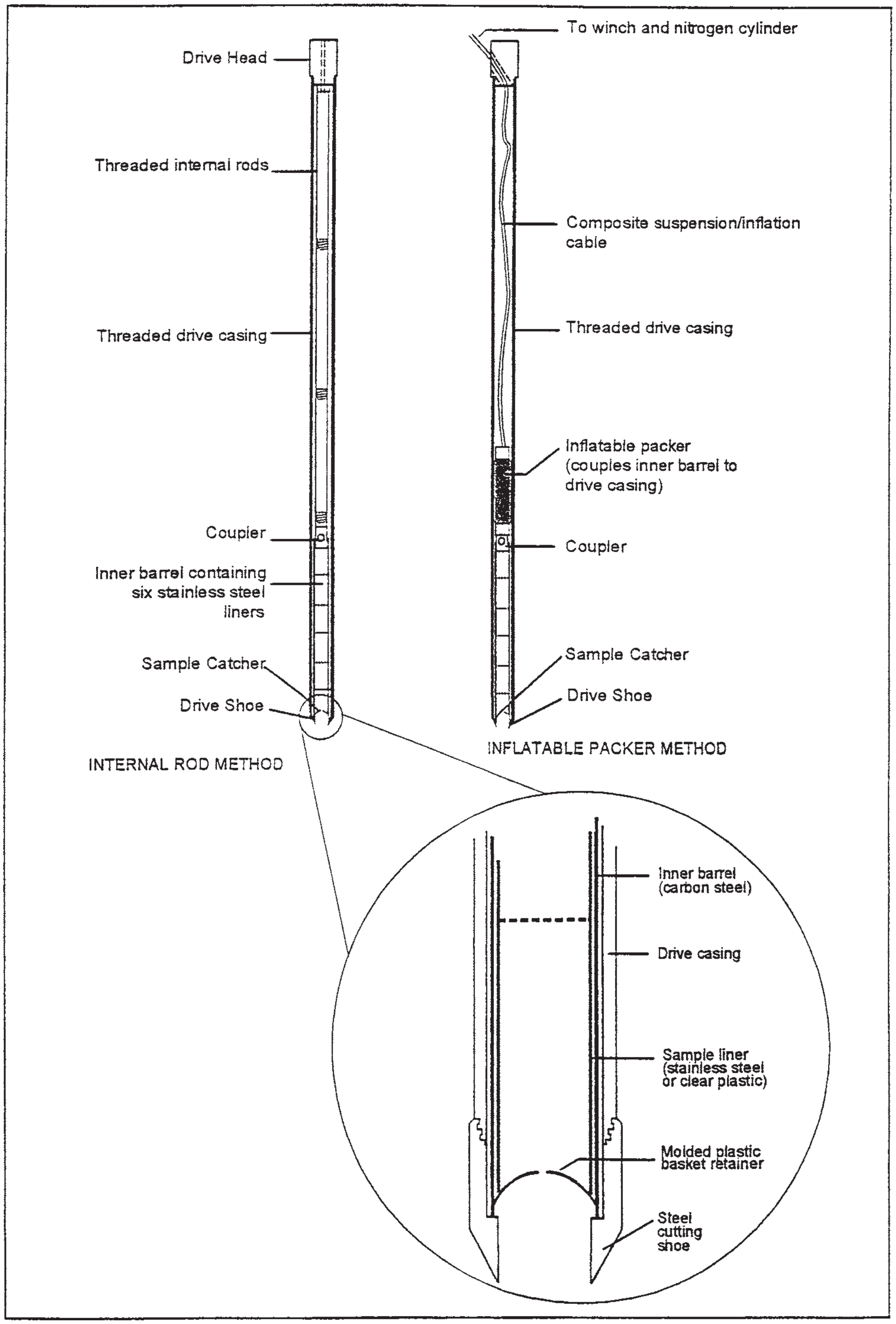

FIG. 9 Sampler Holding Methods, Two Tube System

level the machine. Tool handling is facilitated by high speed winches common to drilling rigs, extended masts for long tool pulls, and longer feed stroke length. Drill units with direct push adaptations also offer drilling techniques should obstacles be encountered while using direct push technology. Large drill units may have reactive weights that can exceed the tool capacity, thereby resulting in damaged tools.

8. Conditioning

8.1 *Decontamination*—Sampling equipment that will contact the soil to be sampled should be cleaned and decontaminated before and after the sampling event. Extension rods should be cleaned prior to each boring to avoid the transfer of contaminants and to ease the connecting of joints. Thread

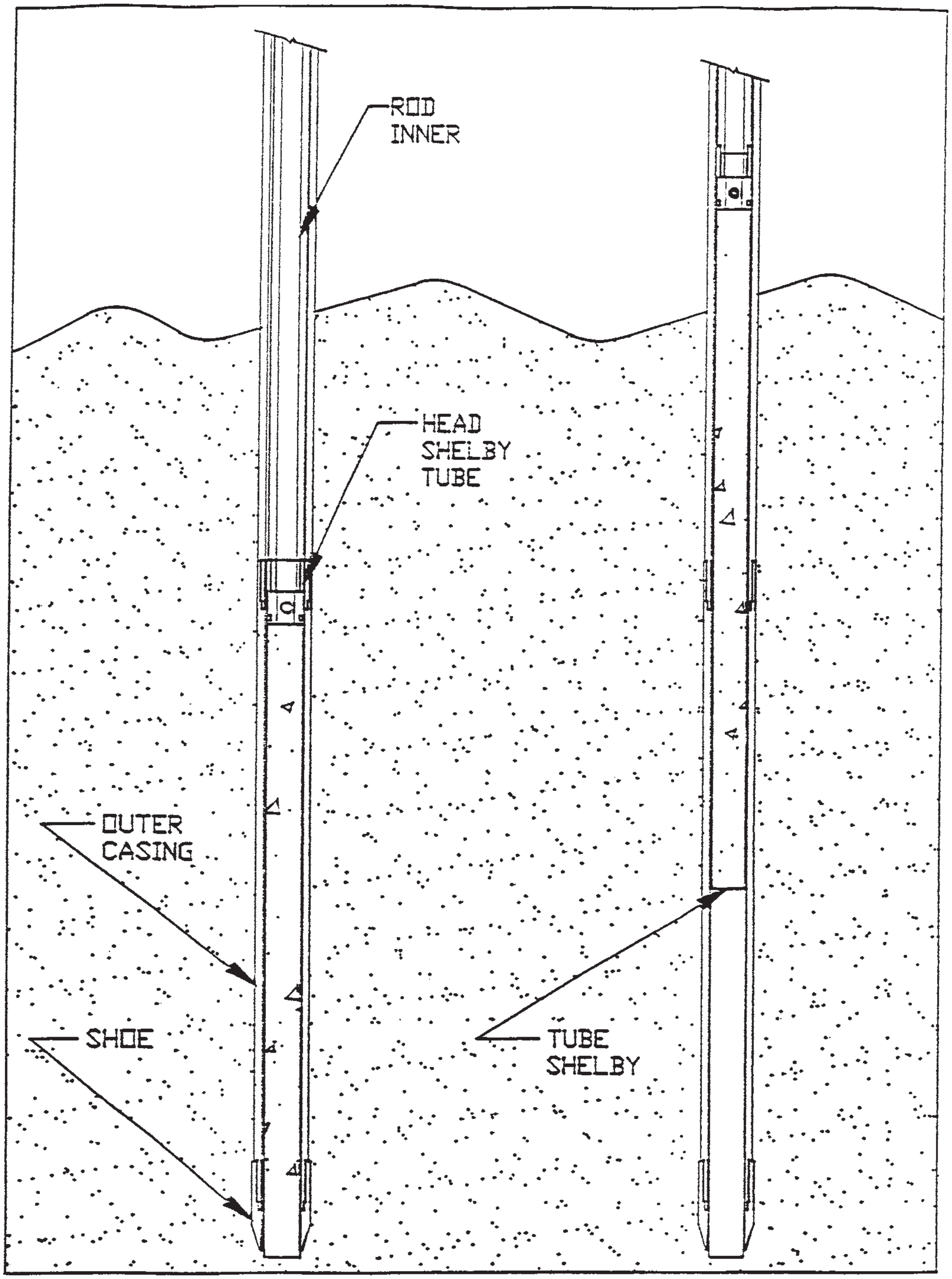

FIG. 10 Thin Wall Tube Sampler, Two Tube System

maintenance is necessary to ensure long service life of the tools. Sample liners should be kept in a sealed or clean environment prior to use. Reusable liners should be decontaminated between each use. All ancillary tools used in the sampling process should be cleaned thoroughly, and if contaminants are encountered, decontaminated before leaving the site. It should not be assumed that new tools are clean. They should be cleaned and decontaminated before use. Decontamination should be performed following procedures outlined in Practice D 5088 along with any site safety plans, sampling protocols, or regulatory requirements.

8.2 *Tool Selection*—Prior to dispatch to the project site an inventory of the necessary sampling tools should be made. Sample liners, containers, sampling tools, and ancillary equipment should be checked to ensure its proper operation for the work program prescribed. Sampling is expedited by having two or more samplers on site. Since samples can be recovered quite fast, a supply of samplers will allow a boring to be completed so other functions can be performed while samples are being processed. A backup tool system adaptable to and within the capabilities of the power source should be available should the original planned method prove unworkable. Materials for proper sealing of boreholes should always be available at the site **(5-7)**.

9. Procedure

9.1 While procedures for direct push soil sampling with two common direct push methods are outlined here, other systems may be available. As long as the basic principles of practice relating to sampler construction and use are followed, other systems may be acceptable.

9.2 *General Set-Up*—Select the boring location and check for underground and overhead utilities and other site obstructions. Establish a reference point on the site for datum measurements, and set the direct push unit over the boring location. Stabilize and level the unit, raise the drill mast or frame into the drilling position, and attach the hammer assembly to the drill head if not permanently attached. Attach the anvil assembly in the prescribed manner, slide the direct push unit into position over the borehole, save a portion of the sliding distance for alignment during tool advancement, and ready the tools for insertion.

9.2.1 *Tool Preparation*—Inspect the direct push tools before using, and clean and decontaminate as necessary. Inspect drive shoes for damaged cutting edges, dents, or thread failures as these conditions can cause loss of sample recovery and slow the advancement rate. Where permissible, lubricate rod joints with appropriate safe products, and check impact surfaces for cracks or other damage that could result in failure during operations. Assemble samples and install where required, install sample retainers where needed, and install and secure sampler pistons to ensure proper operation where needed.

9.2.2 *Sample Processing*—Sample processing should follow a standard procedure to ensure quality control procedures are completed. View sample in the original sampling device, if possible. Open the sampling device with care to keep disturbance to a minimum. When using liners or thin wall tubes, protect ends to prevent samples from falling out or being disturbed by movement within the liner. Measure recovery accurately, containerize as specified in the work plan or applicable ASTM procedures, and label recovered samples with sufficient information for proper identification. When collecting samples for volatile chemical analysis, sample specimens must be contained and preserved as soon as possible to prevent loss of these components. Follow work plan instructions or other appropriate documents (see Practice D 3694) when processing samples collected for chemical analysis.

9.3 *Two Tube System*:

9.3.1 *Split Barrel Sampling (see Fig. 1)*—Assemble the outer casing with the drive shoe on the bottom, attach the drive head to the top of the outer casing, and attach the sampler to the extension rods. Connect the drive head to the top of the sampler extension rods, and insert the sampler assembly into the outer casing. The sampler cutting shoe should contact the soil ahead of the outer casing to prevent unnecessary sample disturbance. The split spoon cutting shoe should extend a minimum of 0.25 in. (6.25 mm) ahead of the outer casing. Greater extensions may improve recovery in soft formations. Mark the outer casing to designate the required drive length, position the outer casing and sampler assembly under the drill head, and move the drill head downward to bring pressure on the tool string. If soil conditions allow, advance the sampler/casing assembly into the soil at a steady rate slow enough to allow the soil to be cut by the shoe and move up inside the sample barrel. If advancement is too rapid, it can result in loss of recovery because of soil friction in the shoe. Occasional hammer action during the push may help recovery by agitating the sample surface. If soil conditions prevent smooth static push advancement, activate the hammer to advance the sampler. Apply a continuous pressure while hammering to expedite soil penetration. The pressure required is controlled by subsurface conditions. Applications of excessive down pressure may result in the direct push unit being shifted off the borehole causing misalignment with possible tool damage. Stop the hammer at completion of advancement of the measured sampling barrel length. Release the pressure and move the drill head off the drive head. Attach a pulling device to the extension rods or position the hammer bail and retrieve the sampler from the borehole. At the surface remove the sampler from the extension rods and process. Soil classification is accomplished easily using split barrel samplers as the specimen is available readily for viewing, physical inspection and subsampling when the barrel is opened. Clean, decontaminate, and reassemble the sampler. Reattach the sampler to the extension rod, add the necessary extension rod and outer casing to reach the next sampling interval, and sound the borehole for free water before each sample interval. If water is present, it may be necessary to change sampling tools. Unequal pressure inside the casing may result in blow-in of material disturbing the soil immediately below the casing. Lower the sampler to its proper position, add the drive heads, and repeat the procedure. If it is desired that the pass through certain strata without sampling, install an extension rod point in lieu of the sampler. When the sampling interval is reached, remove the point and install the sampler. Advance the sampler as described. Upon completion of the borehole, remove the outer casing after instrumentation has been set or as the borehole is sealed as described in Section 10 **(6)**.

9.3.2 *Two Tube System—Other Samplers*:

9.3.2.1 *Thin Wall Tubes*—Thin wall tubes (see Fig. 10) can be used with the dual tube system. Attach the tube to the tube head using removable screws. Attach the tube assembly to the extension rods and position at the base of the outer casing shoe protruding a minimum of 0.25 in. (6.25 mm) to contact the soil ahead of the outer casing. Advance the tube, with or without the outer casing, at a steady rate similar to the requirements of Practice D 1587. At completion of the advancement interval, let the tube remain stationary for 1 min. Rotate the tube slowly two revolutions to shear off the sample. Remove the tube from the borehole, measure recovery, and classify soil. The thin wall tube can be field extruded for on-site analysis or sealed in accordance with Practice D 4220 and sent to the laboratory for processing. Samples for environmental testing generally require the subsampling and preservation of samples in controlled containers. Soil samples generally are removed from the sampling device for storage and shipping. Thin wall tubes should be cleaned and decontaminated before and after use.

9.3.2.2 *Thin Wall Tube Piston Sampler (see Fig. 11)*—Check the fixed piston sampling equipment for proper operation of the cone clamping assembly and the condition of the sealing "O" rings. Slide the thin wall tube over the piston, and attach it to the tube head. Position the piston at the sharpened end of the thin wall tube just above the sample relief bend. Attach the sampler assembly to the extension rods, and lower the sampler into position through the outer casing. Install the actuator rods through the extension rod, and attach to the actuator rod in the sampler assembly. Attach a holding ring to the top of the actuator rod string, and hook the winch cable or other hook to the holding ring to hold the actuator rods in a fixed position. Attach the pushing fork to the drill head/probe hammer, and slowly apply downward pressure to the extension rods advancing the thin wall tube over the fixed piston into the

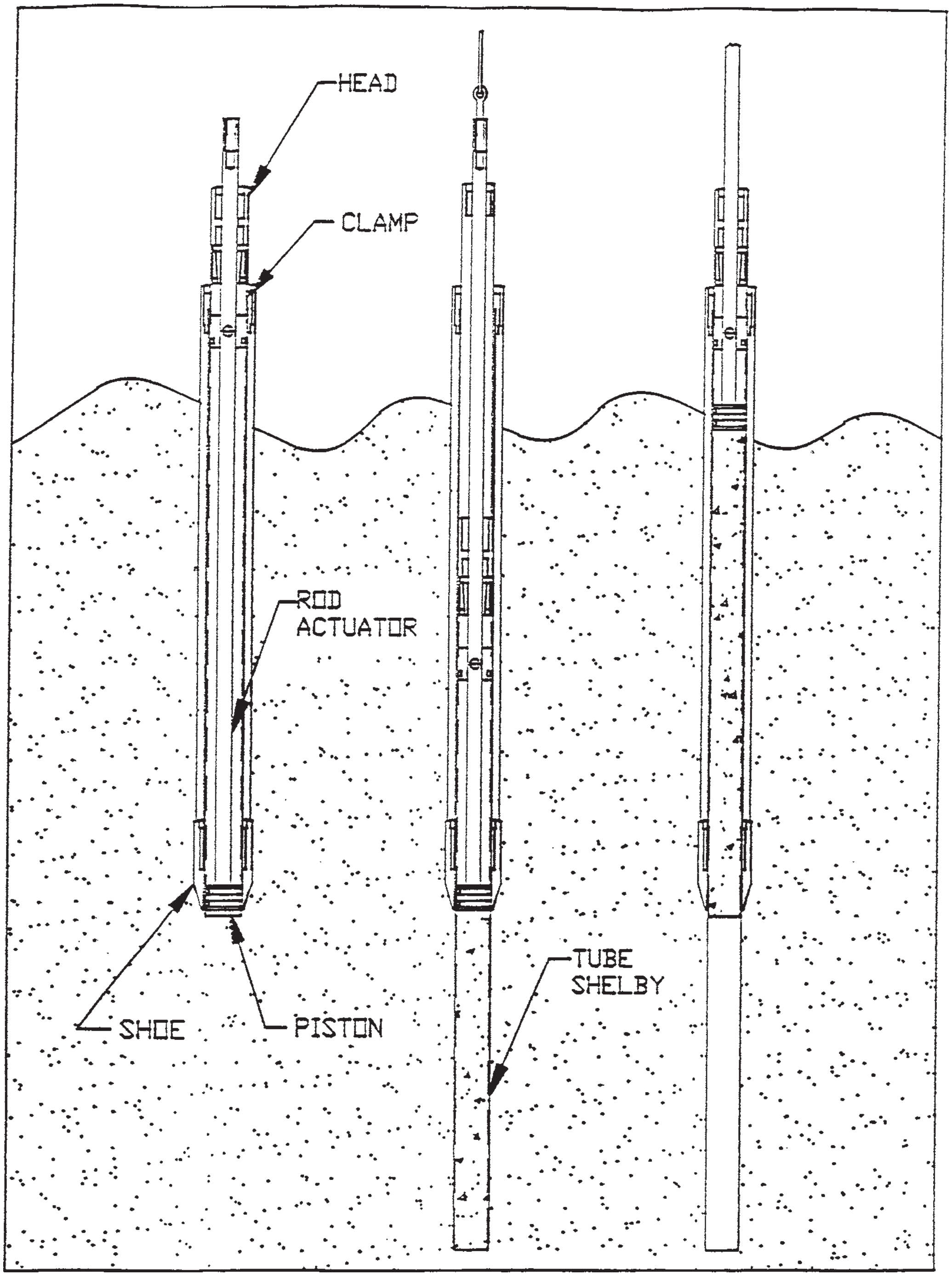

FIG. 11 Fixed Piston Sampler, Two Tube System

soil for the sample increment. Rest sampler 1 min to allow sample to conform to tube. Rotate tube one revolution to shear off sample. Remove sampler assembly from borehole and process sample (**6**).

9.3.2.3 *Open Solid Barrel Samplers*—Use solid barrel samplers in advance of the outer casing where the soil conditions could cause swelling of split barrel samplers, or where friction against the outer casing precludes its advancement and sampling must still be accomplished. The solid, single, or segmented barrel sampler requires the use of liners for removal of the sample. The sampler must be cleaned and decontaminated before use. Use of the sampler follows the procedure described in 9.3.1.

9.4 *Single Tube System*:

9.4.1 *Open Solid Barrel Sampler (see Figs. 5 and 6)*—Attached the required liner to the cutting shoe by insertion into the machined receptacle area or by sliding over the machined tube. Insert the liner and shoe into the solid barrel, and attach the shoe (**6**, **8-11**). Attach the sampler head to the sampler barrel providing a backing plate for the liner. Attach the sampler assembly to the drive rod and the drive head to the drive rod. Position the assembly under the hammer anvil and advanced as described in 9.3.1. At completion of the sampling increment, remove the sampler from the borehole. Remove the filled sample liner from the barrel by unscrewing the shoe, cap the liner for laboratory testing or spit open for field processing, and advance the borehole by repeating the procedure. Because the solid barrel cannot be opened for cleaning, it may require more effort for cleaning and decontamination. The open solid barrel sampler is used in soil formations that have sufficient wall strength to maintain a borehole wall without sloughing or cave-in. In soil formations not affording such structure, other sampling methods may be required or the opening sealed. To enhance recovery in some soil strata, it may be necessary to vary the length of the sampling increment. Shorter increments generally improve recovery because of lower sample friction and compression inside the sampler chamber. Sample recovery can be enhanced in some formations by intermittent use of the percussion hammer (**6**, **8**, **10**, **11**).

9.4.2 *Closed Solid Barrel Sampler (see Figs. 5-7, Fig. 11)*—Insert or attach the sample liner to the shoe, and insert the assembly into the solid barrel sampler. Install sample retaining basket if desired. Attach the latch coupling or sampler head to the sampler barrel, and attach the piston assembly with point and“ O” rings if free water is present, to the latching mechanism or holder. Insert the piston or packer into the liner to its proper position so the point leads the sampler shoe. Set latch, charge packer, or install locking pin, and attach assembled sampler to drive rod. Add drive head and position under the hammer anvil. Apply down pressure, hammer if needed, to penetrate soil strata above the sampling zone. When the sampling zone is reached, insert the piston latch release and recovery tool, removing the piston, or insert the locking pin removal/extension rods through the drive rods, turn counterclockwise, and remove the piston locking pin so the piston can float on top of the sample, or release any other piston holding device. Direct push or activate the hammer to advance the sampler the desired increment. Retrieve the sampler from the borehole by withdrawing the extension/drive rods. Remove the shoe, and withdraw the sample liner with sample for processing. Clean and decontaminate the sampler, reload as described, and repeat the procedure. Extreme stress is applied to the piston when driving through dense soils. If the piston releases prematurely, the sample will not be recovered from the correct interval, and a resample attempt must be made. The piston sampler can be used as a re-entry grouting tool for sealing boreholes on completion if it is equipped with a removable piston (**5**, **6**, **7**, **10**, **11**).

9.4.3 *Standard Split Barrel Sampler*—Attach the split spoon to an extension rod or drill rod. Using a mechanical or hydraulic hammer drive the sampler into the soil the desired increment, as long as that increment does not exceed the sampler chamber length. Remove the sampler from the borehole, disassemble, and process sample. Standard split barrel samplers can be used, as long as borehole wall integrity can be maintained and the additional friction can be overcome. If caving or sloughing occurs, the sampler tip should be sealed or other sampling tools used (**9**).

9.5 *Quality Control*:

9.5.1 *Quality Control*—Quality control measures are necessary to ensure that sample integrity is maintained and that project data quality objectives are accomplished. By following good engineering principles and applying common sense, reliable site characterizations can be accomplished.

9.5.2 *Water Checks*—Water seeping into the direct push casing or connecting rods from contaminated zones may influence testing results. Periodically check for ground water before inserting samplers into borehole or into outer casings in the two tube system. If water is encountered, it may be necessary to switch to the sealed piston type samplers to protect sample integrity. Sealed piston type samples may not always be water tight. Sealing of rod or casing joints can prevent ground water from entering through the joints.

9.5.3 *Datum Points*—Establishment of a good datum reference is essential to providing reliable sample interval depths and elevators. Select datum reference points that are sufficiently protected from the work effort, and that can be located for future reference. Field measurements should be to 0.1 ft (3.05 mm). Measure extension rods as the bore advances to locate sample depth. Mark rods before driving each sample interval to determine accurate measurement of sample recovery and to accurately log borehole depth.

9.5.4 *Sample Recovery*—Sample recovery should be monitored closely and results documented. Poor recovery could indicate a change in sampling method is needed, that improper sampling practices are being conducted, or that sampling tools are incorrect. Sample recovery involves both volume and condition. Poor sample recovery should cause an immediate review of the sampling program.

9.5.5 *Decontamination*—Follow established decontamination procedures. Taking shortcuts may result in erroneous or suspect data.

10. Completion and Sealing

10.1 *Completion*—For boreholes receiving permanent monitoring devices, completion should be in accordance with Practice D 5092, site work plan, or regulatory requirements.

10.2 *Borehole Sealing*—Seal direct push boreholes to minimize preferential pathways for containment migration. Additional information and guidance on borehole sealing can be found in Guide D 6001 and in Guide D 5299. State or local regulations may control both the method and the materials for borehole sealing. Regulations generally direct bottom up borehole sealing as it is the surest and most permanent method for complete sealing. High pressure grouting is available for use with direct push technology for bottom up borehole sealing.

10.2.1 *Sealing by Slurry, Two Tube System*—Sound the borehole for free water. If water exists in the casing, place the extension rods, open-ended, to the bottom of the outer casing, as a tremie. Mix the slurry to standard specifications prescribed by regulation or work plan. Pump slurry through the extension/drive rod until it appears at the surface of the outer casing. Remove the extension rods. If no free water exists in the borehole, the slurry can be placed by gravity. Top off the outer casing as it is removed from the borehole.

10.2.1.1 *Slurry Mixes*—Slurry mixes used for slurry grouting of direct push boreholes generally are of lower viscosity because of the small diameter tremie pipes required. Usable mixes are 6 to 8 gal (22.7 to 30.28 L) of water/94-lb (42.64-kg) bag of cement with 5 lb (2.27 kg) of bentonite or 24 to 36 gal (90.84 to 136.28 L) of water to 50 lb (22.68 kg) of bentonite.

10.2.2 *Sealing by Gravity—Two Tube System*—Measure the cased hole to ensure it is open to depth. Slowly add bentonite chips or granular bentonite to fill the casing approximately 2 ft. Withdraw the casing 2 ft and recheck depth. Hydrate the bentonite by adding water. Repeat this procedure as the outer casing is withdrawn. The bentonite must be below the bottom of the casing during hydration. Wetness inside the rods may affect the flow of granular bentonite to the bottom of the casing. Fill the top foot of the borehole with material that is the same as exists in that zone.

10.2.3 *Borehole Sealing Single Tube System*:

10.2.3.1 *Gravity Sealing from Surface*—If the soil strata penetrated has sufficient wall strength to maintain an open hole, then it may be possible to add sealing materials from the surface. Dry bentonite chips or granular bentonite can be placed by gravity. The borehole volume should be determined and the borehole sounded every 10 ft (3 m) to ensure bridging has not occurred. The bentonite should be hydrated by adding approximately 1 pt (0.57 L) of water for each 5 ft of filled borehole. Seal the surface with native material.

10.2.3.2 *Wet Grout Mix Tremie Sealing*—Tremie sealing methods can be used with single tube systems when borehole wall strength is sufficient to maintain an open hole or when extension rods with an expendable point are used to reenter the borehole. The grout pipe should be inserted immediately after the direct push tools are withdrawn or through the annulus of the extension rods that have been reinserted down the borehole for grouting. Care must be taken to not plug the end of the grout pipe. Side discharge grout pipes also can be used to prevent plugging.

10.2.4 *Re-Entry Grouting*—If the borehole walls are not stable, the borehole can be re-entered by static pushing grouting tools, such as an expendable point attached to the extension/drive rods to the bottom of the original borehole. Pump a slurry through the rods as they are withdrawn. High pressure grouting equipment may be beneficial in pumping standard slurry mixes through small diameter gravity pipes. Care must be taken to ensure the original borehole is being sealed.

11. Record Keeping

11.1 *Field Report*—The field report may consist of boring log or a report of the sampling event and a description of the sample. Soil samples can be classified in accordance with Practice D 2488 or other methods as required for the investigation **(12)**. Prepare the log in accordance with standards set in Guide D 5434 listing the parameters required for the field investigation program. List all contaminants identified, instrument readings taken, and comments on sampler advancement. Record any special field tests performed and sample processing procedures beyond those normally used in the defined investigation. Record borehole sealing procedures, materials used, and mix formulas on the boring log. Survey or otherwise locate the boring site to provide a permanent record of its replacement.

11.2 *Backfilling Record*—Record the method of sealing, materials used, and volume of materials placed in each borehole. This information can be added to the field boring log or recorded on a separate abandonment form.

12. Keywords

12.1 decontamination; direct push; ground water; sealing; soil sampling

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ATTACHMENT 5

ASTM D6151-97(2003) Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling

Standard Practice for
Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling[1]

This standard is issued under the fixed designation D 6151; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers how to obtain soil samples using hollow-stem sampling systems and use of hollow-stem auger drilling methods for geotechnical exploration. This practice addresses how to obtain soil samples suitable for engineering properties testing.

1.2 In most geotechnical explorations, hollow-stem auger drilling is combined with other sampling methods. Split barrel penetration tests (Test Method D 1586) are often performed to provide estimates of engineering properties of soils. Thin-wall tube (Practice D 1587) and ring-lined barrel samples (Practice D 3550) are also frequently taken. This practice discusses hole preparation for these sampling events. For information on the sampling process, consult the related standards. Other in situ tests, such as the vane shear Test Method D 2573, can be performed below the base of the boring by access through the drill string.

1.3 This practice does not include considerations for geoenvironmental site characterizations and installation of monitoring wells which are addressed in Guide D 5784.

1.4 This practice may not reflect all aspects of operations. It offers guidance on current practice but does not recommend a specific course of action. It should not be used as the sole criterion or basis of comparison, and does not replace or relieve professional judgment.

1.5 *Hollow-stem auger drilling for geotechnical exploration often involves safety planning, administration, and documentation. This standard does not purport to specifically address exploration and site safety. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to its use.* Performance of the test usually involves use of a drill rig, therefore, safety requirements as outlined in applicable safety standards, for example OSHA (Occupational Health and Safety Administration) regulations, DCDMA safety manual (**1**),[2] drilling safety manuals, and other applicable state and local regulations must be observed.

2. Referenced Documents

2.1 *ASTM Standards:*

D 420 Guide to Site Characterization for Engineering, Design, and Construction Purposes[3]

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[3]

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[3]

D 5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock[3]

2.2 *Standards for Sampling of Soil and Rock:*

D 1452 Practice for Soil Investigation and Sampling by Auger Borings[3]

D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils[3]

D 1587 Practice for Thin-Walled Tube Geotechnical Sampling of Soils[3]

D 2113 Practice for Diamond Core Drilling for Site Investigation[3]

D 3550 Practice for Ring-Lined Barrel Sampling of Soils[3]

D 4220 Practice for Preserving and Transporting Soil Samples[3]

D 4700 Guide for Soil Sampling from the Vadose Zone[3]

D 5079 Practices for Preserving and Transporting Rock Core Samples[3]

2.3 *In situ Testing:*

D 2573 Test Method for Field Vane Shear Test in Cohesive Soils[3]

D 3441 Test Method for Deep, Quasi Static, Cone and Friction-Cone Penetration Tests of Soil[3]

D 4719 Test Method for Pressuremeter Testing in Soils[3]

2.4 *Instrument Installation and Monitoring:*

D 4428 Test Methods for Crosshole Seismic Testing[3]

D 4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)[3]

D 5092 Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers[3]

2.5 *Drilling Methods:*

D 5784 Guide for the Use of Hollow-Stem Augers for

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[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

Current edition approved August 10, 1997, Published December 1997.

[2] The boldface numbers in parentheses refer to the references at the end of this practice.

[3] *Annual Book of ASTM Standards,* Vol 04.08.

Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices[4]

D 5876 Guide for the Use of Direct Rotary Wireline Casing Advancement Drilling Methods for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices[4]

3. Terminology

3.1 *Definitions:* Terminology used within this practice is in accordance with Terminology D 653 with the addition of the following (see Figs. 1-5 for typical system components):

3.1.1 *auger cutter head*—the terminal section of the lead auger equipped with a hollow cutting head for cutting soil. The cutter head is connected to the lead auger. The cutter head is equipped with abrasion-resistant cutting devices, normally with carbide surfaces. The cutter can be teeth (usually square or conical), or blades (rectangular or spade design). Cutter head designs may utilize one style cutter or a combination of cutters.

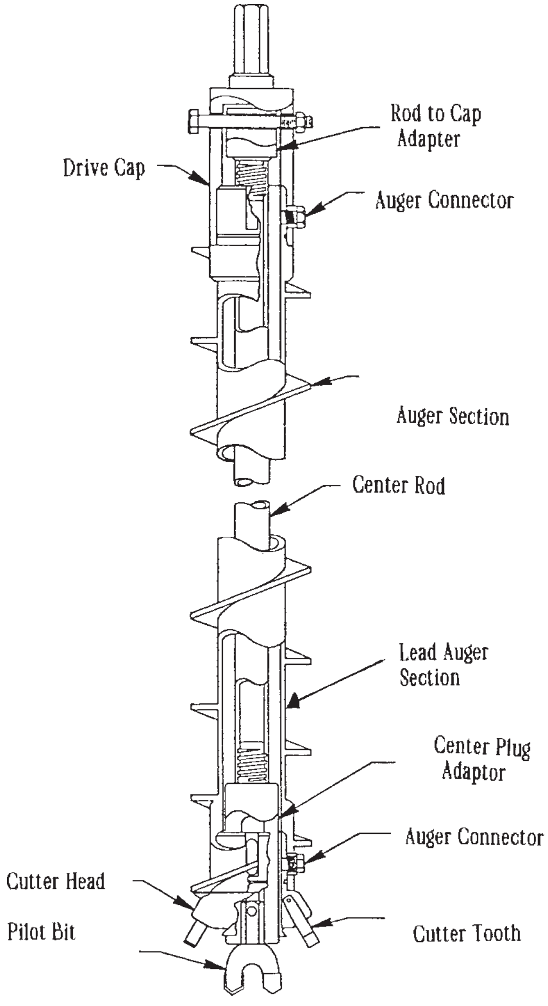

FIG. 1 Rod-Type Auger System With Pilot Bit[6]

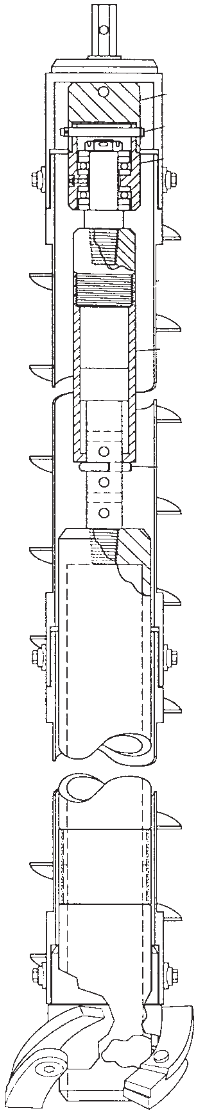

FIG. 2 Example of Rod-Type Sampling System[5]

3.1.2 *bit clearance ratio*—a ratio, expressed as a percentage of the difference between the inside diameter of the sampling tube and the inside diameter of the cutting bit divided by the inside diameter of the sampling tube.

3.1.3 *blow-in*—(Practice D 5092)—the inflow of groundwater and unconsolidated material into the borehole or casing caused by differential hydraulic heads; that is, caused by the presence of a greater hydraulic head outside the borehole/casing than inside. Also known as *sanding in* or *soil heave*.

3.1.4 *clean out depth*—the depth to which the end of the drill string (bit or core barrel cutting end) has reached after an interval of drilling. The clean out depth (or drilled depth as it is referred to after cleaning out of any sloughed material or cuttings in the bottom of the drill hole) is normally recorded to the nearest 0.1 ft. (0.03 m).

3.1.5 *continuous sampling devices*—sampling systems which continuously sample as the drilling progresses. Hollow-stem sampling systems are often referred to as continuous samplers because they can be operated in that mode. Hollow-stem sampling systems are double-tube augers where barrel-type samplers fit within the lead auger of the hollow auger column. The double-tube auger operates as a soil coring system

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[4] *Annual Book of ASTM Standards*, Vol 04.09.

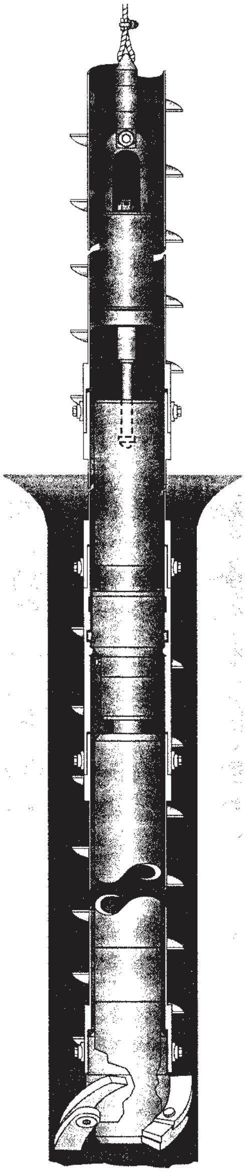

FIG. 3 Example of Wireline Sampling System[5]

in certain subsurface conditions where the sampler barrel fills with material as the augers advance. The barrel can be removed and replaced during pauses in drilling for continuous coring.

3.1.6 *double-tube auger*—an auger equipped with an inner barrel for soil sampling (soil coring). If equipped with an inner barrel and liner, the auger system can be described as a triple-tube auger.

3.1.7 *drill hole*—a cylindrical hole advanced into the subsurface by mechanical means. Also known as borehole or boring.

3.1.8 *drill string*—the complete drilling assembly under rotation including augers, core barrel or pilot bit, drill rods, and connector subassemblies. Drilling depth is determined by knowledge of the total length of the drill string, and by subtracting the string length above a ground surface datum.

3.1.9 *fluid injection devices*—pumps, fittings, hose and pipe components, or drill rig attachments that may be used to inject a fluid within a hollow auger column during drilling.

3.1.10 *HSA*—Hollow stem auger(s). See 3.1.11.

3.1.11 *hollow stem auger*—a cylindrical hollow tube with a continuous helical fluting/fighting on the outside, which acts as a screw conveyor to lift cuttings produced by an auger drill head or cutter head bit to the surface.

3.1.12 *in-hole-hammer*—a drop hammer for driving a soil sampling device. The in-hole hammer is designed to run down-hole within the HSA column. It is usually operated with

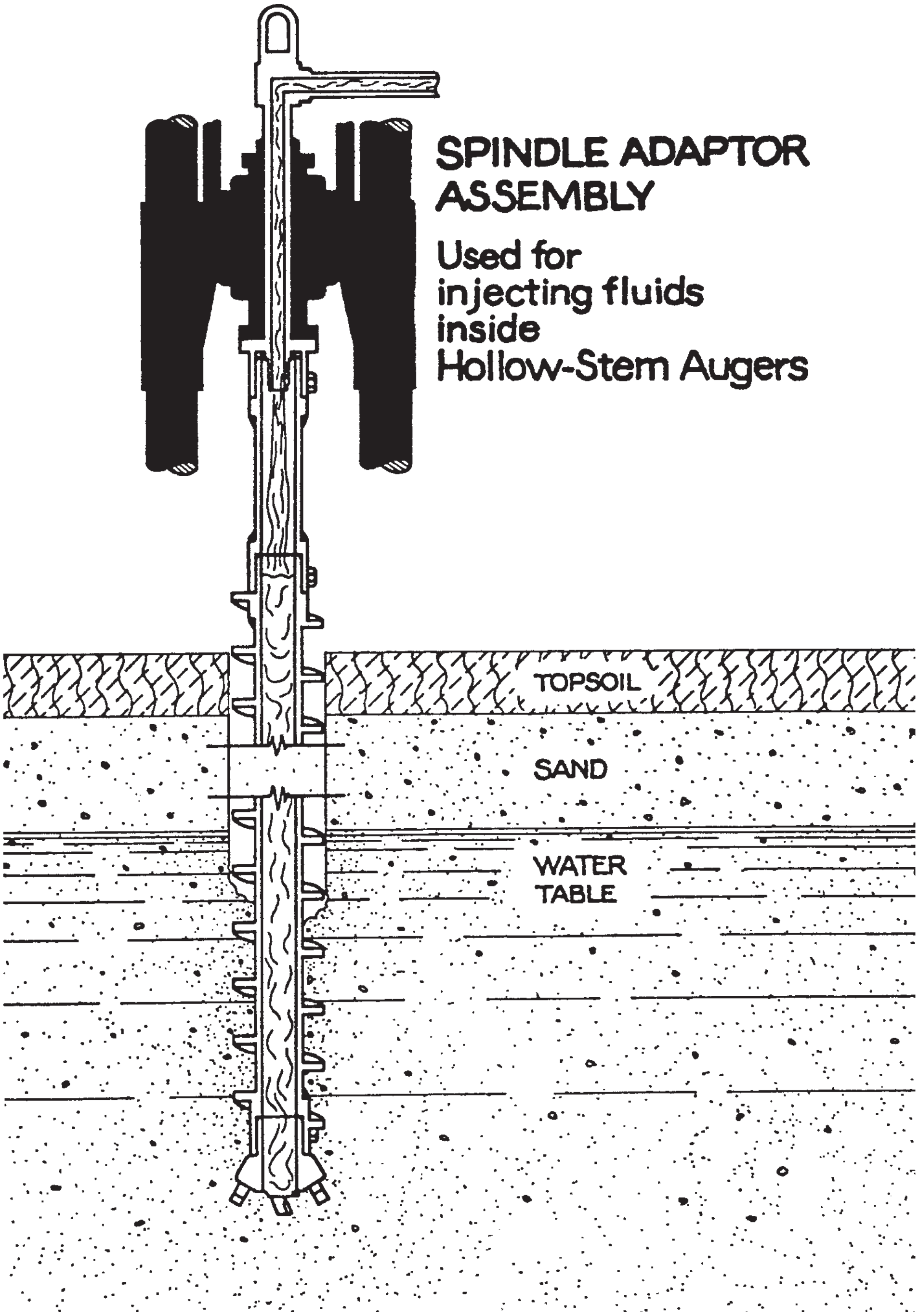

FIG. 4 Spindle Adaptor Assembly

a free-fall wireline hoist capable of lifting and dropping the hammer weight to drive the sampler below the HSA column and retrieve the hammer and sampler to the surface. See Fig. 6[5]

3.1.13 *in situ testing devices*—sensors or probes, used for obtaining test data for estimation of engineering properties, that are typically pushed, rotated, or driven in advance of the hollow auger column assembly at a designated depth or advanced simultaneously with advancement of the auger column (see 2.3).

3.1.14 *intermittent sampling devices*—barrel-type samplers that may be rotated, driven, or pushed below the auger head at a designated depth prior to advancement of the auger column (see 2.2).

3.1.15 *lead auger assembly*—the first hollow stem auger to be advanced into the subsurface. The end of the lead auger assembly is equipped with a cutter head for cutting. The lead auger may also contain a pilot bit assembly or sample barrel assembly housed within the hollow portion of the auger. If a wireline system is used, the lead auger assembly will have an adapter housing on top of the first auger containing a latching

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[5] Foremost Mobile, Mobile Drilling Company Inc., 3807 Madison Avenue, Indianapolis, IN.

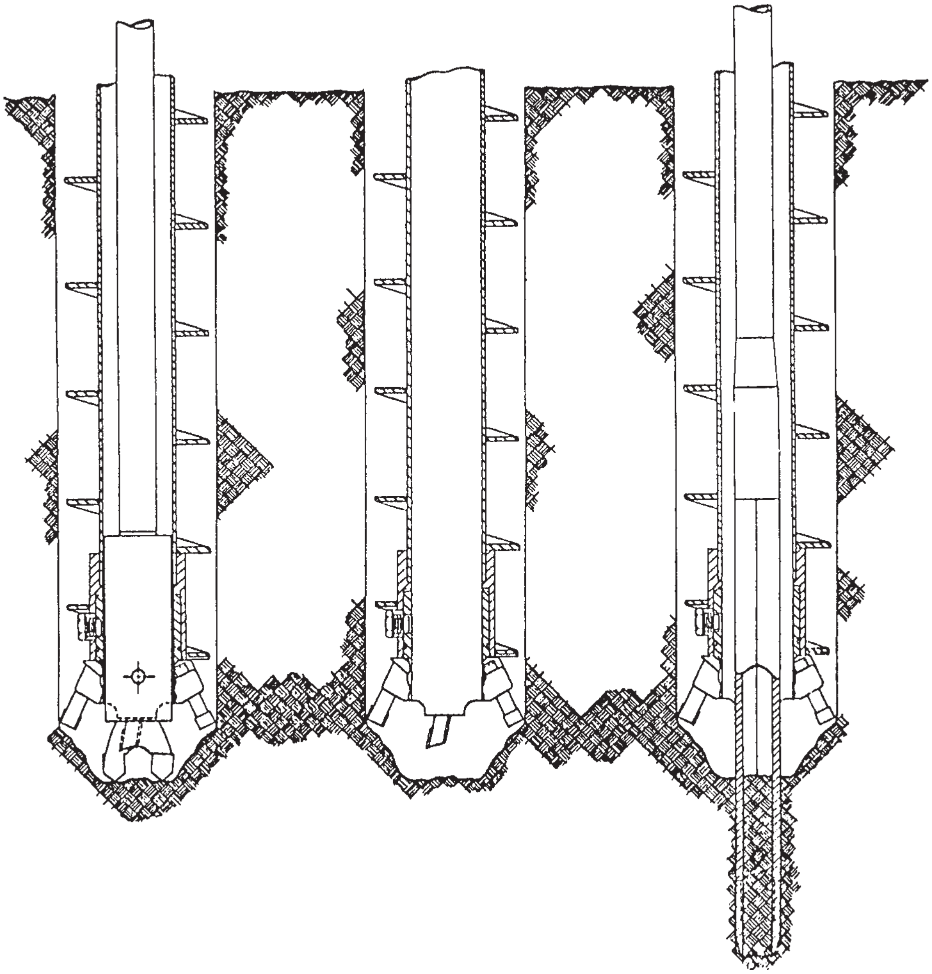

FIG. 5 Example of Drive Case Sampling Through HSA

device for locking the pilot bit assembly or sampling core barrel into the lead auger assembly.

3.1.16 *lead distance*—the mechanically adjusted length or distance that the inner core barrel cutting shoe is set to extend beyond the lead auger assembly cutting head.

3.1.17 *overshot*—a latching mechanism located at the end of the hoisting line (wireline). It is specially designed to latch onto or release the pilot bit or core barrel assemblies. It serves as a lifting device for removing the pilot bit or sampler assembly.

3.1.18 *O-ring*—a rubber ring for preventing leakage between joining metal connections, such as hollow-stem auger sections.

3.1.19 *percent recovery*—percentage which indicates the success of sample retrieval, calculated by dividing the length of sample recovered by the length of sampler advancement.

3.1.20 *pilot bit assembly*—an assembly designed to attach to a drill rod or lock into the lead auger assembly for drilling without sampling. The pilot bit can have various configurations (drag bit, roller cone, tooth bit, or combination of designs) to aid in more efficient or rapid hole advancement.

3.1.21 *recovery length*—the length of sample actually retrieved during the sampling operation.

3.1.22 *sanding in*—a condition that occurs when sand or silt enters the auger after removal of the pilot bit or sampling barrel. See *blow-in*. Sanding in can occur from hydrostatic imbalance or by suction forces caused by removal of the pilot bit or sampling barrel.

3.1.23 *slough*—the disturbed material left in the bottom of the borehole, usually from falling off the side of the borehole, or falling out of the sampler, or off of the auger.

3.1.24 *soil coring, hollow-stem*—The drilling process of using a double-tube HSA system to intermittently or continuously sample the subsurface material (soil).

3.1.25 *wireline drilling, hollow-stem*—a rotary drilling process using a lead auger which holds a pilot bit or sampling barrel delivered and removed by wireline hoisting. Latching assemblies are used to lock or unlock the pilot bit or sampler barrel. The pilot bit or core barrel is raised or lowered on a wireline cable with an overshot latching device.

4. Significance and Use

4.1 Hollow-stem augers are frequently used for geotechnical exploration. Often, hollow-stem augers are used with other sampling systems, such as split barrel penetration resistance testing, Test Method D 1586, or thin-wall tube sampling, Practice D 1587 (see 2.5). Hollow-stem augers may be used to advance a drill hole without sampling using a pilot bit assembly, or they may be equipped with a sampling system for obtaining soil cores. In some subsurface conditions that contain

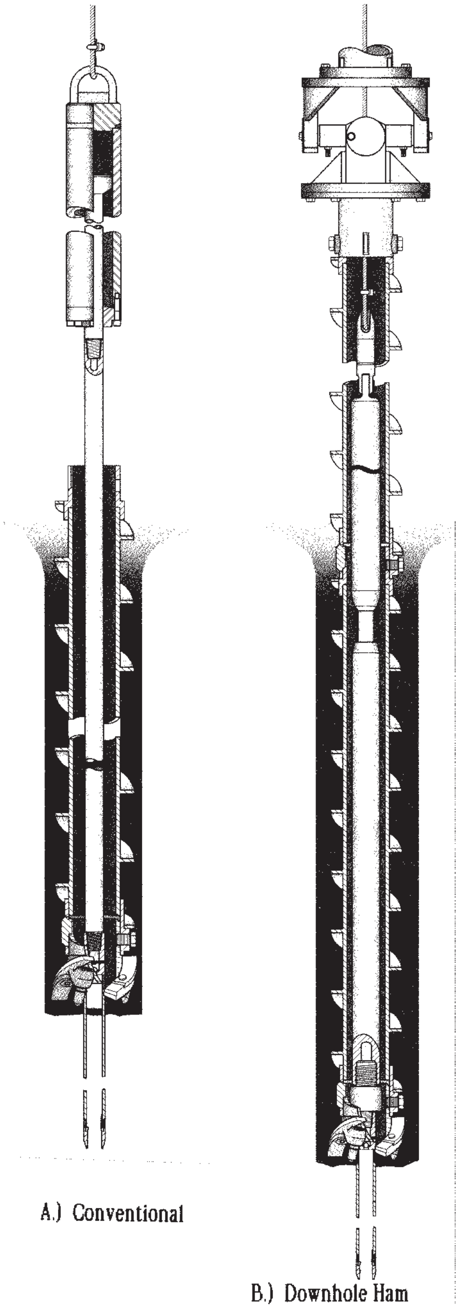

FIG. 6 In-Hole-Hammer and Conventional Drive Hammer[5]

cohesive soils, the drillhole can be successfully advanced without the use of a pilot bit assembly. Intermittent drilling (advancing of the HSA column with or without a pilot bit) and sampling can be performed depending on the intervals to be sampled, or continuous sampling can be performed. During pauses in the drilling and sampling process, in situ testing or other soil sampling methods can be performed through the hollow auger column below the lead auger assembly. At completion of the boring to the depth of interest, the hole may be abandoned or testing or monitoring devices can be installed. Hollow-stem auger drilling allows for drilling and casing the hole simultaneously, thereby eliminating hole caving problems and contamination of soil samples (**2**). The hollow-stem auger drilling and sampling method can be a satisfactory means for collecting samples of shallow unconsolidated subsurface materials (**2**). Additional guidance on use can be found in Refs. **2, 3, 4, 5, 6**.

4.2 Soil sampling with a double-tube hollow-stem sampling system provides a method for obtaining continuous or intermittent samples of soils for accurate logging of subsurface materials to support geotechnical testing and exploration. A wide variety of soils from clays to sands can be sampled. The sampling systems can be particularly effective in dry soft to stiff clayey or silty deposits but also can work well under saturated conditions. Saturated cohesionless soils such as clean sands may flow and cave during drilling (see Note 1). In many cases, the HSA soil core sampling system can produce very little disturbance to the sample and can provide samples for laboratory tests for measurement of selected engineering properties. Large-diameter soil cores, if taken carefully, can provide Class C and D samples as described in Practice D 4220. The HSA systems can also provide disturbed samples of unsaturated sands and gravels with some structure preserved. Full 5-ft (1.5-m) long cores usually cannot be obtained in unsaturated sands due to increasing side wall friction between the dry sands and inside surface of the sample core barrel. Sample length of 2 to 2.5 ft. (0.60 to 0.75 m) is generally the limit of amount of sample that can be recovered in unsaturated sands before the friction between the sampler and the sand becomes too high and causes blocking or plugging of the sampler. Shorter large diameter core runs of 2.5 ft with the 5-ft sample barrel system, or with a 2.5-ft sample barrel system, have generally proven to result in the best samples.

NOTE 1—Research on thin-wall piston sampling in clean sands indicates that in general it is impossible to obtain truly undisturbed samples of saturated clean sands. These soils can dilate or collapse upon insertion of a sampling tube. The hollow-stem auger double-tube system can only obtain partitially disturbed samples of sands below the water table.

4.3 Hollow-stem auger drilling is considered a shallow drilling method with maximum depth of drilling of 200 to 300 ft (60 to 90 m) depending on torque and pull down/retract capacity of the drilling equipment and subsurface conditions of the formation(s) encountered. Saturated loose unconsolidated deposits further limit maximum depth that can be attained. Hollow-stem augers can act as casings set through unconsolidated surficial soils and drilling can be converted to other methods (see 2.5) for deeper drilling.

4.4 Drilling and soil sampling can be accomplished with a variety of hollow-stem auger systems. Types of systems can be chosen depending on the advantages of handling, sampling requirements, and subsurface conditions. There are two basic types of systems. One type of system uses inner drill rods or hex rods connecting the sampler or pilot bit assembly to the surface for advancing and retrieving the sampler barrel or pilot bit assembly (Fig. 1[6] and Fig. 2[5]). Another system uses a wireline latching system in the HSA column to lower, latch, and retrieve a core barrel or pilot bit assembly (Fig. 3[5]).

4.5 Double tube hollow-stem auger sampling systems can be particularly advantageous for sampling water-sensitive soils, such as collapsible soils, since fluid is not used in the drilling process. Since no pressurized circulation medium is used during the drilling process, the possibility for hydraulic fracturing of formation materials and core contamination from drill fluids is reduced.

4.6 Difficulties in drilling may occur if cohesionless soils are drilled below the water table. Possibilities for sand lock or wedging of cuttings may occur (**2**). In cases where sands enter the HSA, water or drilling fluid may be added to the HSA column to provide hydrostatic balance or special pilot bit assemblies can be used (see 5.6). Problems may occur in getting the soil core barrel or pilot bit assembly back to the bottom of the HSA column. Highly saturated sands or liquefiable material may be drawn into the HSA by vacuum created when the sampler barrel or pilot bit assembly is initially pulled back through the cutter head of the lead auger assembly from the bottom of the borehole.

4.7 Consideration should be given to proper decontamination and cleaning of drilling equipment, hollow-stem augers, samplers, and soil coring components.

5. Apparatus

5.1 Fig. 1 illustrates the components of a hollow-stem auger used with a pilot bit for hole advancement using a center-inner rod system. Figs. 2 and 3 illustrate hollow-stem augers equipped for soil sampling in either a rod-type or wireline system. Hollow-stem auger systems consist of rotating outer hollow-stem augers and a cutter head assembly, with either a center pilot bit or a nonrotating inner sample barrel with a smooth cutting shoe.

5.2 *Hollow-stem Augers*—Each auger section of the hollow-stem auger assembly consists of a cylindrical steel tube with continuous helical steel flights rigidly attached to the outer surface of the tube (see Fig. 1). Each hollow auger section has a coupling at each end for attaching additional auger sections at the top end to make up the articulated hollow-stem auger column. The bottom of the lead auger has a coupling attachment for the cutter head. Typical hollow-stem auger inside diameters are 2¼ , 3¼ , 3⅜ , 4¼ , 4⅝ , 6¼ , 6⅝ , and range up to 12¼ in. (57, 83, 86, 108, 117, 159, 168, and 311 mm). Outside diameters of the auger flights range from 5 to 18 in. (127 to 457 mm). Typical HSA double-tube sample inside diameters range from 2.25 to 6.85 (57 to 174 mm). Hollow-stem augers are normally supplied in 5-ft (1.5-m) lengths. The helical auger flights are often hard surfaced for better wearing characteristics.

5.2.1 *Diameter Requirements*—The inside diameter of the hollow-stem auger system is selected by considering sample size requirements, intermittent sampling and in situ testing tool size, and completion requirements. For undisturbed sampling, larger-diameter systems generally produce less disturbance (**6**). For logging purposes, where a disturbed sample is sufficient, smaller diameters are selected. The inside diameter of the hollow stem must be large enough to insert intermittent sampling or in situ testing devices if used (sec 2.2 and 2.3). When using sampling methods such as split barrel, Method D 1586, or thin-wall tube Test Method D 1587, the inside diameter of the hollow-stem should be at least 0.25 in. (6 mm) larger than the sampler outside diameter or rod diameter, which ever is largest. If other drilling methods (see 2.5) are to be used, the inside diameter of the HSA drill string should be selected to accommodate those tools. If special completion is required, such as piezometer or well casing installation, the diameter should be large enough for placing completion materials. For example, if a 2–in. (50 mm) riser pipe is to be completed for shear wave velocity testing in accordance with Test Methods D 4428, consideration of clearance for tremie pipes may also increase diameter requirements. If the lead auger section contains a stabilizer ring, this clearance may govern available diameter for sampling, testing, or completion (see 5.4.1).

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[6] Modified from Central Mine Equipment Company, 4215 Rider Trail North, Earth City, MO.

5.2.2 *Auger Connections*—Augers are connected using either locking bolts, drive pins, locking collars, or threaded connections. In some cases when drilling saturated soils, water entering the augers may cause difficulty with drilling or sampling. Hollow-stem augers may be used with O-ring seals or other sealing designs at the HSA connections to prevent leakage. Some HSA connection designs have compression seals and bolt caps to facilitate sealing between auger connections. This can prevent soil or water ingress through the auger connecting joints (in certain drilling conditions) and the accumulation of a high solids slurry in the bottom of the HSA column that may interfere with the latching system for retrieval and placement of sample barrel assembly by means of the wireline/overshot system

5.3 *Drive Cap*—The drive cap assembly (see Fig. 1) attaches to the uppermost hollow-stem auger section and transfers rotary power and axial force from the drill rig to the auger drill string assembly.

5.4 *Lead Auger Section*—The lead auger has a hollow cutter head. The cutter head is attached to the lead auger of the hollow auger column and usually contains replaceable, abrasion-resistant cutters or teeth (see Fig. 1). As the hollow auger head is rotated, it cuts and directs the cuttings to the auger flights which convey the cuttings to the surface. The cutters can be made of hardened steel or carbide and in several designs. Cutter head types should be selected to effectively remove cuttings and minimize soil disturbance when sampling. The cutter head or cutter teeth, or both, should be replaced if worn or damaged.

5.4.1 If a wireline system is used, there can be an adapter coupling on top of the lead auger and may contain inside barrel grooves or recesses for latching systems for wireline tooling.

5.4.2 A stabilizer ring may be used (usually made of brass) in the end of the HSA cutter head opening. The stabilizer ring is machined to a close tolerance to be slightly larger than the outside diameter of the sample barrel or pilot bit. The actual opening of the end of the HSA column at the cutter head is smaller with this stabilizer ring than the normal designated inside diameter of the HSA being used. The stabilizer ring keeps the sample barrel centered in the middle of the HSA cutter head and prevents material that may interfere with the sample barrel remaining stationary from lodging around the barrel and shoe and between the full opening of the HSA cutter head. In some cases, in unstable soils the vacuum created during removal of the pilot bit through a stabilizer ring may produce sanding in. In these cases, provisions for venting may be required.

5.5 *Sampler or bit retrieval system*:

5.5.1 *Rod-type System* (Fig. 1 and Fig. 2)—The sampler or pilot bit can be inserted into the lead auger using a system of inner rods. The inner rods are typically AW, or NW size (**7**) or hex rods. Rods are supplied in the same lengths as the hollow-stem augers.

5.5.2 *Wireline system, In-hole-hammer*—The sampler or pilot bit can be inserted into the lead auger by using a free-fall wireline cable hoist capable of lifting and dropping the hammer weight down the hole within the HSA column to drive the sampler below the HSA column. This wireline method can also be used in conjunction with a drilling rig with an open spindle rotary head to allow the wireline and in-hole-hammer with the proper bit to act as a pilot bit assembly while advancing the HSA column. The weight of the hammer and pilot bit is allowed to float within the HSA column and advance with the cutter head and lead auger section to deter material from entering the HSA column.

5.5.3 *Wireline System, Double-tube HSA* (Fig. 3)—The sampler or pilot bit is raised and lowered using a wireline and latching mechanism. A wireline system may consist of a latching lead auger section, a locking or latching head assembly above the sample barrel or pilot bit, and an overshot (retrieving tool) that locks into the locking head assembly to hoist and lower the sample barrel or pilot bit assembly through the HSA column.

5.6 *Pilot Bit Assembly*—The pilot bit assembly can be a machined plug with a bit attached to the bottom to enhance cutting when used with the cutter head of the HSA and to keep material from entering the hollow-stem auger. Another version is a center auger with left-handed flighting to provide a downward spiral rotation in the middle of the HSA drill string. This left hand flighting keeps material from entering the HSA drill string forcing the parent material down and to the outside of the main auger. While the HSA drill string is rotating and drilling, the material displaced by the left hand flighting is conveying up along the outer flighting away from the cutter head to the surface.

5.7 *Hollow-stem Double-tube Auger Sample Barrel Systems*—The sampler is suspended in the HSA column and is retained in a stationary position. The head may be made with connections to a latching assembly including a bearing assembly. A bearing assembly helps prevent rotation of the sampler barrel and is especially important for undisturbed sampling. In the wireline system the barrel is connected to a latching and hanger bearing assembly that locks into the HSA column (Fig. 3). In the rod-type system (Fig. 2) the bearing is located either down hole or at the top of the auger column and is connected to drill rods or hex rods extending to the top of the HSA column. The drill rod or hex rod string is connected through the auger drive adapter to the drill rig to provide a means of controlling rotation of the sampler.

5.7.1 The sample barrel may be of various sizes and lengths. The barrel may be used with or without liners. A split barrel without a liner is most often used for easy examination of disturbed soil cores while a barrel with a liner is most often used for preserving specimens for laboratory testing. The liners fit in the inside of the barrel to facilitate sample collection. The sample barrel and HSA are matched with respect to size. The actual sample diameter varies with different manufacturers. The sample diameter is controlled by the inside diameter of the cutting shoe. With some manufacturer's designs, the inside diameter of the cutting shoe varies depending upon the liners used in the sample barrel. To obtain samples with minimal disturbance, care must be taken to ensure a smooth transition from the insider diameter of the cutting shoe to the barrel or liners. There should be no gaps or upset surfaces in the inside clearance. A smaller inside diameter shoe can be used when coring swelling materials, such as stiff clays, to allow for the sample to swell inside the barrel without blocking. Core swelling may affect engineering properties determinations.

5.7.2 Sample barrels may be 5-ft (1.5-m) long, solid or split, 5-ft long one piece, or two 30-in. (0.75-m) barrels (solid or split), with a coupling to make a 5-ft barrel. The 5-ft barrel length matches the length of the lead HSA section. The shorter 2.5-ft (0.75-m) barrel may be used in place of the 5-ft barrel for shorter sampling runs to reduce disturbance and to facilitate handling.

5.7.3 *Retainers*—Basket retainers are used, if necessary, to prevent the sample from falling out of the barrel during retrieval. They are generally used when sampling some wet clays and wet or dry sands and gravels. The retainers may affect the sample quality.

5.7.4 *Cutting Shoe and Lead Distance*—The sample barrel with cutting shoe is extended beyond the cutter head in varying increments. The shoe is set at or beyond the bottom of the cutter bits, or teeth. The extent of the distance the shoe is set beyond the cutter head is dictated by the stiffness of the material to be sampled (cored). When the sampler cutting shoe is extended beyond the cutter head, the cutting edge of the shoe is being forced down in front of the cutter head before the HSA cutter head cuts the soil away. The HSA column and cutter head is rotating around the double-tube HSA soil coring barrel as the drill rig applies down force and rotation to the HSA soil coring column. The softer the material, the greater the lead distance. The harder the soil, the shorter the lead distance. Adjusting the lead distance for the sample barrel shoe may be done by various methods. Some systems require adjusting the lead distance directly above the sample barrel assembly, some can be adjusted at the top of the HSA column. Examples of adjusting methods include the following: rod subs, adjustable hex extension with U-pins, threaded adjustment with locking nut, special HSA drive adapter with adjusting slots, or different shoe lengths. The length of extension may vary from the shoe being flush (even) with the cutter bits to as much as 6 in. (150 mm) or more.

5.7.5 *Liners*—The sample barrel may be fitted with liners. Liners are nomially one 5-ft (1.5-m) length or two 2½-ft (0.75-m) sections. The liners can be metal, stainless steel, or acrylic. Acrylic tubing provides for visual inspection of the material sampled. Clear liners can sometimes show detailed soil layering, but, in many cases, the core could be smeared or masked by the disturbance. If the purpose of the exploration program is detailed, logging the complete core should be inspected. Liners should be checked for roundness and wall thickness. Acrylic tubing is reusable but should be checked for cracks before reuse.

5.8 Auxiliary components of a HSA system are various devices such as auger connector wrenches, auger forks, hoisting hooks, hoisting assemblies, pipe vices, strap wrenches or chain wrenches, and fluid injection swivels or adapters (Fig. 4).

5.9 A drill rig is used to rotate and advance the auger column. The drill rig must be capable of producing controlled rotation, feed pressure, and feed rate. The drill rig should be capable of applying sufficient power and torque at a rotary velocity of 50 to 100 r/min. The drill rig should have a feed stroke of at least the effective length of the auger sections plus the effective length of the auger couplings plus about 4 in. (100 mm). As the HSA soil coring systems diameters increase, more torque and pulldown/retract capacities of the drill rig will be required. The subsurface conditions to be explored will also affect the torque and pulldown/retract capabilities required of the drill rig. Conditions such as depth to ground water, cemented or very dense formations, loose sands and gravels, cobbles, cohesiveness of soil, and potential for saturated flowing conditions and heaving sands will affect the depth that can be explored with a drill of any given torque and pulldown/retract capability.

6. Drilling and Sampling Procedures

6.1 *General*—Several drilling approaches are discussed in the following sections. Hollow-stem auger drilling can be performed with a pilot bit to advance a boring. During pauses in drilling, sampling and field testing can be performed at the base of the augers. A section is also devoted to taking continuous or intermittent cores with the double tube auger soil coring method. Any combination of these drilling and sampling methods may be performed in a single boring.

6.2 *General Drilling and Sampling Considerations*:

6.2.1 *Site Setup*—Stabilize the drill rig, erect the drill rig mast, and attach an initial assembly of hollow-stem auger components (Fig. 1) to the rotary drive of the drill rig. When erecting the mast, check above the drilling rig for overhead obstructions or hazards, such as power lines, prior to lifting the mast. Perform a survey of underground and all other utilities prior to drilling to evaluate possible hazards. Establish and document a datum for measuring hole depth. This datum normally consists of the ground surface, or a stake driven into stable ground surface, or a drilling deck if used. If the hole is to be surveyed later for elevation, record and report the height of the datum to the ground surface.

6.2.2 *Hole Starting*—Push the auger column assembly below the ground surface and initiate rotation at a low velocity. Good practice for starting a straight hole normally requires minimum rotation speed while maintaining firm downward pressure to avoid whipping and widening of the top of the hole (**1**). An auger guide may be used (if available) to aid in starting the first auger to maintain a straight hole.

6.2.3 *Hole Advancement and Cuttings Return*—As the augers are rotating, apply down feed pressure to the HSA column to clean the hole and bring cuttings to the surface. Use rotation and penetration rates compatible with efficient cuttings returns. The use of excessive penetration rates faster than cuttings can be returned to the surface may result in the following: (1) cuttings which are packed into the auger flights, prohibiting newly penetrated materials from moving up the auger or, (2) forcing materials into the hole wall and increasing the chances of locking or binding of the HSA drill string. After advance of the auger string to the desired incremental depth in a hole advancement mode with pilot bits, rotation is normally continued without penetration for a time period long enough to ensure circulation of the cuttings up the flights.

6.2.4 *Pauses in Drilling*—Sampling or in situ testing can be performed at any depth by interrupting the advance of the augers and stopping rotation. During pauses in drilling the

HSA drill string can be held in place with an auger fork inserted at the surface. The fork will suspend the augers and prevent settling.

6.2.5 *Drill Hole Advancement*—Drilling at greater depths is accomplished by attaching additional hollow-stem auger sections to the top of the previously advanced HSA column assembly. If drilling with the pilot bit assembly in the HSA column using a wireline/overshot system; HSA sections can be added to the top of the HSA column without pulling the pilot bit assembly or adding any drill rods to advance the hole to a predetermined depth. When using the rod-type system, add a new inner rod along with an additional hollow-stem section.

6.2.6 *Cuttings Removal and Classification*—Periodically remove cuttings from around the top of the auger column, typically with a shovel. Soil cuttings above the ground water may be representative of deposits being penetrated if proper conveyance up the auger flight is maintained. Cuttings from below the ground water surface are likely to be mixed from varying formations in the hole and are usually not representative of deposits at the end of the auger. If cuttings are sampled for classification (Practice D 2488) and relation to lithology, report and document the intervals sampled.

6.2.7 *Recording of Drilling Information*—Record depths, progress, and location of samples or testing as drilling progresses. Monitor down feed pressures, rotation rates, and cuttings return during drilling. Note any indications of binding or locking of the augers during drilling. Observe the ease or difficulty of advancing the HSA drill string during drilling as it relates to the geologic strata being penetrated. Document occurrences of any significant abrupt changes and anomalies which occur during drilling. As drilling progresses, note and document drilling procedures such as water or drilling fluid added and losses, and intervals where equipment is changed or drilling method is changed.

6.3 *Hole Advancement with Pilot Bit*:

6.3.1 *General Considerations*—Following an increment of drilling, removal of the pilot bit assembly should be performed slowly so that the entrance of material into the bottom of the HSA column is minimized prior to sampling or installation of testing devices. The success of pilot assembly removal without disturbance will depend upon the following several principal factors: (1) the character of the soil at the auger head, (2) the water levels inside and outside the HSA column prior to removal of the pilot assembly, (3) the type of pilot assembly used, and (4) the speed of removal. As drilling progresses in saturated, granular materials, it usually becomes progressively more difficult to maintain the stability of the material below the auger column because of unbalanced hydraulic heads between outside ground water and inside the hollow stem. The stability of the material below the auger head may be enhanced by using special pilot assemblies, or maintaining fluid level in the HSA column during auger advancement and during retrieval of the pilot bit assembly (Fig. 4). Under some circumstances it may be effective to drill without using a pilot assembly. If a pilot assembly is not used, however, and water or drilling fluid is not injected into the auger column simultaneously with advancement, material often will enter the hollow stem of the auger column. In some cases when drilling in saturated granular materials, a screened lead auger section may be used to help deter blow-in. The screened auger allows formation water to flow into the HSA column to help prevent water level differences and maintain a hydrostatic balance.

6.3.2 *Knock Out Plugs*—If sampling or in situ testing is not required during drilling for installation of an instrumentation device, the boring can be advanced (for some geologic conditions) using an expendable, knock-out plate or plug, or flexible center plus instead of a pilot assembly. Knock-out plates or plugs usually remain in the ground close to the instrumentation device. It may be necessary to fill or partially fill the auger stem with water or drilling fluid to prevent blow-in, or sanding in at the time of plate or plug removal. An auger head with an integral, hinged aperture cover or flexible center plug can be used to deter entrance of materials into the auger stem.

6.3.2.1 *Flexible Plug*—The flexible center plug system uses a plastic basket with flexible finger, inverted in the HSA column at the cutter head. The flexible center plug allows split spoon sampling through the flexible fingers and helps prevent water-bearing sands from entering the HSA column while advancing the augers.

6.3.3 *Locking Problems, Blow-in*—There may be instances, during insertion of the pilot bit, when difficulties are encountered in locking of the bit and getting it back to the bottom of the HSA column. If material is present in the hollow-stem auger, it may be necessary to lift the HSA column to engage the locking mechanism. The action of lifting the hollow-stem augers can cause subsurface disturbance. Blow-in can be minimized by venting or the use of fluids in the hollow-stem auger.

6.4 *Intermittent Sampling or Field Testing*—Sampling or field testing can be performed at any depth by interrupting the advance of the augers and stopping rotation. Solid sampling is usually accomplished by either of the following two methods: (1) drive, push, or core sampling or (2) soil coring using hollow-stem augers (see 6.5)

6.4.1 Soil sampling and in situ testing methods, some of which are listed in 2.2 and 2.3, are often used to obtain samples or perform tests at the base of the boring. Slowly remove the pilot assembly, if being used, and insert a sampler or testing device through the hollow stem of the auger column. The sampled or tested depth should be compared to the clean-out depth if the sampler is attached to the rods. This comparison is accomplished by resting the sampler or testing device at the bottom of the hole and comparing the apparent depth with the clean-out depth. If cuttings, cave in material, or sanding in is apparent, these conditions should be noted. Sampler barrels which drop past the cutting teeth of the augers may indicate excessive disturbance at the base of the drill hole. If there is material in the HSA column that does not allow for the sampler to rest at the augured depth below the end of the HSA bit, it may be necessary to allow the material to fall out of the HSA column. Actual depth of the sampler in relation to the bottom of the hole should be considered, not where the bottom of HSA string is setting. If in situ testing is performed below the base of the borehole, check for disturbance below the base of the borehole, and advance the testing instrument well in advance of any disturbance at the base of the boring.

6.5 *Continuous or Intermittent Soil Sampling with the Double-Tube HSA Soil Coring System*:

6.5.1 *Intermittent Sampling*—The pilot bit can be replaced at any time with the double-tube HSA core barrel assembly and samples taken at desired depths. Samples can be taken at selected intervals of concern and based on change of soils encountered.

6.5.2 *Continuous Sampling*—In the continuous soil sampling process a sampler barrel is used during hole advancement. Remove and replace barrels as drilling progresses. Detailed stratigraphic logging and sampling for geotechnical exploration may be obtained.

6.5.3 *Hole Advancement and Cuttings Return*—When using the double-tube HSA soil coring system, typically perform drilling at a rotary velocity of about 50 to 100 r/min. Advance the system to a depth equal to the length of the sample barrel, or where intermittent sampling or in situ testing is required, or until the cutter head assembly is advanced to the desired depth. When using the HSA double-tube soil sampling system, rotational speeds and rate of down feed may vary with the degree of resistance of the material being sampled. As the augers are rotating, apply down feed pressure to the HSA column. Cut away the material from around the inner barrel by the cutter head. The rotating action of the cutter head around the sampler barrel cutting shoe allows the inner sample barrel to push/core down over the column of material filling the inner barrel. Cuttings are directed to the HSA flights and conveyed to the surface by the rotating HSA column. Rotation to clean cuttings from the hole should be limited in the HSA double-tube soil sampling mode to prevent sample from being vibrated (loosen) out of the sample barrel. Rotation for borehole cleaning can be accomplished after removal of the HSA sample barrel prior to the beginning of the next sampling increment.

6.5.4 *Selection of HSA Sampling Barrel*—Depending on the exploration needs, different types of sample barrels may be used. Split barrels are often used for lithologic logging and soil classification. Split barrel samples are often taken in 5-ft (1.5-m) lengths. Sample length can be reduced to reduce disturbance. Undisturbed samples consistent with Practice D 4220, Class c and d are often taken in liners. For undisturbed sampling, it is important to adjust the clearance ratio and the lead distance to reduce disturbance. In general, satisfactory undisturbed samples are usually at least 3 in. (75 mm) in diameter and larger and sampling length is reduced to 2.5 ft (0.75 m).

6.5.4.1 *Considerations for Undisturbed Sampling*:

6.5.4.1.1 *Undisturbed Sampling*—If the goal of the investigation program is to obtain samples with minimal disturbance, lead distance and cutting shoe clearance ratio must be adjusted for optimum sample recovery. This will be a trial-and-error process. The ultimate goal in undisturbed sampling is to achieve core recovery as close to 100 % as possible with a sample that just fills the liner.

6.5.4.1.2 *Lead Distance Optimization*—The lead distance of the core barrel cutting shoe should be adjusted to obtain optimum sample recovery (see 5.7.4). With wireline systems, the lead distance can be checked by vertically suspending the entire lead auger so that the inner barrel assembly can hang freely and then latch inside the lead auger.

6.5.4.1.3 *Clearance Ratio Optimization*—The clearance ratio of the cutting shoe should be optimized for the soil formations to be sampled (see 5.7.4). For undisturbed sampling, hold the liners in place in the sample barrel assembly by the cutting shoe which threads onto the end of the barrel. Cutting shoes are machined with different bit clearance ratios (see 3.1.2). Cutting shoe bit clearance ratios should be checked prior to use. Guidelines for bit clearance ratios for different soil types are as follows:

Bit clearance ratio %	Material
0 to ½	sands with little or no fines
½ to 1	silty sand, clay, silt
1 to 1½	expansive clay, shales, claystones

6.5.5 *General HSA Sampling Considerations*—When the bit or sample barrel assembly is removed and replaced, check the depth to the base of the boring where the end of the string rests and compare to the clean-out depth to evaluate hole quality. Hole depth is recorded by knowing the length of the auger assemblies and the actual amount of extension of the end of the sample barrel beyond the end of the HSA cutter head. This will facilitate accurate depth calculation of the sample taken and comparison of its position relative to the established surface datum. Excessive slough or cuttings within the hollow stem are undesirable and should be corrected by changes in technique, changes in equipment, or repair of equipment. Carefully record the start and stop depths of the sampling interval. Calculate the recovery. Sample recovery is the most important indicator of sample quality. To enhance sample recovery, the rate of penetration should be no greater than the speed at which the HSA cutter head is able to cut; that is, the downward force on the sampler barrel assembly should be a minimum. The speed of rotation should be limited to that which will not tear or break the soil during sampling (generally this varies from 40 to 125 r/min.) Important considerations for optimum sampling are lead distance and clearance ratio or head space of the cutting shoe and prevention of inner barrel rotation (**5**). Extension of the sample barrel shoe beyond the HSA cutter head depends on the soil type and should be the least amount which will result in a fully filled sample barrel (see 5.7.4).

6.5.6 *Sample Barrel Recovery and Reinsertion*

6.5.6.1 *Rod Systems*—After drilling the length of the sample barrel, stop, secure, and disconnect the HSA column from the drill rig drive connector. Disconnect the connecting rods inside the HSA column that may be attached to or extend through the rotary spindle of the drill rig. Remove the drill rotary head off the hole and hoist the rods connecting the sample barrel out of the HSA column. Replace the barrel by attachment of a new barrel to inner rods which are lowered back into the hollow-stem column and secured through the drive cap or rotary spindle attachment.

6.5.6.2 *Wireline Systems*—If a wireline/overshot system is used, after disconnecting the drill rig rotary drive connector from the top of the HSA column and removing the rotary head, lower the overshot retrieval tool down the HSA column to latch into the latching head on top of the sample barrel assembly. After the overshot is locked into the latching head assembly, hoist the sample barrel out of the HSA drill string on a wire cable attached to a hydraulic winch on the drill rig. Remove the sample barrel and connect another sample barrel assembly to the latching head and hoist and lower down the HSA column by means of the overshot and wireline assembly until the latching head locks into the latching connector box (part of the HSA column above the lead HSA and cutter head). Release the overshot from the locking head above the sample barrel and hoist to the surface.

6.5.6.3 *Reinsertion*—Add the next HSA section to the top of the HSA column and connect to the drill rig rotary spindle. Connect inner connecting rods (if not the wireline system) to or through the rotary spindle before the auger drive adapter is connected to the top of the HSA column. In special cases, such as in loose sand, lift the HSA drill string by the drill rig to remove the auger holding fork, and then lower to the bottom of the hole where the previous sample stopped. Rotate and push the HSA column to begin the soil coring procedure again.

6.5.6.4 There may be instances, during insertion of the sample barrel, when difficulties are encountered in locking of the barrel and returning it back to the bottom of the HSA column. If material is present in the hollow-stem auger it may be necessary to lift the HSA column to engage the locking mechanism. This will allow the sample barrel assembly to fall to the bottom of the HSA column, forcing out the slough and reach the locking position. When the sample barrel assembly is connected to drill rods or hex rods to the top of the HSA column, the rods may have to be pushed with the hydraulics of the drill rig to the bottom of the HSA column to reach the proper depth to begin the next soil coring interval. When drilling in 5-ft (1.5-m) intervals, a shorter HSA coring interval may have to be run to allow for slough material. If 2.5-ft (0.75-m) sample intervals are being used, use of a 5-ft barrel will allow for accommodation of slough. Note and record sample intervals, recovery, and any slough, cuttings, fluid exposure, or evidence of rotation contained in the samples recovered.

6.5.7 *Sample Testing and Handling*—First measure samples for recovery upon retrieval. Handle and transport samples in accordance with Practice D 4220. Classify soil samples in accordance with Practice D 2488. Samples from split liners can be classified and stored in jars or bags. Report the locations of specimens removed for testing. Collect material for classification of samples in liners to be stored for laboratory testing from the ends of the sample. Trim and seal the sample ends for preservation. The average soil in-place unit weight can be determined (**6**). Moisture specimens can be obtained from the cutting shoe or liner trimmings. Report results and locations of any tests performed on cores such as Torvane or pocket penetrometer.

7. Drill Hole Monitoring and Completion

7.1 *Monitoring*—It is advisable to monitor ground water levels, if present, in the drill hole during and after drilling. Ground water elevations should be measured and documented during drilling. If ground water is not encountered or if the level is of doubtful reliability, such information should also be documented.

7.2 *Installation of Instrumentation Devices*:

7.2.1 Instrumentation devices, such as piezometers or inclinometers (see 2.4) are installed using hollow-stem augers following a three-step procedure: (1) drilling, with or without sampling, (2) removal of the pilot assembly, if being used, and insertion of the instrumentation device, and (3) incremental removal of the hollow auger column as completion materials such as backfill or grout is installed as required.

7.2.1.1 If materials enter the bottom of the auger hollow stem during removal of the pilot assembly, they can be removed with a bailer, other device, or fluid rotary drilling (see 2.4) .

7.2.1.2 Completion materials such as bentonite pellets, granules and chips, and grouts should be selected and installed to specific subsurface instrumentation requirements.

7.3 *Other Completion Methods*—Depending on requirements of the investigation it may be necessary to perform special installations with protective casings or to the backfilling. An example of special completion is for the seismic crosshole test (Test Methods D 4428) which requires grouted PVC casings. These installations are also performed using the three-step method in 7.2.1. Several methods are available for grouting of casings. It is desirable to use injection grouting where injection is performed at the base of the boring, and grouts are pumped up the annulus until they reach the surface indicating a continuous seal.

7.4 *Drill hole Abandonment*—If there are no needs for special completion or instrument installations for the drill hole, it should be backfilled for completion. The method of backfilling for abandonment depends on the requirements of the exploration program and should be specified as part of the program. Certain state and local regulations may apply. At a minimum, the surface of the hole should be backfilled to reduce potential hazard to those at the surface. In cases where the hole is to be backfilled completely, the condition of the hole should be evaluated and documented. Any zones of caving or blocking which preclude complete backfilling should be documented. Backfilling can be performed by addition of backfill materials from the surface or through injection by tremie pipes. When backfilling from the surface, either cuttings spoil, (only if suitable for replacement) bentonite pellets or granules, or select materials may be added. If complete backfilling is desired using surface methods, use of uniform backfill materials such as bentonite pellets or granules will reduce the possibility of bridging. The hole can be probed to test for bridging. The tremie methods ensure the best backfilling and should be performed when exploration plans require assurance of complete backfilling. Tremie methods consist of placing a small-diameter grout pipe near the base of the drill hole and pumping either cement or bentonite grouts to the surface while displacing any drill hole fluid. The tremie pipe is withdrawn in increments, but the tip is maintained below the grout surface. Typical grout consistencies depend on equipment and the needs of the exploration program. Typical grout mixtures are given in Practice D 5092 and Test Methods D 4428.

8. Report

8.1 Report information in accordance with Guide D 5434 of “Subsurface Explorations of Soil” and identified as necessary and pertinent to the needs of the exploration program. Information is normally required for the project, exploration type and execution, drilling equipment and methods, subsurface conditions encountered, ground water conditions, sampling events, and installations.

8.2 Other information in addition to that mentioned in Guide D 5434 should be considered if deemed appropriate and necessary to the requirements of the exploration program. Additional information should be considered as follows:

8.2.1 *Drilling Methods*:

8.2.1.1 Report description of the hollow-stem auger system including the head, drive, and pilot assemblies. Provide information on drill hole and sample sizes. Note intervals of equipment change or drilling method changes and reasons for change.

8.2.1.2 Report type, quantities, and locations of use of additives such as water added to the hole. If changes to the circulating medium are made, such as addition of water, the depth(s) or interval(s) of these changes should be documented.

8.2.1.3 Report descriptions of down-feed pressures, rotation rates, and cuttings returns over intervals drilled. Note locations of loss of cuttings return and probable cause. Note any indications of binding or locking of the augers during drilling. Observe the ease of drilling during advancement as it relates to the geologic strata being penetrated. Document occurrences of any significant abrupt changes and anomalies in drilling conditions which occur during drilling.

8.2.1.4 If blow-in or sanding-in is evident in the HSA column, note occurrences and the amount. As the drilling progresses, note and document drilling procedures such as cuttings return, water added and losses, and intervals where equipment is changed or drilling method is changed.

8.2.2 *Sampling*:

8.2.2.1 Report depth interval sampled, recovery, classification, and any other tests performed, such as moisture or soil in-place unit weight determinations.

8.2.2.2 When core sampling or undisturbed sampling at the base of the boring, report condition of the base of the boring prior to sampling and report any slough or cuttings present in the recovered sample.

8.2.2.3 If cuttings are sampled for classification and relation to lithology, report and document the intervals sampled.

8.2.2.4 During insertion of the continuous sample barrel note any difficulties in locking of the barrel. Note any disturbances or evidence of rotation observed in the samples recovered.

8.2.3 *In situ Testing*:

8.2.3.1 For devices which were inserted below the base of the drill hole, report the depths below the base of the hole and any unusual conditions during testing.

8.2.3.2 For devices testing or seating at the drill hole wall, report any unusual conditions of the drill hole wall such as inability to seat pressure packers.

8.2.4 *Completion and Installations*—A description of completion materials and methods of placement, approximate volumes placed, intervals of placement, methods of confirming placement, and areas of difficulty or unusual occurrences.

9. Keywords

9.1 continuous sampling; double-tube auger; drilling; hollow-stem augers; soil coring; soil sampling; subsurface exploration

REFERENCES

(**1**) *DCDMA Drilling Safety Manual*, Drilling Equipment Manufacturers Assn., 3008 Millwood Ave., Columbia SC 29205, 1991.

(**2**) Shuter, E., and Teasdale, W.E.,“ Application of Drilling, Coring, and Sampling Techniques to Test holes and Wells - Chapter F1 - Techniques of Water-Resource Investigations of the United States Geological Survey,” U.S. Government Printing Office, Washington, DC, 1989.

(**3**) *Groundwater and Wells,* F.G. Driscoll, 2nd ed, Johnson Filtration Systems, St. Paul, MN, 1989.

(**4**) O’Rourke, J.E., Gibbs, H.J., and O’Connor, K.O., “Core Recovery Techniques for Soft or Poorly Consolidated Materials,” *Final Report*, Contract No. J0275003, U.S. Bureau of Mines, Department of Interior, Washington, DC, April 28, 1978.

(**5**) *Drillers Handbook*, T.C. Ruda and P.J. Bosscher, eds, National Drilling Contractors Assn., 3008 Millwood Ave., Columbia, SC 29205, June 1990.

(**6**) USBR D-7115, “Undisturbed Sampling Using Mechanical Drilling Methods,” Part II, *Earth Manual*, 3rd ed, U.S. Department of Interior, Bureau of Reclamation, U.S. Government Printing Office, Washington, DC, 1990.

(**7**) *DCDMA Technical Manual*, Drilling Equipment Manufacturers Assn., 3008 Millwood Ave., Columbia, SC 29205, 1991.

ATTACHMENT 6

Field Logs

DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

AIR MONITORING REPORT SHEET

DATE:____________________ PAGE:_______ OF _________

JOB #:_____________________

SITE:____

BY:____

ON-SITE:___________ OFF-SITE:______________________

WEATHER CONDITIONS:______________________ PREVAILING WIND DIRECTION:_________

PERSONNEL ON-SITE:____

NOTES:____

DESCRIPTION	TIME	LOCATION	PID (ppm)	PARTICULATES (mg/m3)

DESCRIPTION: BZ = Breathing Zone, BG = Upwind Background, CAMP = Outside work area/at property boundary
S:/fieldforms/Air Monitoring

PAGE________OF________

DAY ENVIRONMENTAL, INC.
SOIL SAMPLE SCREEING LOG

CLIENT:	DATE: DAY:
PROJECT #:	WEATHER:
LOCATION:	TEMPERATURE: Fahrenheit

Sample Location/#	Sample Description and Depth	PID Head space (ppm)	Analysis Y / N	Comments

DAY Representative (print):__________________________ DAY Representative (signed): _________________

ENVIRONMENTAL CONSULTANTS

DAY ENVIRONMENTAL, INC.

AN AFFILIATE OF DAY ENGINEERING, P.C.

TEST PIT TP-

Page of

Project #:

Project Address:

Date:

DAY Representative:

Test Pit Depth:

Contractor:

Depth to Water:

Equipment:

Depth (ft)	**PID Reading (ppm)**	**Samples Collected**	**PID Headspace (ppm)**	**Sample Description**	**Notes**
1-					**1-**
2-					**2-**
3-					**3-**
4-					**4-**
5-					**5-**
6-					**6-**
7-					**7-**
8-					**8-**
9-					**9-**
10-					**10-**
11-					**11-**
12-					**12-**
13-					**13-**
14-					**14-**
15-					**15-**
16-					**16-**

Notes:
1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable

TEST PIT TP-

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ROCHESTER, NEW YORK 14606
(585) 454-0210
FAX (585) 454-0825

www.dayenvironmental.com

420 LEXINGTON AVENUE, SUITE 300
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day
DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

Test Boring TB-

Page 1 of 2

Project #:
Project Address:

DAY Representative:
Drilling Contractor:
Sampling Method:

Ground Elevation:
Datum:
Date Started:
Date Ended:
Borehole Depth:
Borehole Diameter:
Completion Method: ☐ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date):

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-

dav

DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS

AN AFFILIATE OF DAY ENGINEERING, P.C.

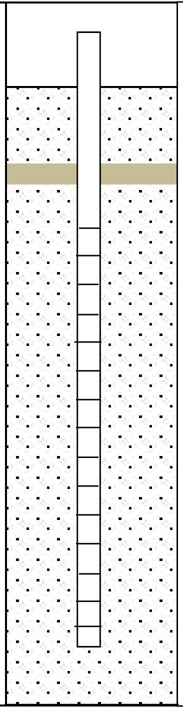
MONITORING WELL CONSTRUCTION DIAGRAM

MONITORING WELL MW-

Project #: ____________________
Project Address: ____________________
____
DAY Representative: ____________________
Drilling Contractor: ____________________

Ground Elevation: ________ Datum: ________
Date Started: ________ Date Ended: ________
Water Level (Date): ____________________

Refer to Test Boring Log TB- ~ for Soil Description



_______Height of Stickup (ft)

Ground Surface
_______Depth to Bottom of Cement Surface Patch (ft)
Backfill Type ______________________________
_______Depth to Top of Bentonite Seal (ft)
_______Depth to Bottom of Bentonite Seal (ft)

_______Depth to Top of Well Screen (ft)

_______Diameter of Borehole (in)

Backfill Type ______________________________

_______Inside Diameter of Well (in)

Type of Pipe ______________________________
Screen slot size ____________________________

_______Depth to Bottom of Well Screen (ft)

______ Depth to Bottom of Borehole (ft)

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) NA = Not Available or Not Applicable

MONITORING WELL MW-

S:\Fieldforms\Monitoring Well Installation Log (revised November 2013)

WELL DEVELOPMENT DATA
MW-

SITE LOCATION: JOB#: _

DATE/ TIME								
EVACUATION METHOD								
PID/FID (PPM)								
DEPTH OF WELL (FT)								
STATIC WATER LEVEL (SWL) FT								
VOLUME EVACUATED (GAL)								
TOTAL VOLUME EVACUATED (GAL)								
TEMPERATURE (^{O}C)								
pH								
ORP (mV)								
CONDUCTIVITY (µs/cm)								
TURBIDITY (NTU)								
VISUAL OBSERVATION								

LEGEND:
NC = Not Collected
ND = Not Detected
*= Not Measurable

Day Environmental, Inc.
1563 Lyell Avenue
Rochester, New York 14606

S:\Fieldforms\Fieldforms.2011\Well Development Data Log-revised 8-29-06.doc

DAY ENVIRONMENTAL, INC.

LOW-FLOW GROUNDWATER PURGING AND SAMPLING LOG

WELL MW-

SECTION 1 - SITE AND WELL INFORMATION

SITE LOCATION ______________________ **JOB #** ______________________

PROJECT NAME: ______________________ **DATE:** ______________________

SAMPLE COLLECTOR(S): ______________________ **WEATHER:** ______________________

PID READING IN WELL HEADSPACE (PPM): __________ **MEASURING POINT (for water levels):** __________

CASING TYPE: ______________________ **WELL DIAMETER (INCHES):** __________

INITIAL WATER LEVEL (SWL) [FT]: **<u>SWL / Date Measured</u>** ________ / ________

SCREENED INTERVAL [FT BGS]: ______________________

WELL DEPTH [FT BGS]: ______________________ **DEPTH OF PUMP INTAKE [FT BGS]:** __________

(Do <u>NOT</u> Measure Well depth Prior To Purging And Sampling)

LNAPL: __________ **DNAPL:** __________ **OTHER OBSERVATIONS:** __________

SECTION 2 – SAMPLING EQUIPMENT

CONTROL BOX: ______________________ **TUBING TYPE:** ______________________

WATER QUALITY METER: ______________________ **WATER LEVEL METER:** ______________________

PUMP TYPE: ______________________ **PURGE GAS:** ______________________

CONTROL BOX DISCHARGE RATE: __________ **CONTROL BOX REFILL RATE:** __________

STABILIZED PUMP RATE (ml/min): __________ **STABILIZED DRAWDOWN WATER LEVEL [FT]:** __________

SECTION 3 – WATER QUALITY DATA MONITORING

Time	Pumping Rate (ml/min)	Water Level (ft)	DO (mg/L)	ORP (mv)	Turbidity (NTU)	Conductivity (mS/cm)	pH	Temp. (C^0)	Total Vol. Pumped (ml)
	SAMPLE OBSERVATIONS:								

SECTION 4 - SAMPLE IDENTIFICATION AND ANALYTICAL LABORATORY PARAMETERS

SAMPLE ID #	DATE / TIME	SAMPLING METHOD	ANALYTICAL SCAN(S)

PAGE________OF________

DAY ENVIRONMENTAL, INC.
SITE OBSERVATION REPORT

CLIENT:	DATE: DAY:
PROJECT:	WEATHER:
LOCATION:	TEMPERATURE: Celsius; ( ) Fahrenheit
CONTRACTOR:	

On Site at: ___________ am/pm

COMMENTS:

Off Site at: __________ am/pm

WORK FORCE AND EQUIPMENT:

DAY Representative (print):_________________________ DAY Representative (signed):_______________________________

DAY ENVIRONMENTAL, INC.
MONITORING WELL SAMPLING LOG

WELL MW-

SECTION 1 - SITE INFORMATION

SITE LOCATION: ________________________________ **JOB #:**__________________

________________________________ **DATE :**__________________

SAMPLE COLLECTOR(S): ___________________

WEATHER CONDITIONS: ___________________ **PID IN WELL (PPM):** ____ **LNAPL** _____ **DNAPL** ____

SECTION 2 - PURGE INFORMATION

DEPTH OF WELL [FT]: ____________________________ (MEASURED FROM TOP OF CASING - T.O.C.)

STATIC WATER LEVEL (SWL) [FT]: ________________ (MEASURED FROM T.O.C.)

THICKNESS OF WATER COLUMN [FT]: _________________ (DEPTH OF WELL - SWL)

CALCULATED VOL. OF H_2O PER WELL CASING [GAL]: _____________ **CASING DIA.:** _________

CALCULATIONS:

CASING DIA. (FT)	WELL CONSTANT(GAL/FT)	CALCULATIONS
¾” (0.0625)	0.023	VOL. OF H_2O IN CASING = DEPTH OF WATER COLUMN X WELL CONSTANT
1” (0.0833)	0.041	
1¼” (0.1041)	0.063	
2” (0.1667)	0.1632	
3” (0.250)	0.380	
4” (0.3333)	0.6528	
4½” (0.375)	0.826	
6” (0.5000)	1.4688	
8” (0.666)	2.611	

CALCULATED PURGE VOLUME [GAL]: ___________ (3 TIMES CASING VOLUME)

ACTUAL VOLUME PURGED [GAL]: ___________

PURGE METHOD: __________________________ **PURGE START:** ________ **END:**________

SECTION 3 - SAMPLE IDENTIFICATION AND TEST PARAMETERS

SAMPLE ID #	DATE / TIME	SAMPLING METHOD	ANALYTICAL SCAN(S)

SECTION 4 - WATER QUALITY DATA

SWL (FT)	TEMP (°C)	pH	CONDUCTIVITY (uS/cm)	TURBIDITY (NTU)	DO (mg/L)	ORP (mV)	VISUAL

N/M = Not Measured
ND = Not Detected

ATTACHMENT 7

USEPA SOP #2010 - Tank Sampling

TANK SAMPLING

SOP#: 2010
DATE: 11/16/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide technical guidance for the implementation of sampling protocols for tanks and other confined spaces from outside the vessel.

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 or other procedure limitations. 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

The safe collection of a representative sample should be the criteria for selecting sample locations. A representative sample can be collected using techniques or equipment that are designed for obtaining liquids or sludges from various depths. The structure and characteristics of storage tanks present problems with collection of samples from more than one location; therefore, the selection of sampling devices is an important consideration.

Depending on the type of vessel and characteristics of the material to be sampled, one can choose a bacon bomb sampler, sludge judge, subsurface grab sampler, glass thief, bailer or Composite Liquid Waste Sampler (COLIWASA) to collect the sample. A sludge judge, bacon bomb or COLIWASA can be used to determine if the tank contents are stratified. Various other custom-made samplers may be used depending on the specific application.

All sample locations should be surveyed for air quality prior to sampling. At no time should sampling continue with an LEL reading greater than 25%.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples collected from tanks are considered waste samples and as such, addition of preservatives is not required due to the potential reaction of the sample with the preservative. Samples should however, be cooled to 4°C with ice and protected from sunlight in order to minimize any potential reaction due to the light sensitivity of the sample.

Sample bottles for collection of waste liquids, sludges, or solids are typically wide mouth amber jars with Teflon-lined screw caps. Actual volume required for analysis should be determined in conjunction with the laboratory performing the analysis.

Waste sample handling procedures should be as follows:

1. Place sample container in two ziplock plastic bags.
2. Place each bagged container in a 1-gallon covered can containing absorbent packing material. Place the lid on the can.
3. Mark the sample identification number on the outside of the can.
4. Place the marked cans in a cooler, and fill remaining space with absorbent packing material.
5. Fill out chain of custody record for each cooler, place in plastic, and affix to inside lid of cooler.
6. Secure and custody seal the lid of cooler.

7. Arrange for the appropriate transportation mode consistent with the type of hazardous waste involved.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Sampling a storage tank requires a great deal of manual dexterity, often requiring climbing to the top of the tank upon a narrow vertical or spiral stairway or ladder while wearing protective clothing and carrying sampling equipment.

Before climbing onto the vessel, a structural survey should be performed. This will ensure appropriate consideration of safety and accessibility prior to initiation of any field activities.

As in all opening of containers, extreme caution should be taken to avoid ignition or combustion of volatile contents. All tools used must be constructed of a non-sparking material and electronic instruments must be intrinsically safe.

All sample locations should be surveyed for air quality prior to sampling. At no time should sampling continue with a lower explosive limit (LEL) reading greater than 25%.

5.0 EQUIPMENT/APPARATUS

Storage tank materials include liquids, sludges, still bottoms, and solids of various types. The type of sampler chosen should be compatible with the waste. Samplers commonly used for tanks include: a bacon bomb sampler, sludge judge, glass thief, bailer, COLIWASA, and subsurface grab sampler.

<u>Tank Sampling Equipment Checklist:</u>

C Sampling plan
C Safety equipment
C Tape measure
C Weighted tape line, measuring stick or equivalent
C Camera/film
C Stainless steel bucket or bowl
C Sample containers
C Ziplock plastic bags
C Logbook
C Labels
C Field data sheets
C Chain of Custody records
C Flashlight (explosion proof)
C Coolers
C Ice
C Decontamination supplies
C Bacon bomb sampler
C Sludge judge
C Glass thieves
C Bailers
C COLIWASA
C Subsurface grab sampler
C Water/oil level indicator
C OVA (organic vapor analyzer or equivalent)
C Explosimeter/oxygen meter
C High volume blower

6.0 REAGENTS

Reagents are not typically required for the preservation of waste samples. However, reagents will be utilized for decontamination of equipment. Decontamination solutions required are specified in the Sampling Equipment Decontamination SOP.

7.0 PROCEDURE

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.

6. Identify and mark all sampling locations.

7.2 Preliminary Inspection

1. Inspect the external structural characteristics of each tank and record in the site logbook.

Potential sampling points should be evaluated for safety, accessibility and sample quality.

2. Prior to opening a tank for internal inspection, the tank sampling team shall:

   - Review safety procedures and emergency contingency plans with the Health and Safety Officer.
   - Ensure that the tank is properly grounded.
   - Remove all sources of ignition from the immediate area.

3. Each tank should be mounted using appropriate means. Remove manway covers using non-sparking tools.

4. Collect air quality measurements for each potential sample location using an explosimeter/oxygen meter for a lower explosive limit (LEL/O_2) reading and an OVA/HNU for an organic vapor concentration. Both readings should be taken from the tank headspace, above the sampling port, and in the breathing zone.

5. Prior to commencing sampling, the tank headspace should be cleared of any toxic or explosive vapor concentration using a high volume explosion proof blower. No work shall start if LEL readings exceed 25%. At 10% LEL, work can continue but with extreme caution.

7.3 Sampling Procedure

1. Determine the depth of any and all liquid, solid, and liquid/solid interface, and depth of sludge using a weighted tape measure, probe line, sludge judge, or equivalent.

2. Collect liquid samples from one (1) foot below the surface, from mid-depth of liquid, and from one (1) foot above the bottom sludge layer. This can be accomplished with a subsurface grab sampler or bacon bomb. For liquids less than five (5) feet in depth, use a glass thief or COLIWASA to collect the sample.

   If sampling storage tanks, vacuum trucks, or process vessels, collect at least one sample from each compartment in the tank. Samples should always be collected through an opened hatch at the top of the tank. Valves near the bottom should not be used, because of their questionable or unknown integrity. If such a valve cannot be closed once opened, the entire tank contents may be lost to the ground surface. Also, individual strata cannot be sampled separately through a valve near the bottom.

3. Compare the three samples for visual phase differences. If phase differences appear, systematic iterative sampling should be performed. By halving the distance between two discrete sampling points, one can determine the depth of the phase change.

4. If another sampling port is available, sample as above to verify the phase information.

5. Measure the inside diameter of the tank and determine the volume of wastes using the depth measurements (Appendix A). Measuring the external diameter may be misleading as some tanks are insulated or have external supports that are covered.

6. Sludges can be collected using a bacon bomb sampler, glass thief, or sludge judge.

7. Record all information on the sample data sheet or site logbook. Label the container with the appropriate sample tag.

8. Decontaminate sampling equipment as per the steps listed in the Sampling Equipment Decontamination SOP.

7.4 Sampling Devices

7.4.1 Bacon Bomb Sampler

The bacon bomb sampler (Figure 1, Appendix B) is designed for the collection of material from various levels within a storage tank. It consists of a cylindrical body, usually made of chrome-plated brass and bronze with an internal tapered plunger that acts as a valve to admit the sample. A line attached to the top of the plunger opens and closes the valve. A line is attached to the removable top cover which has a locking mechanism to keep the plunger closed after sampling.

Procedures for Use:

1. Attach the sample line and the plunger line to the sampler.

2. Measure and then mark the sampling line at the desired depth.

3. Gradually lower the sampler by the sample line until the desire level is reached.

4. When the desired level is reached, pull up on the plunger line and allow the sampler to fill before releasing the plunger line to seal off the sampler.

5. Retrieve the sampler by the sample line being careful not to pull up on the plunger line and thereby prevent accidental opening of the bottom valve.

6. Rinse or wipe off the exterior of the sampler body.

7. Position the sampler over the sample container and release its contents by pulling up on the plunger line.

8. Cap the sample container tightly and place prelabeled sample container in a carrier.

9. Replace the flange or manway or place plastic over the tank.

10. Log all samples in the site logbook and on field data sheets and label all samples.

11. Package samples and complete necessary paperwork.

12. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

7.4.2 Sludge Judge

A sludge judge (Figure 2, Appendix B) is used for obtaining an accurate reading of settleable solids in any liquid. The sampling depth is dependent upon the length of the sludge judge. The sampler consists of 3/4" plastic pipe in 5-ft. sections, marked at 1-ft. increments, with screw-type fittings.

Procedures for Use:

1. Lower the sludge judge to the bottom of the tank.

2. When the bottom has been reached, the pipe is allowed to fill to the surface level. This will seat the check valve, trapping the column of material.

3. When the unit has been raised clear of the tank liquid, the amount of sludge in the sample can be read using the one foot increments marked on the pipe sections.

4. By touching the pin extending from the bottom section against a hard surface, the material is released from the unit.

5. Cap the sample container tightly and place prelabeled sample container in a carrier.

6. Replace the flange or manway or place plastic over the tank.

7. Log all samples in the site logbook and on field data sheets and label all samples.

8. Package samples and complete necessary paperwork.

9. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

7.4.3 Subsurface Grab Sampler

Subsurface grab samplers (Figure 3, Appendix B) are designed to collect samples of liquids at various depths. The sampler is usually constructed of aluminum or stainless steel tubing with a polypropylene or teflon head that attaches to a 1-liter sample container.

Procedures for Use:

1. Screw the sample bottle onto the sampling head.

2. Lower the sampler to the desired depth.

3. Pull the ring at the top which opens the spring-loaded plunger in the head assembly.

4. When the bottle is full, release the ring, lift sampler, and remove sample bottle.

5. Cap the sample container tightly and place prelabeled sample container in a carrier.

6. Replace the flange or manway or place plastic over the tank.

7. Log all samples in the site logbook and on field data sheets and label all samples.

8. Package samples and complete necessary paperwork.

9. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

7.4.4 Glass Thief

The most widely used implement for sampling is a glass tube commonly referred to as a glass thief (Figure 4, Appendix B). This tool is simple, cost effective, quick, and collects a sample without having to decontaminate. Glass thieves are typically 6mm to 16mm I.D. and 48 inches long.

Procedures for Use:

1. Remove cover from sample container.

2. Insert glass tubing almost to the bottom of the tank or until a solid layer is encountered. About one foot of tubing should extend above the drum.

3. Allow the waste in the tank to reach its natural level in the tube.

4. Cap the top of the sampling tube with a tapered stopper or thumb, ensuring liquid does not come into contact with stopper.

5. Carefully remove the capped tube from the tank and insert the uncapped end in the sample container. Do not spill liquid on the outside of the sample container.

6. Release stopper and allow the glass thief to drain until the container is approximately 2/3 full.

7. Remove tube from the sample container, break it into pieces and place the pieces in the tank.

8. Cap the sample container tightly and place prelabeled sample container in a carrier.

9. Replace the bung or place plastic over the tank.

10. Log all samples in the site logbook and on field data sheets and label all samples.

11. Package samples and complete necessary paperwork.

12. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

In many instances a tank containing waste material will have a sludge layer on the bottom. Slow insertion of the sample tube down into this layer and then a gradual withdrawal will allow the sludge to act as a bottom plug to maintain the fluid in the tube. The plug can be gently removed and placed into the sample container by the use of a stainless steel lab spoon.

7.4.5 Bailer

The positive-displacement volatile sampling bailer (Figure 5, Appendix B) (by GPI) is perhaps the most appropriate for collection of water samples for volatile analysis. Other bailer types (messenger, bottom fill, etc.) are less desirable, but may be mandated by cost and site conditions. Generally, bailers can provide an acceptable sample, providing that the sampling personnel use extra care in the collection process.

Operation

1. Make sure clean plastic sheeting surrounds the tank.

2. Attach a line to the bailer.

3. Lower the bailer slowly and gently into the tank so as not to splash the bailer into the tank contents.

4. Allow the bailer to fill completely and retrieve the bailer from the tank.

5. Begin slowly pouring from the bailer.

6. Cap the sample container tightly and place prelabeled sample container in a carrier.

7. Replace the flange or manway or place plastic over the tank.

8. Log all samples in the site logbook and on field data sheets and label all samples.

9. Package samples and complete necessary paperwork.

10. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

7.4.6 COLIWASA

Sampling devices are available that allow collection of a sample from the full depth of a tank and maintain its integrity in the transfer tube until delivery to the sample bottle. The sampling device is known as a Composite Liquid Waste Sampler (COLIWASA) (Figure 6, Appendix B). The COLIWASA is a much cited sampler designed to permit representative sampling of multiphase wastes from tanks and other containerized wastes.

One configuration consists of a 152 cm by 4 cm I.D. section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper.

The major drawbacks associated with using a COLIWASA concern decontamination and costs. The sampler is difficult to decontaminate in the field, and its high cost in relation to alternative procedures (glass tubes) makes it an impractical throwaway item. Disposable COLIWASA's are a viable alternative. However, the COLIWASA is still the sampling device of choice for specific applications, especially in instances where a true representation of a multiphase waste is absolutely necessary.

Procedures for Use:

1. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.

2. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.

3. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.

4. Slowly withdraw the sample from the waste container with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand.

5. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.

6. Cap the sample container tightly and place prelabeled sample container in a carrier.

7. Replace the bung or place plastic over the tank.

8. Log all samples in the site logbook and on field data sheets and label all samples.

9. Package samples and complete necessary paperwork.

10. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

8.0 CALCULATIONS

There are no specific calculations for these procedures. Refer to Appendix A regarding calculations utilized in determining tank volumes.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures. More specifically, the hazards associated with tank sampling may cause bodily injury, illness, or death to the worker. Failure to recognize potential hazards of waste containers is the cause of most accidents. It should be assumed that the most unfavorable conditions exist, and that the danger of explosion and poisoning will be present. Hazards specific to tank sampling are:

1. Hazardous atmospheres which are either flammable, toxic, asphyxiating, or corrosive.

2. If activation of electrical or mechanical equipment would cause injury, each piece of equipment should be manually isolated to prevent inadvertent activation while workers are occupied.

3. Communication is of utmost importance between the sampling worker and the standby person to prevent distress or injury going unnoticed.

4. Proper procedures to evacuate a tank with forced air and grounding of equipment and tanks should be reviewed.

12.0 REFERENCES

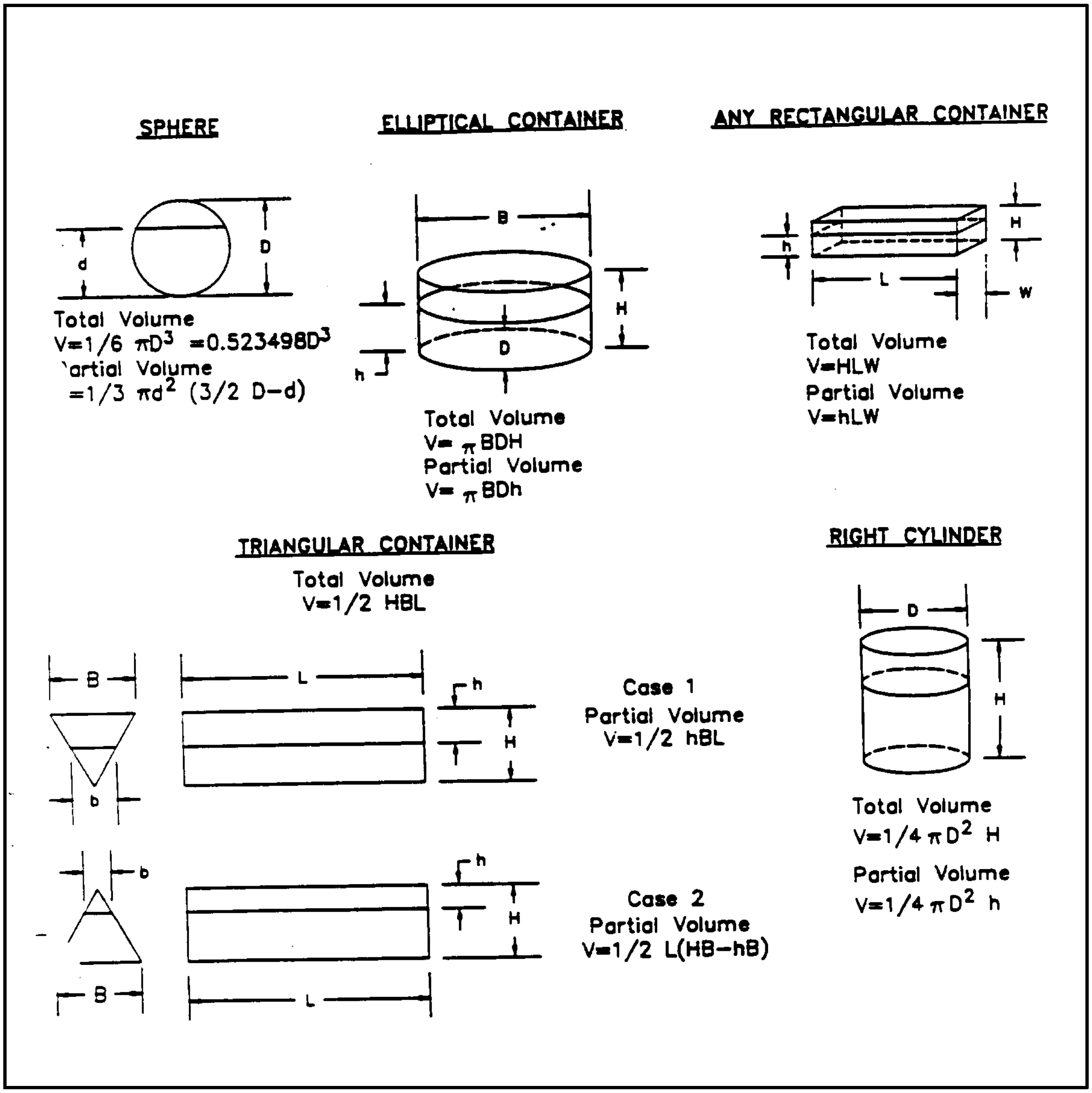
Guidance Document for Cleanup of Surface Tank and Drum Sites, OSWER Directive 9380.0-3.

Drum Handling Practices at Hazardous Waste Sites, EPA-600/2-86-013.

APPENDIX A

Calculations

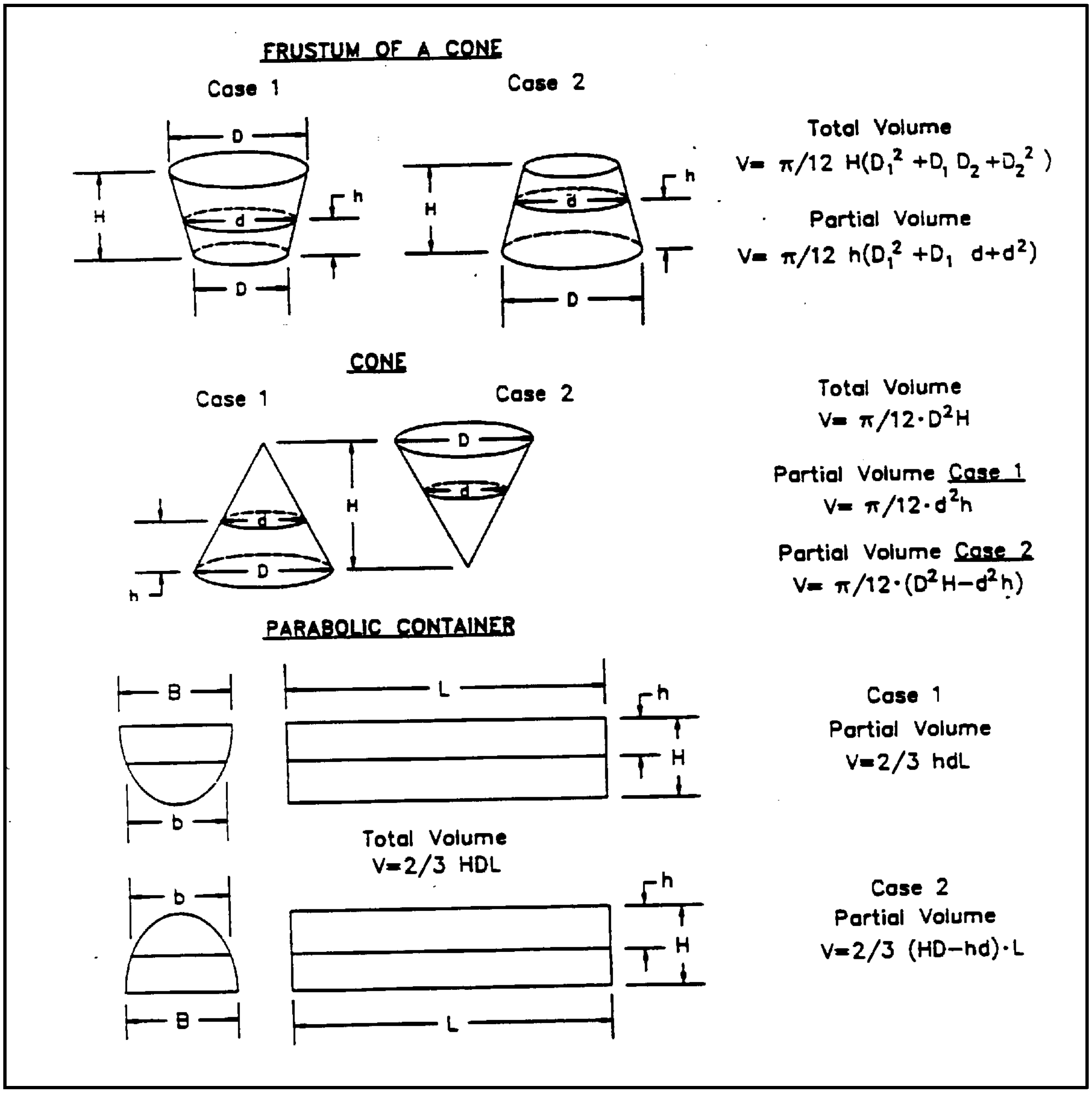
Various Volume Calculations



APPENDIX A (Cont’d)

Calculations

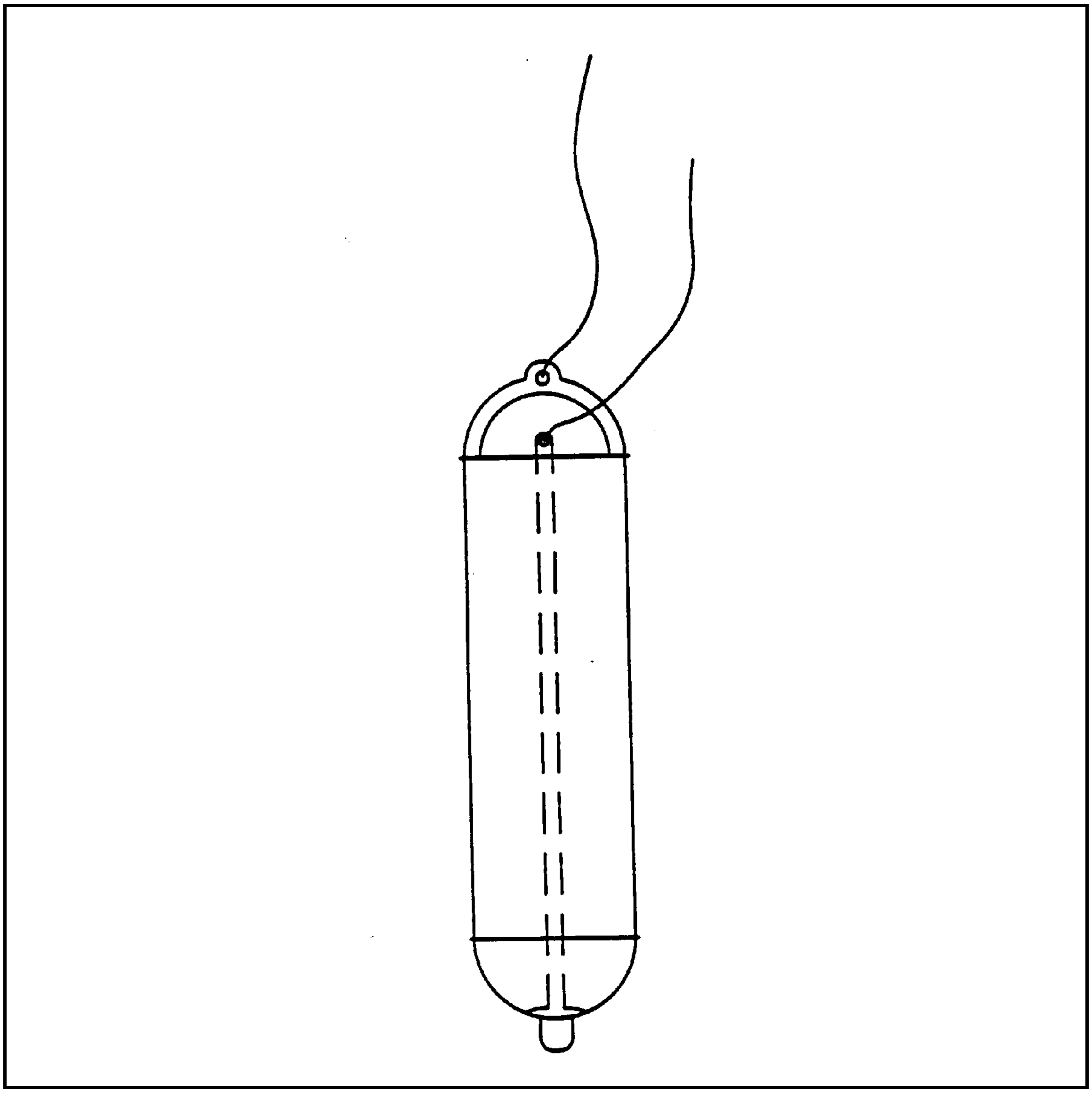
Various Volume Calculations (Cont'd)



APPENDIX B

Figures

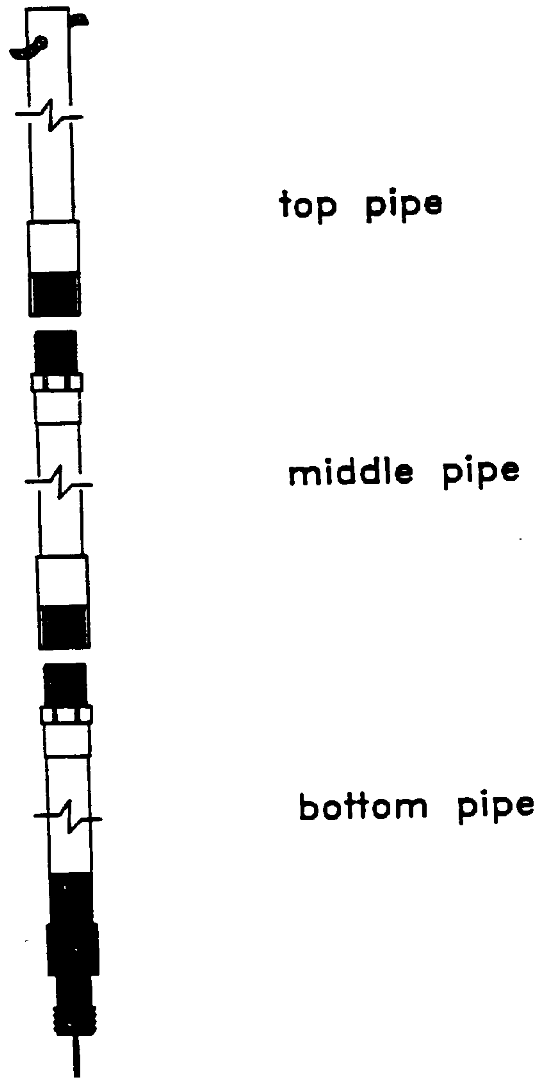
FIGURE 1. Bacon Bomb Sampler



APPENDIX B (Cont'd)

Figures

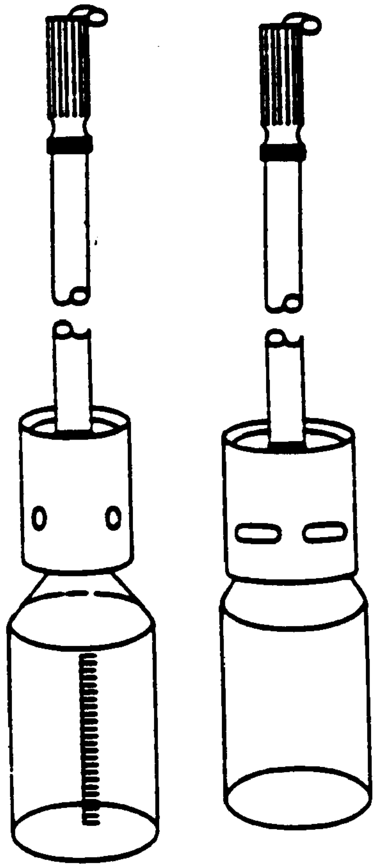
FIGURE 2. Sludge Judge



APPENDIX B (Cont’d)

Figures

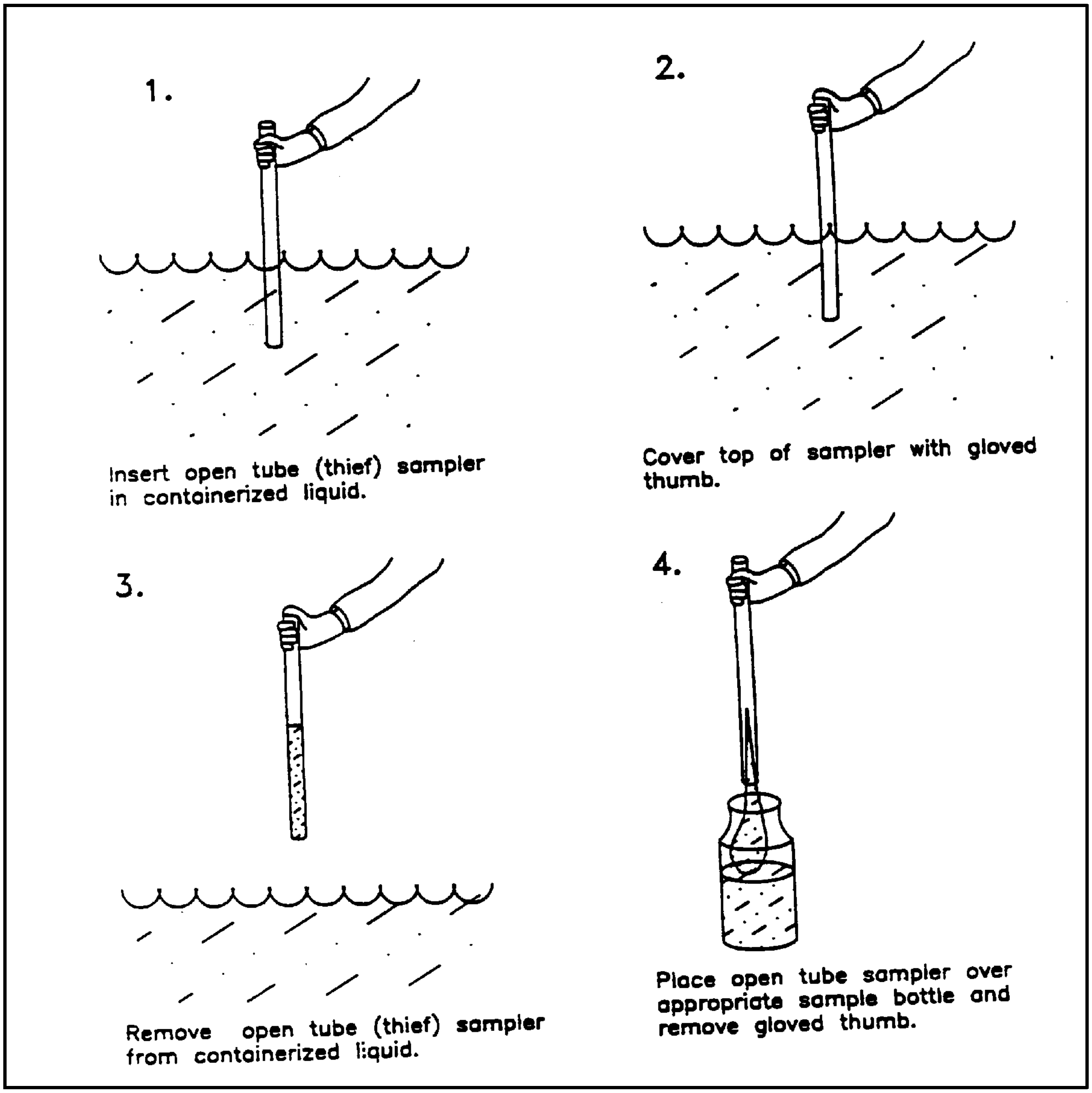
FIGURE 3. Subsurface Grab Sampler



APPENDIX B (Cont'd)

Figures

FIGURE 4. Glass Thief



Insert open tube (thief) sampler in containerized liquid.

Cover top of sampler with gloved thumb.

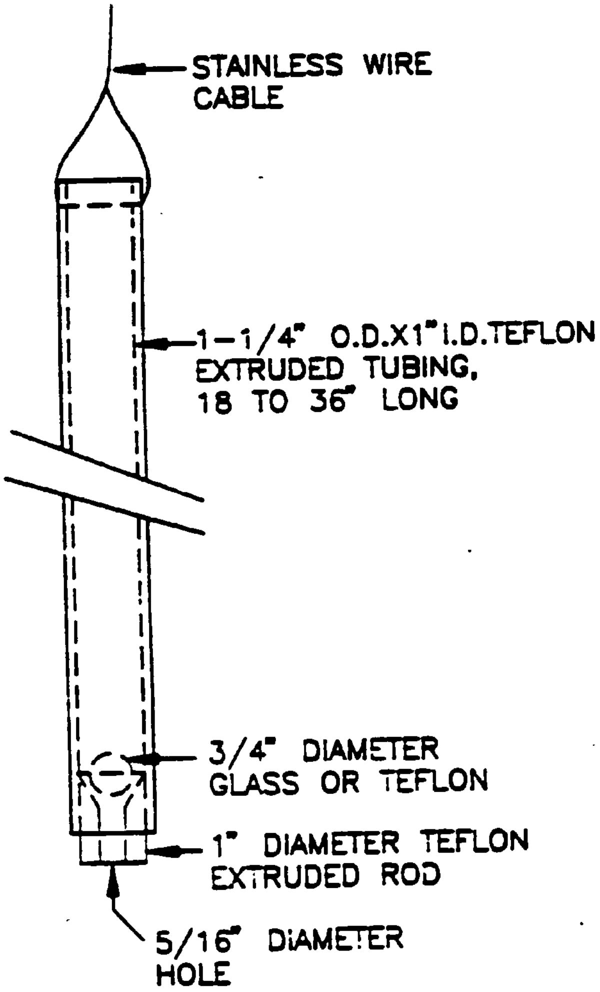
Remove open tube (thief) sampler from containerized liquid.

Place open tube sampler over appropriate sample bottle and remove gloved thumb.

APPENDIX B (Cont'd)

Figures

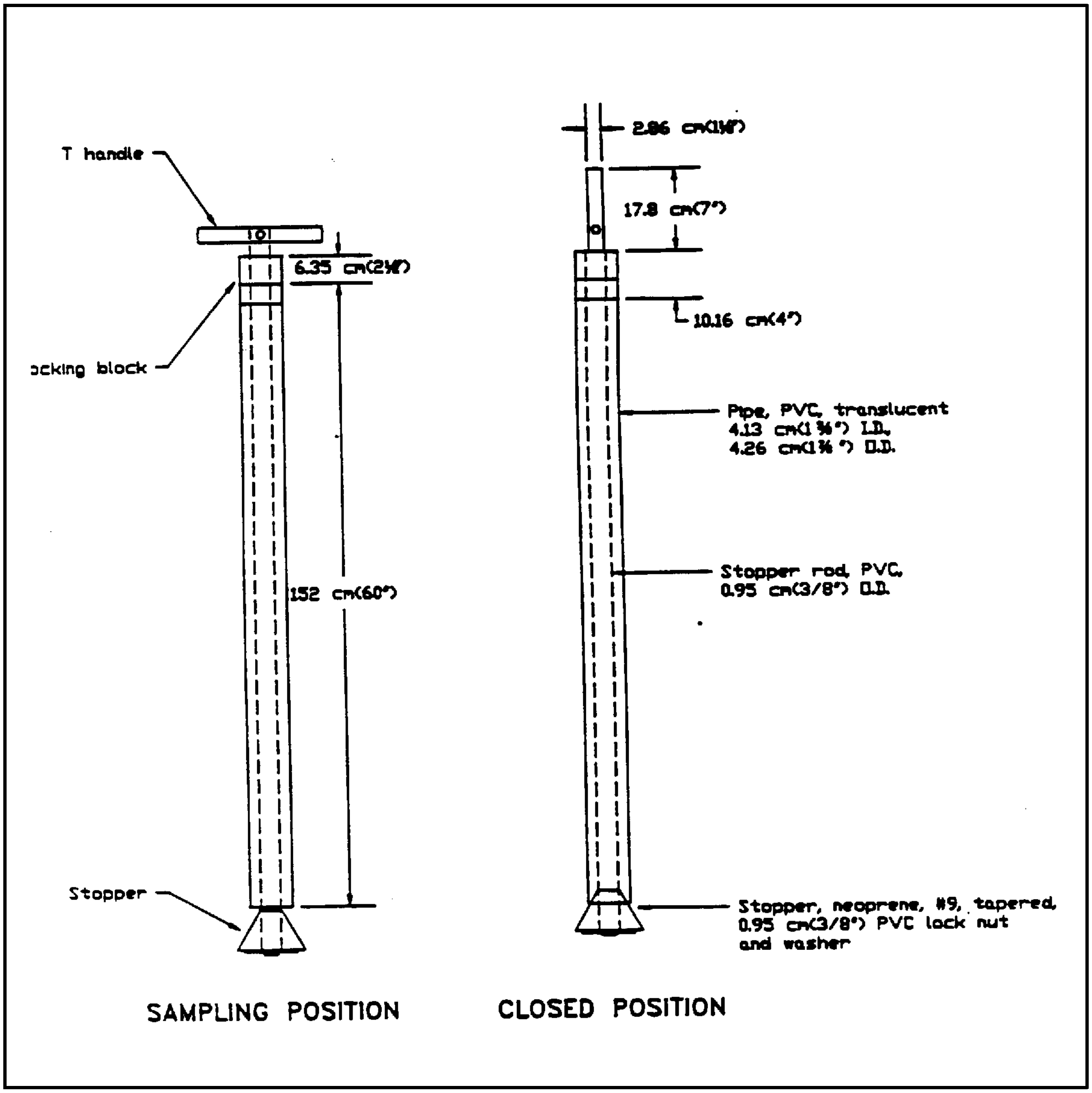
FIGURE 5. Bailer



APPENDIX B (Cont'd)

Figures

FIGURE 6. COLIWASA



ATTACHMENT 8

EDV QA/QC Plan

QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

EDV, INC
ENVIRONMENTAL DATA VALIDATION, INC

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QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

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QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

OVERVIEW

Environmental Data Validation Inc. (hereinafter referred to as EDV) is a certified small, woman-owned, disadvantaged, data validation and consulting business specializing in Environmental, Public Health and Scientific Research, Analytical data validation, Environmental consulting and Total environmental quality. Our motto is to deliver quality work on a timely basis. Established in 1990, EDV has kept its pace with changes and procedures in the environmental arena.

EDV is comprised of scientists and technical experts who specialize in environmental health and safety training & occupational health and safety consulting, building inspections, environmental site assessments, chemical and radiochemical data validation, environmental health and safety consulting, risk assessment, hazard assessment, exposure assessments, environmental health assessments, ecological risk assessments, epidemiological/environmental study design and quality consulting. Our consultants are from the academic arena or private sector and include; environmental scientists, industrial hygienists, epidemiologists, toxicologist, public health specialists and environmental engineers, chemists, biologists and health and safety specialists.

As part of our commitment to quality and the environment, EDV established an Environmental Management System based on the ISO 14000 standard and an Environmental Policy Statement; the blue print on which the company operates, and the basis for the environmental management system. The Environmental Policy Statement in integrated in our QA/QC program.

ENVIRONMENTAL POLICY STATEMENT

Environmental Data Validation Inc is committed to developing, implementing, reviewing and maintaining an environmental management system, wherein the organizational structure, processes and resources are sufficient to continually measure, monitor and improve our environmental performance.

EDV understands that all activities, products or services can impact the environment. It is our policy to use practices and materials that can reduce, avoid or control pollution, which may include recycling, efficient use of resources and material substitution.

EDV will:
- adhere to all relevant environmental regulations and laws
- integrate this policy with its Quality policy
- seek to continually improve our overall environmental impact to our customers and the community
- adhere to integrity and high ethical standards

QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

INTRODUCTION

Quality Assurance (QA) plays a critical role in the generation and use of environmental data. QA activities ensure that the environmental sampling and analysis process is verified and documented so that the uncertainties in the resulting data can be controlled and quantified. In this way, the information gained from QA activities allows a data end user to determine whether the data are good enough to support their intended use.

Our motto is to deliver quality work on a timely basis. Our size and technical expertise has allowed us to accommodate our clients on very short notices and quick turnaround times. Our Quality Assurance/Quality Control program was established so as to give our clients formal documentation as to how we perform our validation efforts and the added security of knowing that their data is being handled professionally. As part of our commitment to quality and the environment, EDV established an Environmental Management System based on the ISO 14000 standard and an Environmental Policy Statement, the blue print on which the company operates, and the basis for the environmental management system. The Environmental Policy Statement in integrated in our QA/QC program.

QUALITY ASSURANCE/QUALITY CONTROL PLAN
FOR DATA VALIDATION SERVICES

POLICY AND OBJECTIVES

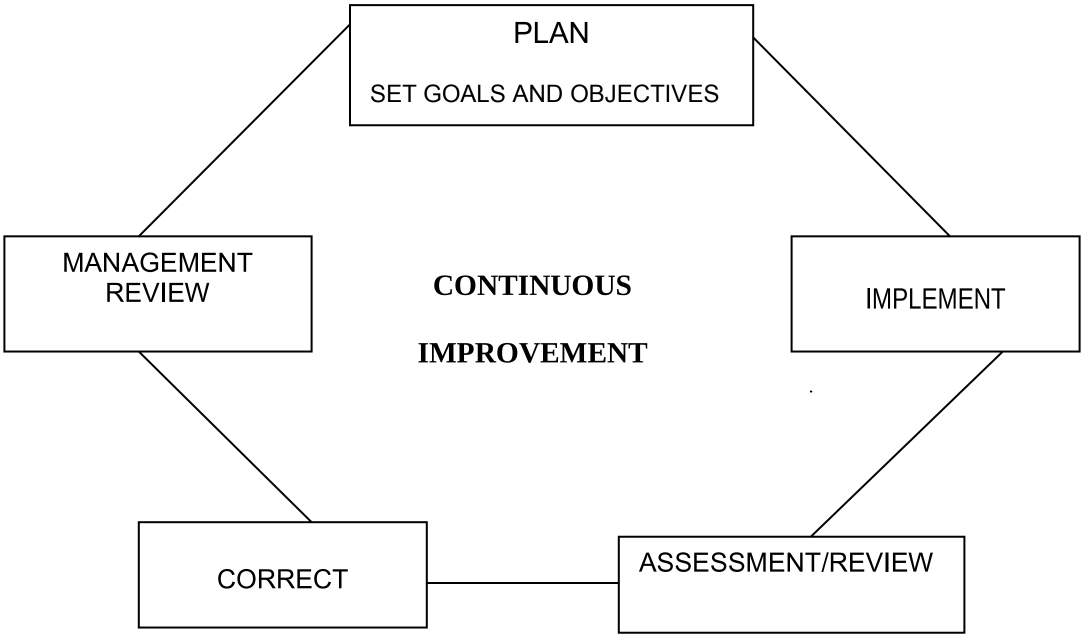
EDV's Quality Assurance/Quality Control (QA/QC) program was established to ensure quality and, validity to the work performed. The **quality assurance program** provides the structure, policies and responsibility for the execution of quality control and quality assessment operations, to assure our clients that defined standards and quality of a stated confidence level are met. The quality **control program** ensures maintenance of the controlled validation, review and data management process. The quality **assessment program** incorporates all the necessary elements to ensure that the quality control system is functioning effectively. To ensure that the highest standard of work is accomplished, EDV strictly adheres to QA/QC guidelines for data validation established by the EPA, in the National Functional Guidelines for Organic Analyses, and the National Functional Guidelines for Inorganic Analyses. Modifications to these guidelines established by various EPA regions or other governing bodies such as NEESA, DOE and AFCEE are utilized on a project specific basis. Our objective is to stay within the limits of data validation as we perform our tasks.

The satisfaction of our clients is most important to us; for this reason, we like to earn their confidence in the work performed by EDV. Our QA/QC program was so designed. This **Quality Assurance Project Plan** (QAPP) is designed based on the QA/QC program. It is important to us that our clients know, EDV's QA/QC system is in place so that their data can be accounted for, at all times, while it is in our hands and, that a thorough and complete job is done in validating the data.

It is the objective of the QAPP to ensure that quality results are produced by our validation efforts and that there is documentation every step of the way to verify this. It is also our objective and, policy to ensure that the results from the validation process are traceable. Our reports are written for easy understanding by the data end user.

QA/QC PROGRAM CYCLE

EDV QA/QC program is based on Continuous Improvement and is reflected in the program's cycle for which the key elements of the system are listed below.



QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

Plan - This is important so that the each department implement the quality policy in accordance with its guiding principles. Here objectives and goals/targets are identified.

Implement - This is necessary to effectively carry out the objectives of the QA/QC program,

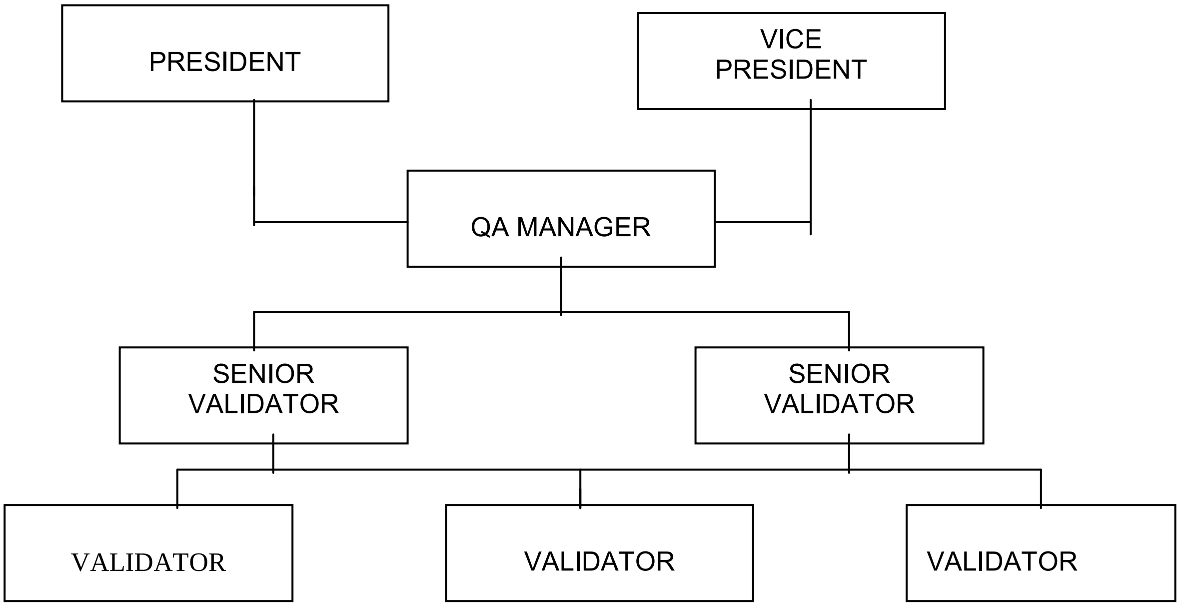
Assess/Review - This is where the policy and objectives of the program are reviewed.

Correct - This is the action necessary to ensure that the policy goals/targets and objectives are met.

Management Review - This is the overall assessment of the QA/QC program by management. From here deficiencies are corrected and continuous improvement enhanced.

QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

QA MANAGEMENT



QA Responsibilities and Reporting Relationships

The QA Management team is reflected above. Reporting goes up the chain of command, that is, the validators report to the senior validators who in turn report to the QA manager who reports to the president or vice president (in the event that the president is absent).

The QA manager is responsible for the overall QA/QC program and implements procedures, changes and corrective actions. The senior validators oversee or mentor the validators. The validators are responsible for data tracking, and overall smooth running of the QA/QC system on a day to day basis.

QA Document Control

This is executed from the time the data package gets to EDV. It is highly important to have this so that we know where things are at all times. We understand the confidential nature of this subcontract and so, a data package or SDG will be assigned to a validator and remain in his/her possession until completed. The assigned validator is responsible for that package until its review is completed

A specific file cabinet will be designated for each subcontract. All documents pertaining to the subcontract will be stored here. The cabinet is fire proof and will be kept locked. The QA manager will hold the keys.

Only validators assigned to the subcontract will handle these data packages. All transfer of data packages will require a signature. When the review process is completed the Log-In notebook, shipping/mailing logbooks will be completed to reflect this. Once the report is received and approved by the client, the data generated from the package will be backed up electronically and stored for two (2) years. A hard copy will also be stored.

QA Program Assessment Procedures

The QA program will be assessed periodically by the QA manager to ensure that all parameters are within control. Corrective action measures will be taken to remedy any out of control criteria. The program will be assessed to ensure that it is fulfilling its intended purpose. The goal of the program will be reviewed and such items as logbooks, worksheets, reports and re-submittals. The results of our assessment will be tallied and statistically assessed to see if there are any established trends.

PERSONNEL

EDV hires qualified professionals. Each validator holds at least a bachelor's degree and has extensive laboratory experience. These validators are highly trained and are competent and fully experienced to work on any subcontract. Upon hire validators embark upon an extensive training program which includes such topics as: quality assurance project plan (QAPP), chain of custody, laboratory procedures, sample preparation methods, analytical methods, instrumentation, chromatogram interpretation and report writing.

Training Progress

Once every six months a refreshers training program is provided for our validators.

FACILITIES AND EQUIPMENT

EDV has the necessary equipment to successfully perform on any subcontract. We are equipped with computers, calculators, adding machines, a typewriter, a copier, a fax machine and scientific calculators. Our computers have a battery operated backup system in the event of a power failure. Our fax machine is operational 24 hours per day, 7days per week.

These equipments are maintained on a schedule of once per year, or on the manufacturer’s suggested schedule. All validators utilize a password to log on to the computer system. This password expires every thirty (30) days, at which point a new one must be selected. All electronic files are backed up on a daily basis. All file cabinets will be locked and the keys secured by the QA manager.

INTERNAL DATA VALIDATION (IDV) PROCEDURES

WHAT IS ANALYTICAL DATA VALIDATION

Analytical data validation is defined as an independent ***systematic*** process for reviewing a body of data against a set of criteria to provide assurance that the level of quality of the data are known and ***documented***. It consists of data screening, checking, auditing, verification and review. It serves two important management functions. First, it reviews the entire data collection, reduction and management process and identifies any errors in the flow of data from the point of generation to the final laboratory report. Second, it compares analytical precision as measured by laboratory duplicates, spikes and calibration standards against guidelines that are available from either analytical method or documents such as EPA's Functional Guidelines

DOCUMENT CONTROL

Tracking Custody-and Storage

For the SDGs and Certificate of Analysis herein after referred to as Data Package, once received by EDV it will be stamped "received" and dated. The data package will then be logged in the Data Package Log-In notebook. It is also logged into the computer system. It will be logged by client's name, contract number, number of samples, sample matrix(ces), analysis type/parameter, date received, turnaround time and validation protocol to be utilized. All this will be done on the same day that the data package is received by EDV. For data packages received on a Saturday, the same process will be in effect.

Upon completion of the receipt process, the data package will then be distributed to tile relevant data validator(s), who must sign to the receipt of the data package and the number of samples in receipt. The validator will then check with the Data Log-In notebook as well as the computer log-ln for such information as turnaround time, validation protocol and any other pertinent information related to the Data Package. Based on the sample type/parameters, the validator will then obtain the required data validation protocol and worksheets to be used for the project. For this project, general data validation worksheets will be used.

The Data Package can be tracked at all times from the Data Log-In notebook or the computer Data Package Log-In The Data Package remains in the custody of the validator until the data review process is completed. The data packages, when not in use and at the end of each workday, will be locked in the designated file cabinet(s). No outdated SOPs will be utilized for validation.

Logbook Maintenance and Archiving Procedures

Logbooks are maintained as per EDV's in house guidelines for Log Book Maintenance. The guidelines are:

No white outs or erasers of any form are to be used in the logbooks.
All errors must be lined through and the corrected item written above.
All corrections must be initialed and dated.
All entries in the logbooks must be signed
All logbook pages must have a heading and the pages sequentially numbered

All logbooks when full are labeled in bold letters across the cover as to the period for which it was used, that is, the start and end date of the logbook. The full (completed) logbook is stored in fire-proof cabinets, which are stored in the Data Storage room.

SOPs Review, Distribution and Revision

All SOPs for the validation process are reviewed periodically and revised when necessary. The revised edition will clearly state what revision number it is. For every revision done, the same number is assigned with the letter R# indicating revision number (e.g. SOP LG 3005 at second revision would be LG3005R2). The numbers are assigned in numeric order starting with the number one. The QA manager must approve the revised and original SOPs. A copy of each SOP is distributed to tile data validators for their files.

Documentation or Technical procedures will be revised as necessary. The QA manager will do all revision. Each revision will be stated on the document. Before any revision can take place management personnel must first discuss it. Once a consensus is reached then the QA manager will perform the revision.

INTERNAL DATA VALIDATION (IDV) METHODOLOGY

IDV Procedures

Upon receipt of the data package from the client, the QA manager will check that the work Release is both technically and contractually correct in its entirety. EDV will verify/ that no conflicting information is present. If conflicting information is found EDV will immediately notify the client in writing (within 48 hrs of discovery) before proceeding further. The data package will be stamped “received" and dated. Once all conflicting information is resolved, the data package will then be logged in the Data Package Log-ln notebook. It will be logged by client's name, contract number, number of samples, sample matrix (ces), analysis type/parameter, date received, turnaround time and validation protocol to be utilized.

Upon completion of the receipt process, the data package will then be assigned and distributed to a qualified data validator to perform data validation on each applicable package. The data validator must sign to the receipt of the data package and the number of samples in receipt. **(Only the data validators listed in the Proposal will be allowed to work on the data** packages}. The validator at this point would have already been briefed on the requirements of this subcontract and will then check with the Data Package Log-In notebook for such information as turnaround time, validation protocol, and any other pertinent information related to the data package. The validators will also cross-check the information with the computer Log-In.

Data is generally validated according to the EPA’s National Functional Guidelines for Organic Data Review, National Functional Guidelines for Inorganic Data Review, DOE Rocky Flats Plant “Radiochemical Data Validation Guidelines – Gross Alpha/Beta by Gas Proportional Counters”, DOE Rocky Flats “Radiochemical Data Validation Guidelines-Analyses by High Resolution Gamma Spectroscopy” and any other relevant modifications of these protocols.

The extent of data validation will be at level IV, which is CLP. All our validation efforts will be documented on worksheets to allow traceability and ensure thoroughness. The worksheets will document any criteria out of limits. Flagging will be done according to the guidelines referenced above. The client will be notified in writing of any contract and or quality assurance criteria, which were not met within 48 hours of discovery. Any corrections made will be done in red ink by drawing a line through the incorrect item, writing the corrected item above, initialing and dating the item.

At the end of the IDV review process, the validation findings will be cross-checked by a secondary validator. If there are discrepancies that cannot be resolved, then a senior validator will check the data package for completeness and accuracy. In the event that the senior validator is unable to find a resolve then, the QA manager will check the package and make a decision. The QA manager will check all data packages. All corrective action measures will be approved by the QA manager regardless of who initiated them. On this subcontract any one of the assigned validators can initiate a corrective measure after discussion with the QA manager.

DATA VALIDATION REPORT

The data validation report will be prepared based on findings. It will then be reviewed and approved by the Project/QA Manger.

'The data validation report will be in a narrative form and will describe justification of the proposed rejection of any results, problems encountered in the preparation of samples, during data validation and associated corrective actions (including telephone logs for the analytical laboratory and EDV/client). A checklist that inventories the major types of documents received for each SDG from the laboratory, as well as any missing documents will be included in the data validation report. The final data validation report will be paginated and will contain the signature of the Project Manager documenting her review and approval of the data package.

DELIVERY OF SUPPLIES/SERVICES (DELIVERABLES)

The client will receive deliverables based on the turnaround times on the data packages. This could be 3, 7, 14 or 30 days.

QA OVERSIGHT

Data QA is assured through various steps that are in place. The purpose of QA is to ensure that the required elements of the quality control plan are met. Spot checks (internal audits) will be done on notebooks, worksheets and data summary tables. Corrective actions are in place for any inconsistencies found during this internal audit. When an internal audit is done, a report is generated and presented to every validator. (In the case of this subcontract, the report will only be presented to the validators assigned to this project)

Once every six months a performance audit will be done; the validators assigned to this subcontract will be given a set of data (of known results) to evaluate and generate a data validation report and data qualification summary, If the outcome is unsatisfactory, then, the deficient areas are identified and corrective action measures taken. These measures could include retraining.

Within the realm of QA, proper reporting procedures must be adhered to. QA reporting goes up the chain of command (see QA management chart). The QA manager has full responsibility of the QA program and has the power to designate responsibilities to each validator.

QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

Corporate Qualifications

Maxine Walters

Maxine Walters has 21 years extensive experience in analytical chemistry. Her expertise in data validation includes all types of parameters such as volatile target compounds (TCL), semi-volatile target compounds, pesticide/PCBs, dioxins & furans, conventional general/wet chemistry, TAL metals, leachate and reactivity characteristics (TCLP) priority pollutants-metals & organics; radiological parameters including gross alpha/beta, gamma spectroscopy parameters; thermal ionization mass spectroscopy, fluorometric uranium, alpha spectroscopy-strontium 89/90; alpha spectrometry- thorium-237, uranium-234, 238, neptunium-237, plutonium-238, 239, 240, americium-241 and curium-242, 243, 244 and, liquid scintillation counting parameters-tritium.

Her other experience includes QA/QC consulting for a variety of private sector clients as well as for state and federal programs, development of QAPPs, SAPs and SOPs for standard and non-standard methods, laboratory training, data usability assessment and general project management.

Professional Qualifications

Ms. Walters has 21 years experience in environmental/analytical chemistry. This includes 16 years extensive experience in analytical data validation (CLP and non-CLP), development of Data Quality Objectives, development of QA/QC and laboratory training programs, remedial investigation/feasibility studies (RI/FS), QAPPs and SAPs development. Ms Walters has 19 years project management experience and 9 years in depth research experience, which includes instrumentation and advance organic chemistry.

Linda Wright

Linda Wright has 15 years extensive experience in analytical chemistry. Her expertise in data validation includes all types of parameters such as volatile target compounds (TCL), semi-volatile target compounds, pesticide/PCBs, dioxins & furans, conventional general/wet chemistry, TAL metals, leachate and reactivity characteristics (TCLP) priority pollutants-metals & organics; radiological parameters including gross alpha/beta gamma spectroscopy parameters; thermal ionization mass spectroscopy, fluorometric uranium, alpha spectroscopy-strontium 89/90; alpha spectrometry- thorium-237, uranium-234, 238, neptunium-237, plutonium-238, 239, 240, americium-241 and curium-242, 243, 244 and, liquid scintillation counting parameters-tritium.

Her other experience includes QA/QC consulting for private sector clients as well as for state and federal programs, development of SOPs for standard and non-standard methods, laboratory training and chemical analyses.

Professional Qualifications

Ms. Wright has 15 years experience in environmental/analytical chemistry. This includes 12 years extensive experience in analytical data validation (CLP and non-CLP). Ms Wright has 7 years project management experience and 5 years environmental/radiochemical analytical chemistry experience, which includes instrumentation and advance organic chemistry.

QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

Gay Webber

Gay Webber has 13 years extensive experience in environmental/analytical chemistry. Her expertise in data validation includes all types of parameters such as volatile target compounds (TCL), semi-volatile target compounds, pesticide/PCBs, PCB-congeners, dioxins & furans, conventional general/wet chemistry, TAL metals, leachate and reactivity characteristics (TCLP) priority pollutants-metals & organics; radiological parameters including gross alpha/beta, gamma spectroscopy parameters; thermal ionization mass spectroscopy, fluorometric uranium, alpha spectroscopy-strontium 89/90; alpha spectrometry- thorium-237, uranium-234, 238, neptunium-237, plutonium-238, 239, 240, americuium-241 and curium-242, 243, 244 and, liquid scintillation counting parameters-tritium.

Professional Qualifications

Ms. Webber has 12 years experience in environmental/analytical chemistry. This includes 7 years extensive experience in analytical data validation (CLP and non-CLP). Ms Webber has 7 years project management experience and 7 years radiochemical data validation experience, which includes instrumentation.

Beverly King

Beverly King has 15 years extensive experience in environmental/analytical chemistry. Her expertise in data validation includes all types of parameters such as volatile target compounds (TCL), semi-volatile target compounds, pesticide/PCBs, PCB-congeners, dioxins & furans, conventional general/wet chemistry, TAL metals, leachate and reactivity characteristics (TCLP) priority pollutants-metals & organics. Radiological parameters including gross alpha/beta and liquid scintillation counting parameter-tritium.

Professional Qualifications

Ms. King has 15 years experience in environmental/analytical chemistry. This includes 12 years extensive experience in analytical data validation (CLP and non-CLP). Ms. King has 7 years project management experience and 4 years radiochemical data validation experience, which includes instrumentation.

Denise L. McGuire

Experience Summary

Denise McGuire has 15 years extensive experience in analytical chemistry, laboratory audits and general QA/QC data management. Her expertise in data validation includes all types of parameters such as volatile target compounds (TCL), semi-volatile target compounds, pesticide/PCBs, PCB-congeners, dioxins & furans, conventional general/wet chemistry, TAL metals, TCLP, priority pollutants-metals & organics; radiological parameters including gross alpha/beta gamma spectroscopy parameters; thermal ionization mass spectroscopy, fluorometric uranium, alpha spectroscopy-strontium 89/90; alpha spectrometry- thorium-237, uranium-234, 238, neptunium-237, plutonium-238, 239, 240, americium-241 and curium-242, 243, 244 and, liquid scintillation counting parameters-tritium.

She has extensive experience in the environmental consulting and laboratory services field. This experience has included data validation experience interpreting organic, inorganic, radiological, and chemical warfare agent analytical data; managing and procuring subcontracted analytical laboratories; coordinating field sampling crews; generation and review of site-specific Field Sampling Plans, Quality

QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR DATA VALIDATION SERVICES

Assurance Project Plans (QAPPs), Standard Operating Procedures (SOPs), and Remedial Investigation/Feasibility Study (RI/FS) and Data Validation reports; field data collection and environmental sampling; training and supervision of technical personnel; and field and laboratory auditing. In addition, I have designed a data management system for all projects producing analytical data. The data management system ensures quality data by incorporating quality assurance procedures, data tacking, documentation, and multitask data usage.

APPENDIX C

Phase II ESA dated October 17, 2013

day
DAY ENVIRONMENTAL, INC.
AN AFFILIATE OF DAY ENGINEERING, P.C.

October 17, 2013

Adam S. Walters, Esq.
Partner
Phillips Lytle LLP
3400 HSBC Center
Buffalo, NY 14203

Attorney-Client Privileged and Confidential
Prepared at the Request of Counsel

RE: Preliminary Phase II Environmental Site Assessment
119 Franklin Street, 211 Franklin Street, 202 Franklin Street and 120 West Cornell Street
Olean, New York

Dear Mr. Walters:

Day Environmental, Inc. (DAY) prepared this report describing the results of a preliminary Phase II Environmental Site Assessment (Phase II ESA or study) completed on the property addressed 119 Franklin Street, 211 Franklin Street, 202 Franklin Street and 120 West Cornell Street, Olean, New York (the Site). A project locus map identifying the location of the Site is included as Figure 1.

BACKGROUND

The Site consists of four contiguous parcels of land totaling approximately 14.28 acres. The four parcels that comprise the Site include:

1) 119 Franklin Street (SBL # 94.040-1-20): An approximate 0.19-acre parcel of vacant land.

2) 202 Franklin Street (SBL # 94.040-1-21): An approximate 8.41-acre parcel of land that includes a parking lot, vacant ground, and an athletic field (i.e., Hysol Park).

3) 211 Franklin Street (SBL #94.040-1-21): An approximate 5.54-acre parcel of land, improved with an approximate 280,000-square foot, two-story industrial building with a partial basement.

4) 120 West Connell Street (SBL # 94.040-1-22): An approximate 0.14-acre parcel of vacant land.

The four parcels identified above are currently owned by Goodban Belt LLC (Goodban Belt), and SolEpoxy, Inc., founded in 2010, currently leases the property from Goodban Belt and operates a manufacturing facility on the southern portion of the Site (i.e., the 211 Franklin Street parcel). Products currently manufactured by SolEpoxy include epoxy-molding compounds, insulating coating powders and optically clear molding compounds primarily for use in electrical components. The Site has a long history of industrial usage dating back to the at least 1886. In addition, industrial activities and oil storage facilities with numerous railroad lines to service such operations are/were prevalent in the area surrounding the Site. The Site is part of approximate 500-acre parcel of land that has been designated as a Brownfield Opportunity Area (BOA) due to historic industrial operations.

A Phase I Environmental Site Assessment (Phase I ESA) completed at the Site in October 2013 by DAY identified the following recognized environmental conditions (RECs).

- REC #1 – Historical industrial usage of the Site, including:
    - Industrial manufacturing activities at the Site since at least 1886;
    - Use of chemical and petroleum storage tanks;
    - Use of basements and subsurface vaults for possible chemical waste storage or disposal; and
    - Drain discharges that could contain waste materials generated during past manufacturing operations.

- REC #2 – Potential contaminant migration from off site sources

LIMITATIONS

The findings and conclusions presented in this report are based upon an evaluation of a limited number of samples collected during this study and DAY's interpretation of this data. Conditions between sample locations may vary and, as such, the findings and conclusions presented herein should be considered as a professional opinion. If additional data becomes available in the future, it may be necessary to re-evaluate the opinions expressed in this report.

PHASE II ESA FIELDWORK AND ANALYTICAL LABORATORY TESTING

Between September 10, 2013 and September 13, 2013, test borings designated TB-01 through TB-07 were advanced using a combination of direct-push and rotary drilling methods. Upon completion of drilling, 1-inch diameter monitoring wells constructed of flush-coupled polyvinyl chloride (PVC) well screens and risers were installed in test borings TB-01 through TB-05. The table below summarizes the test borings/monitoring wells completed as part of this preliminary Phase II ESA.

Test Boring	**Monitoring Well**	**Ground Surface Elevation[1] (feet)**	**Bottom of Test Boring (feet bgs)**	**Screened Interval (feet bgs)**
TB-01	MW-A	95.66	27.0	15.9 – 25.9
TB-02	MW-B	97.84	28.0	18.0 – 28.0
TB-03	MW-C	98.26	28.0	18.0 – 28.0
TB-04	MW-D	99.28	30.0	20.0 – 30.0
TB-05	MW-E	101.91	33.0	23.0 – 33.0
TB-06	--	Not Measured	12.0	N/A
TB-07	--	Not Measured	4.0	N/A

[1] Ground elevation measured to an arbitrary site datum of 100.00 feet established on the rim of a bollard located at the northwest corner of the 211 Franklin Street parcel.

The locations of test boring TB-01 through TB-07 and monitoring wells MW-A through MW-E are presented on the Site Plan included as Figure 2.

Soil samples collected during the advancement of the test borings were observed to evaluate stratigraphic conditions, and for evidence of potential environmental impact (e.g., staining, unusual odors, etc.). In addition, a photoionization detector (PID) was used to scan the air space above the samples collected. Copies of test boring logs for TB-01 through TB-07 that summarize subsurface conditions and PID measurements are included in Attachment A. Monitoring well installation diagrams for MW-A through MW-E are also included in Attachment A.

On September 19, 2013 groundwater monitoring wells MW-A though MW-E were developed for the purpose of removing sediment that accumulated in the well casing during drilling in preparation for sampling. Upon completion, the groundwater in each well was allowed to recharge to pre-development levels before groundwater samples were collected from each monitoring well for subsequent testing. In-situ measurements made at the time of groundwater sampling are summarized below.

WELL ID	TEMP (^{O}C)	pH (su)	ORP (mV)	CONDUCTIVITY (ms/cm)	PID (ppm)	TURBIDITY (NTU)	VISUAL OBSERVATIONS
MW-A	14.8	6.97	-144	0.94	275	>800	Very Cloudy, Chemical Odor, Gray/Black, Petroleum Sheen
MW-B	16.0	6.92	-150	2.13	61.5	>800	Very Cloudy, Chemical Odor, Gray/Black, Petroleum Sheen
MW-C	13.5	7.27	-37	1.21	0.0	>800	Very Cloudy, (opaque) No Odor
MW-D	15.4	7.10	-121	1.43	115	>800	Gray/Black Chemical Odor, Petroleum Sheen
MW-E	14.8	7.22	-18	1.60	0.9	>800	Cloudy, Brown, No Odor

Analytical Laboratory Testing

Select soil samples from the test borings advanced during this study and groundwater samples from each of the monitoring wells installed during this study were submitted for testing by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified analytical laboratory. Specifically, soil samples were delivered under chain-of-custody control to ALS Group USA, Corp. dba ALS Environmental (ALS) in Rochester, New York. Groundwater samples were delivered under chain-of-custody control to Spectrum Analytical Inc. (Spectrum) in Agawam, Massachusetts. The samples submitted for testing and the test parameters are summarized on Table 1 *Phase II Environmental Site Assessment, 211 Franklin Street, Olean, New York, Analytical Laboratory Testing Program.* Copies of the analytical laboratory reports prepared by the analytical laboratories, and executed chain-of-custody documentation, are included in Attachment B.

The analytical laboratory results for the samples tested as part of this Phase II ESA are summarized on the following tables. These tables also include applicable regulatory standards/guidance values and/or cleanup objectives.

Table 2a	*Summary of Detected Volatile Organic Compounds (VOCs) and TICs: Soil Samples*
Table 2b	*Summary of Detected VOCs and TICs: Groundwater Samples*
Table 3a	*Summary of Detected Semi-Volatile Organic Compounds (SVOCs) and TICs: Soil/Fill Samples*
Table 3b	*Summary of Detected SVOCs: Groundwater Samples*
Table 4a	*Summary of TAL Metals + Cyanide: Soil Sample*
Table 4b	*Summary of TAL Metals + Cyanide: Groundwater Samples*

FINDINGS

This section describes the findings of the Phase II ESA based upon the work conducted to date.

Subsurface Conditions

Fill material/reworked soil was encountered in each of the test boings advanced for this study beginning at the ground surface with the exception of TB-05, which was installed though approximately 0.5 feet (ft.) of concrete floor in the warehouse portion of the 211 Franklin Street building. The fill material/reworked soil encountered in TB-01 through TB-07 extended to depths ranging from about 0.5 ft. below ground surface (bgs) in TB-1 to about 11 ft. bgs in TB-05. The fill material typically consisted of reworked soil comprised primarily of sand and gravel intermixed in some locations with brick fragments (i.e., within samples collected from test borings TB-01, TB-02, TB-05, and TB-07), ash (TB-02), concrete fragments (TB-05 and TB-07), apparent epoxy resin residue (TB-07) or coal residue (TB-07). Indigenous soil encountered below the fill generally consisted of fine to coarse sand and fine to coarse gravel, with suspected larger aggregate (e.g. cobbles, boulders). Equipment refusal (i.e., refusal of the direct-push drilling equipment) was encountered in test boring TB-06 at 12.0 ft. bgs. The remaining test borings were advanced to depths between 4 feet bgs (TB-07) and 33 feet bgs (TB-05) without encountering refusal. However, test borings TB-01 and TB-02 had to be offset several feet and re-advanced after encountering suspected larger aggregate in the native soils at depths of approximately 10 feet bgs and 12 feet bgs, respectively. [Note: Test borings TB-01 through TB-05 were initially advanced via direct-push drilling methods, and upon encountering refusal with the direct-push equipment the test borings were subsequently advanced via rotary drilling methodologies and sampled using split spoons.]

Evidence of potential environmental impact (i.e., petroleum-like odors and elevated PID readings) was identified during the advancement of test borings TB-01, TB-02, and TB-04. Specifically, beginning at a depth of about 20 ft. bgs PID readings in excess of 100 parts per million (ppm) were measured above soil samples collected from test boring TB-01, and these samples exhibited a petroleum-like odor. A maximum PID reading of 121 ppm was measured above the bottom-most sample collected from test boring TB-01 at a depth of about 26 ft. bgs, and this sample exhibited petroleum-like odors. The samples collected from test boring TB-02 contained petroleum-like odors, and elevated PID readings, beginning at a depth of about 18.0 ft. bgs. A maximum PID reading of 701 ppm was measured above the bottom-most sample collected from test boring TB-02, at a depth of about 26 ft. bgs, and this sample exhibited petroleum-like odors. The samples collected from test boring TB-04 began to exhibit petroleum-like odors, and elevated PID readings, at a depth of about

26 ft. bgs. A maximum PID reading of 279 ppm was measured above the bottom-most sample collected from test boring TB-04, at a depth of about 29 ft. bgs, and this sample exhibited petroleum-like odors. Apparent field evidence of environmental impact was not observed in the other test borings advanced during this study. Test boring TB-07 was advanced in an area of an approximate 0.1 foot thick layer of a hard solid black substance. However, the soil below the hard solid black substance did not exhibit apparent field evidence of impact.

As shown on Table 2a, the soil sample TB-02 (24’) contained detectable concentrations of methylcyclohexane and tert-butylbenzene and soil sample TB-04 (30’) contained no detectable concentrations of target list VOCs. However, the both samples TB-02 (24’) and TB-04 (30’) contained potentially elevated total concentrations of tentatively identified volatile organic compounds (TICs) of 155.2 mg/kg or parts per million (ppm) and 95.1 ppm, respectively. The concentration of the tert-butylbenzene detected in the sample TB-02(24’) does not exceed the Unrestricted Use SCO. [Note: to date, the NYSDEC has not published a SCO for methylcyclohexane, and a SCO has not been established for TICs.]

As shown in Table 3a, several target list SVOCs (i.e., primarily polyaromatic hydrocarbons, PAHs) were detected in soil samples TB-02 (24’), TB-04 (30’), and TB-07 (3’), at concentrations below their respective Unrestricted Use SCOs. The soil samples TB-02 (24’) and TB-04 (30’) contained total concentrations of TICs of 56.6 ppm and 14.44 ppm respectively. The soil sample TB-07 (3’) did not contain detectible concentrations of TICs.

As shown in Table 4a, the concentrations of the TAL Metals detected in the soil sample TB-02 (24’) do not exceed their respective Unrestricted Use SCOs. Cyanide was not detected in the soil sample TB-02 (24’) at a concentration greater than the laboratory detection limit of 0.094 ppm.

Note: Soil sample TB-02 (24’) was tested for the presence of polychlorinated biphenyls (PCBs). However, PCBs were not detected in soil sample TB-02 (24’) at concentrations above the laboratory method detection limit of 0.019 ppm.

Groundwater

On September 25, 2013, groundwater levels were measured in monitoring wells MW-A though MW-E. Figure 3 includes the calculated groundwater elevation determined for each location referenced to an arbitrary site-wide datum and the groundwater contours for the September 25, 2013 measurements. As depicted on Figure 3, groundwater flow in the area of the Site is generally toward the southeast. This flow direction could be locally modified by nearby pumping, subsurface structures, or other factors.

As shown on Table 2b, the groundwater samples collected from monitoring well MW-A though MW-E on September 19, 2012 contained detectable concentrations of one or more of the target list VOCs: acetone, 2-butanone (MEK), sec-butyl benzene, tert-butylbenzene, naphthalene, and toluene. The concentrations of tert-butylbenzene in MW-A and MW-B exceed the Class GA standard of 5 ug/l or parts per billion (ppb), and the concentration of acetone in MW-B exceed the Class GA guidance value of 50 ppb. The concentrations of the other target list VOCs detected in the groundwater samples from MW-A through MW-E do not exceed their respective Class GA standards or guidance values. In addition, groundwater samples MW-A, MW-B, and MW-D contained total concentrations of TICs of 122.2 ppb, 615,200 ppb and 60.2 ppb, respectively.

As shown on Table 3b, the SVOCs bis(2-ethylhexyl)phthalate and di-n-butyl phthalate were detected in the groundwater sample collected from MW-E on September 19, 2013, but the concentrations do not exceed their respective groundwater standards.

As shown on Table 4b, TAL Metals in both groundwater samples tested. The concentrations of the following TAL metals, detected in groundwater sample collected from MW-B on September 19, 2013, exceed their respective Class GA standards or guidance values: arsenic, barium, beryllium, chromium, copper, iron, magnesium, manganese, sodium, nickel, lead, thallium, and zinc. The concentrations of the following TAL metals, detected in groundwater sample collected from MW-D on September 19, 2013, exceed their respective Class GA standards or guidance values: chromium, iron, magnesium, manganese, sodium, and lead.

Total petroleum hydrocarbons (TPH)[1] measured in the groundwater samples tested, are summarized below:

MW-A = 139 mg/l or ppm;
MW- B = 483 mg/l;
MW- C = Not detected at a concentration greater than 0.06 mg/l;
MW- D = 7.3 mg/l; and
MW- E = Not detected at a concentration greater than 0.05 mg/l.

The laboratory reported the above concentrations as ‘unidentified petroleum product’. However, the laboratory indicated that the GC fingerprint of the petroleum product identified in the groundwater samples tested was similar to #2 Fuel Oil, Ligroin (e.g., mineral spirits, petroleum naphtha, vm&p naphtha, etc.), and/or or other oil, including lubricating and cutting oil, and silicon oil.

QA/QC Results

Quality assurance and quality control measures implemented by Spectrum, and ALS are described in the Analytical Data Packages prepared for the samples tested as part of this study (refer to Attachment B). As indicated in the Analytical Data Packages, the laboratory results are within the applicable acceptable ranges and thus “acceptable”. In addition, a trip blank accompanied the groundwater sample containers from the laboratory and, upon return, was tested for TCL VOCs + TICs. Target list VOCs were not detected in the trip blank at concentrations above the laboratory method detection limits. One TIC, identified as 2-2-chloroethoxy-ethanol was reported at a concentration of 1.5 ppb in the Trip Blank. Based upon the above considerations, the analytical laboratory data generated during this study is considered to be acceptable for use during this study.

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[1] No regulatory standard or guidance values have been established for TPH. This test is used to evaluate the nature of the petroleum products and relative concentrations.

CONCLUSIONS AND RECOMMENDATIONS

Based upon this preliminary Phase II ESA it is concluded that:

- Historical uses of the Site and adjoining properties (i.e., identified as REC #1 and REC #2 in the Phase I ESA report) remain RECs for the reasons described below:
  - Evidence of apparent contamination (i.e., petroleum-type odors and elevated PID readings) was encountered within the saturated soil in test borings TB-01, and TB-02, and TB-04.
  - Soil samples collected from below the top of the apparent ground water table in test borings TB-02 and TB-04 contained non-target VOC compounds (i.e., TICs) at concentrations of 155.2 mg/Kg (or ppm) and 95.1 ppm (respectively) and non-target SVOC compounds (TICs) at concentrations of 14.44 ppm and 56.6 ppm, respectively. Groundwater samples collected from these locations (i.e., MW-B and MW-D, respectively) contained non-target VOC compounds (TICs) at concentrations of 0.0602 and 615.2 mg/l or ppm, respectively. A saturated soil sample from TB-01 was not tested for VOCs. However, a groundwater sample collected from this location (MW-A) contained concentration of non-target VOC compounds (TICs) at a concentration of 0.1222 ppm.
  - The concentrations of the VOC tert-butylbenzene in the groundwater samples collected from MW-A (i.e., 5.38 ug/l or ppb) and MW-B (3,130 ppb) exceed the Class GA standard of 5 ppb. In addition, the concentration of acetone in the groundwater sample collected from MW-B (i.e., 4,260 ppb) exceeds the Class GA guidance value of 50 ppb.
  - A groundwater sample collected from monitoring well MW-B contained concentrations of the metals arsenic, barium, beryllium, chromium, copper, iron, magnesium, manganese, sodium, nickel, lead, thallium, and zinc that exceeded applicable groundwater standards/guidance values established by the NYSDEC.

Based on the contaminants detected in the samples tested during this study, it appears that the groundwater and saturated soil are impacted by a combination of petroleum products, metals, acetone, and potentially other constituents. While the source of the contamination detected has not been conclusively determined, additional study is required to evaluate the nature and extent of the contamination identified at the Site.

Future studies, and possible remediation, should be conducted per NYSDEC requirements. This Site appears to be a candidate for inclusion in the Brownfield Cleanup Program (BCP), and consideration should be given to conducting future studies and remedial activities within this program.

If there are questions regarding this report, please contact this office.

Very truly yours,
Day Environmental, Inc.

Raymond L Kampff

Raymond Kampff
Associate Principal

Figures
- Figure 1: Project Locus Map
- Figure 2: Site Plan depicting test locations
- Figure 3: Groundwater Contour Map for September 25, 2013

Tables
- Table 1: Analytical Laboratory Testing Program
- Table 2a: Summary of Detected Volatile Organic Compounds (VOCs) and TICs: Soil Samples
- Table 2b: Summary of Detected VOCs and TICs: Groundwater Samples
- Table 3a: Summary of Detected Semi-Volatile Organic Compounds (SVOCs) and TICs: Soil/Fill Samples
- Table 3b: Summary of Detected SVOCs: Groundwater Samples
- Table 4a: Summary of TAL Metals + Cyanide: Soil Sample
- Table 4b: Summary of TAL Metals + Cyanide: Groundwater Samples

Attachments
- Attachment A: Test Boring Logs/Monitoring Well Installation Diagrams
- Attachment B: Analytical Laboratory Report/ Chain-of-Custody Documentation

CAH0658/4884S-13

FIGURES

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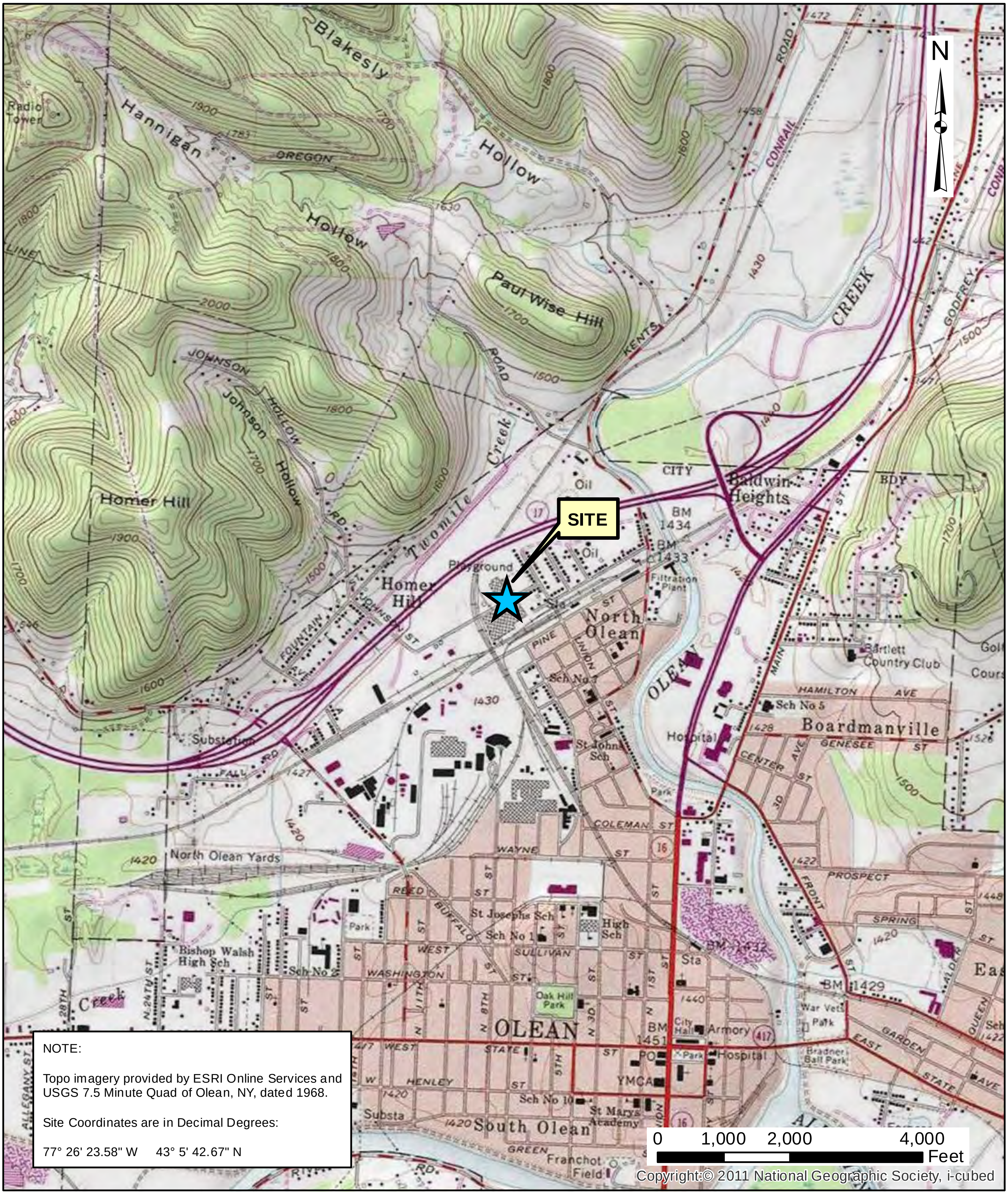
Last Date Saved: 10 Oct 2013



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NOTE:

Topo imagery provided by ESRI Online Services and USGS 7.5 Minute Quad of Olean, NY, dated 1968.

Site Coordinates are in Decimal Degrees:

77° 26' 23.58" W 43° 5' 42.67" N

Date 09-19-2013	**day** **DAY ENVIRONMENTAL, INC.** **Environmental Consultants** **Rochester, New York 14606** **New York, New York 10170**	Project Title 211 FRANKLIN STREET, OLEAN, NEW YORK PHASE II ENVIRONMENTAL SITE ASSESSMENT	Project No. 4884S-13 FIGURE 1
Drawn By CPS		Drawing Title Project Locus Map	
Scale AS NOTED			

NOTE:

Test borings and monitoring wells were tape-measured in the field based on existing site features. These locations are to be considered approximate.

Property boundaries are approximate.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

DESIGNED BY	DATE
RLK	09-2013
DRAWN BY	DATE DRAWN
CPS	09-2013
SCALE	DATE ISSUED
AS NOTED	09-16-2013

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

PHASE II ENVIRONMENTAL SITE ASSESSMENT

Drawing Title
Site Plan

Project No.
4884S-13

FIGURE 2

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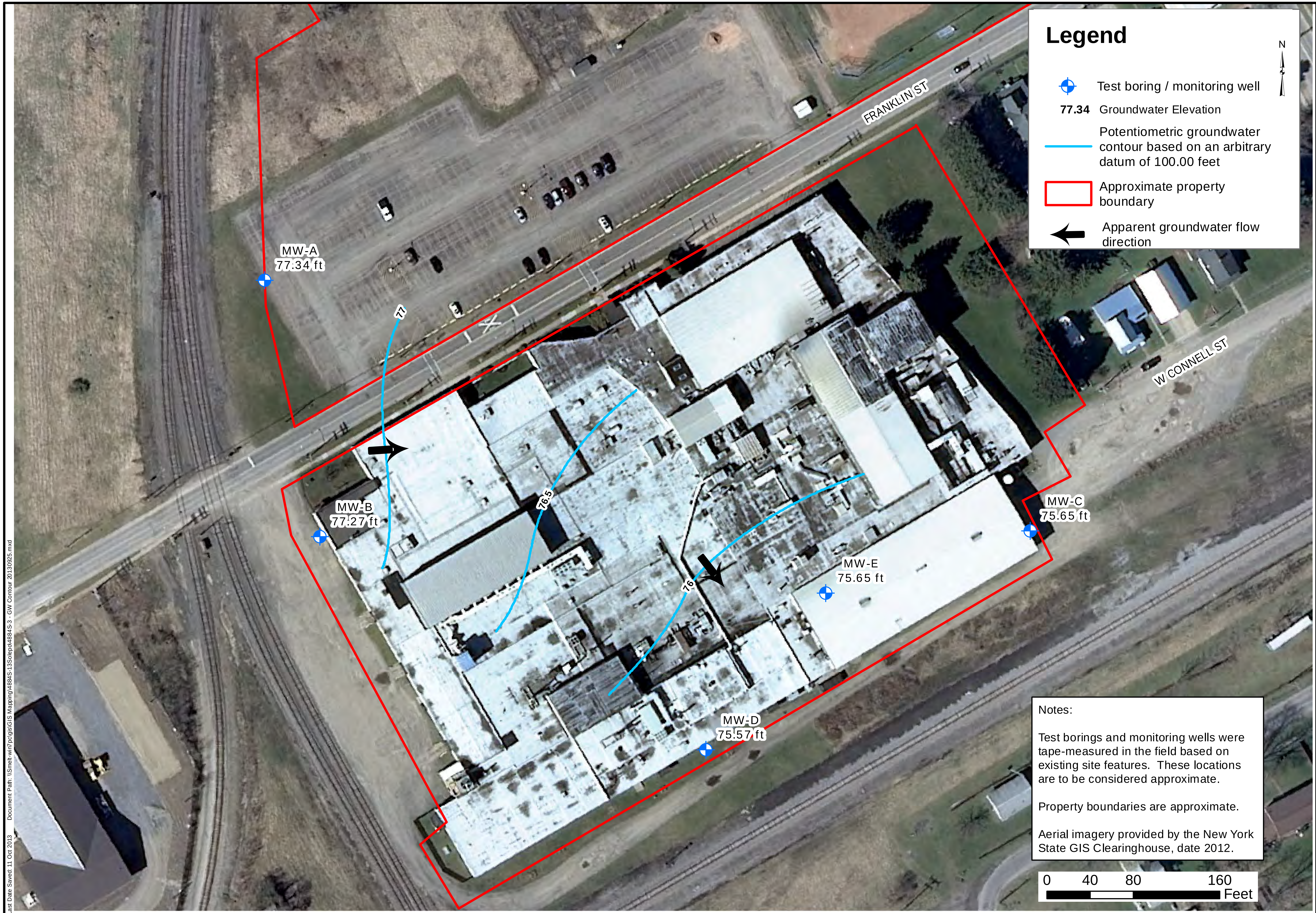

Legend

Test boring / monitoring well

77.34 Groundwater Elevation

Potentiometric groundwater contour based on an arbitrary datum of 100.00 feet

Approximate property boundary

Apparent groundwater flow direction

Notes:

Test borings and monitoring wells were tape-measured in the field based on existing site features. These locations are to be considered approximate.

Property boundaries are approximate.

Aerial imagery provided by the New York State GIS Clearinghouse, date 2012.

DESIGNED BY	DATE
RLK	10-2013
DRAWN BY	DATE DRAWN
CPS	10-2013
SCALE	DATE ISSUED
AS NOTED	10-08-2013

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
211 FRANKLIN STREET
OLEAN, NEW YORK

PHASE II ENVIRONMENTAL SITE ASSESSMENT

Drawing Title
Groundwater Contour Map for September 25, 2013

Project No.
4884S-13

FIGURE 3

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TABLES

Table 1
Phase II Environmental Site Assessment
211 Franklin Street
Olean, NY

Analytical Laboratory Testing Program

Sample Designation	Date Sampled	Matrix	Test Parameters
TB-02 (24')	9/11/2013	Soil	TCL VOCs + TICs, TCL SVOCs + TICs, PCBs, TAL Metals + Cn
TB-04 (30')	9/12/2013	Soil	TCL VOCs + TICs, TCL SVOCs + TICs
TB-07 (3')	9/13/2013	Soil	TCL SVOCs + TICs
MW-A	9/19/2013	Groundwater	TCL VOCs + TICs, TCL SVOCs + TICs, TPH
MW-B	9/19/2013	Groundwater	TCL VOCs + TICs, TCL SVOCs + TICs, TAL Metals + Cn, TPH
MW-C	9/19/2013	Groundwater	TCL VOCs + TICs, TPH
MW-D	9/19/2013	Groundwater	TCL VOCs + TICs, TCL SVOCs + TICs, TAL Metals + Cn, TPH
MW-E	9/19/2013	Groundwater	TCL VOCs + TICs, TCL SVOCs + TICs, TPH

Notes:

TCL VOCs = United States Environmental Protection Agency (USEPA) Target Compound List (TCL) Volatile Organic Compounds by USEPA Method 8260

TICs = Tentatively Identified Compounds

TCL SVOCs = USEPA TCL Semi-Volatile Organic Compounds (SVOCs) by USEPA Method 8270

PCBs = Polychlorinated biphenyls (PCBs) by United States Environmental Protection Agency (USEPA) Method 8082A

TAL Metals = USEPA Target Analyate List (TAL) Metals

THP = Total Petroleum Hydrocarbons

Cn = Cyanide

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PREPARED AT THE REQUEST OF COUNCIL
10/14/2013

Table 2a
Phase II Environmental Site Assessment
211 Franklin Street
Olean, NY

Summary of Detected Volatile Organic Compounds (VOCs) and TICS

Soil Samples

Compound	**Unrestricted SCO** (1)	**Restricted Industrial SCO** (2)	**Test Location and Sample Date**	
			TB-02 (24') 9/11/2013	TB-04 (30') 9/12/2013
Methylcyclohexane	NS	NS	2.7	ND (0.044)
tert-Butylbenzene	5.9	1000	0.16 J	ND (0.056)
Total TICs	NS	NS	155.2	95.1

Notes:

All results and SCO values are in parts per million (ppm)

J = Estimated concentration

ND (0.044) = Not detected at a concentration greater than the laboratory Method Detection Limit shown in parenthesis

NS = No Standard

(1) = Soil Cleanup Objective (SCO) for Unrestricted Use as referenced in 6 NYCRR Part 375 dated 12/14/06.

(2) = Soil Cleanup Objective (SCO) for Restricted Industrial Use as referenced in 6 NYCRR Part 375 dated 12/14/06.

TIC = Tentatively Identified Compound

The compond decahydro-2-methyl-Naphthalene was tentaively identified as a VOC in soil sample TB-12 (30') and TB-15A (24').

Table 2b
Phase II Environmental Site Assessment
211 Franklin Street
Olean, NY

Summary of Detected Volatile OrganicCompounds (VOCs) and Tentatively Identified Compounds (TICs)

Groundwater Samples

Compound	**Groundwater Standard or Guidance Value (1)**	MW-A 09/19/13	MW-B 09/19/13	MW-C 09/19/13	MW-D 09/19/13	MW-E 09/19/13
Acetone	50	10.1	4,260 J,D	ND (2.56)	ND (2.56)	9.53 J
2-Butanone (MEK)	50	2.4 J	ND (1,930) D	ND (1.93)	ND (1.93)	ND (1.93)
sec-Butylbenzene	5	ND (0.82)	ND (820) D	ND (0.82)	1.05	ND (0.82)
tert-Butylbenzene	5	5.38	3,130 D	ND (0.74)	1.90	ND (0.74)
Naphthalene	10	0.59 J	ND (579) D	ND (0.58)	ND (0.58)	ND (0.58)
Toluene	5	ND (0.81)	ND (812) D	0.84 J	ND (0.81)	ND (0.81)
Total TICs	NS	122.2	615,200	None	60.2	None

Notes:

All values reported in µg/l or parts per billion (ppb)

(1) = Groundwater standard or guidance value as referenced in NYSDEC TOGS 1.1.1 dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000

NS = No Standard or Guidance Value

ND (0.82) = Not detected at concentrations above the analytical laboratory detection limits shown in parenthesis

D = Data reported from a dilution

J = Estimated value

5.38 = Exceeds groundwater standard or guidance value

Table 3a
Phase II Environmental Site Assessment
211 Franklin Street
Olean, NY

Summary of Detected Semi-Volatile Organic Compounds (SVOCs) and TICS

Soil Samples

Compound	Unrestricted SCO (1)	Restricted Industrial SCO (2)	Test Location and Sample Date		
			TB-02 (24') 9/11/2013	TB-04 (30') 9/12/2013	TB-07 (3') 9/13/2013
Benz(a)anthracene	1	11	ND (0.056)	ND (0.057)	0.260 J
Benzo(a)pyrene	1	1.1	ND (0.061)	ND (0.061)	0.420 J
Benzo(b)fluoranthene	1	11	ND (0.088)	ND (0.089)	0.360 J
Benzo(g,h,i)perylene	100	1,000	ND (0.069)	ND (0.070)	0.360 J
Benzo(k)fluoranthene	0.8	110	ND (0.065)	ND (0.066)	0.350 J
Bis(2-ethylhexyl) Phthalate	NS	NS	0.180 J	0.080 J	ND (0.170)
Chrysene	1	110	0.057 J	ND (0.052)	0.290 J
Fluoranthene	100	1,000	ND (0.058)	ND (0.059)	0.450 J
Indeno(1,2,3-cd)pyrene	0.5	11	ND (0.060)	ND (0.061)	0.300 J
Phenanthrene	100	1,000	0.350 J	ND (0.050)	0.240 J
Pyrene	100	1,000	ND (0.070)	ND (0.071)	0.400 J
Total TICs	NS	NS	56.6	14.44	ND

Notes:

All results and SCO values are in parts per million (ppm)

J = Estimated concentration

ND (0.070) = Not detected at a concentration greater than the laboratory Method Detection Limit shown in parenthesis

NS = No Standard

(1) = Soil Cleanup Objective (SCO) for Unrestricted Use as referenced in 6 NYCRR Part 375 dated 12/14/06.

(2) = Soil Cleanup Objective (SCO) for Restricted Industrial Use as referenced in 6 NYCRR Part 375 dated 12/14/06.

TIC = Tentatively Identified Compound

The compond decahydro-2-methyl-Naphthalene was tentaively identified as a SVOC in soil sample TB-12 (30') and TB-15A (24').

Table 3b
Phase II Environmental Site Assessment
211 Franklin Street
Olean, NY

Summary of Detected Semi-Volatile OrganicCompounds (SVOCs)

Groundwater Samples

Compound	**Groundwater Standard or Guidance Value**$^{(1)}$	MW-A 09/19/13		MW-B 09/19/13		MW-C 09/19/13		MW-D 09/19/13		MW-E 09/19/13	
Bis(2-ethylhexyl)phthalate	5	ND (56.7)	D	ND (123)	D	NT		ND (1.05)		1.44	J
Di-n-butyl phthalate	50	ND (52.2)	D	ND (123)	D	NT		ND (0.969)		4.07	J

Notes:

All values reported in µg/l or parts per billion (ppb)

(1) = Groundwater standard or guidance value as referenced in NYSDEC TOGS 1.1.1 dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000

ND (56.7) = Not detected at concentrations above the analytical laboratory detection limits shown in parenthesis

D = Data reported from a dilution

J = Estimated value

Table 4a
Phase II ESA
211 Franklin Street
Olean, NY

Summary of Detected Target Analyate List (TAL) Metals

Soil Samples

Analyate	**Unrestricted SCO** [(1)]	**Restricted Industrial SCO** [(2)]	TB-02 (24') 9/11/2013
Aluminum	NS	NS	5580
Arsenic	13	16	6.7
Barium	350	10,000	34.5
Calcium	NS	NS	42,200
Chromium	30	6,800	22
Copper	50	10,000	15.3
Iron	NS	NS	15,900
Lead	63	3,900	9.2
Manganese	1,600	10,000	697
Nickel	30	10,000	10.9
Potassium	NS	NS	619
Vanadium	NS	NS	9.8
Zinc	109	10,000	51.6

Notes:

All results and SCO values are in parts per million (ppm)

NS = No Standard

(1) = Soil Cleanup Objective (SCO) for Unrestricted Use as referenced in 6 NYCRR Part 375 dated 12/14/06.

(2) = Soil Cleanup Objective (SCO) for Restricted Industrial Use as referenced in 6 NYCRR Part 375 dated 12/14/06.

Table 4b
Phase II Environmental Site Assessment
211 Franklin Street
Olean, NY

Summary of Detected Target Analyte List (TAL) Metals

Groundwater Samples

Analyte	**Groundwater Standard or Guidance Value(1)**	MW-A 09/19/13	MW-B 09/19/13	MW-C 09/19/13	MW-D 09/19/13	MW-E 09/19/13
Aluminum	NS	NT	588,000	NT	28,900	NT
Arsenic	25	NT	1,030	NT	46	NT
Barium	1,000	NT	5,860	NT	42.8	NT
Beryllium	3	NT	25.7	NT	1.6 J	NT
Calcium	NS	NT	2,840,000 D	NT	288,000 D	NT
Cobalt	NS	NT	484	NT	23.3	NT
Chromium	50	NT	2,140	NT	57.4	NT
Copper	200	NT	2,050	NT	167	NT
Iron	300	NT	1,220,000	NT	59,800	NT
Potassium	NS	NT	94,500	NT	9,800	NT
Magnesium	35,000	NT	557,000 D	NT	67,900	NT
Manganese	300	NT	59,500 D	NT	2,730	NT
Sodium	20,000	NT	191,000	NT	98,000	NT
Nickel	100	NT	1,120	NT	57.8	NT
Lead	25	NT	1,850	NT	78.4	NT
Thallium	0.5	NT	48.5 J	NT	ND (2.9)	NT
Vanadium	NS	NT	846	NT	47.2	NT
Zinc	2,000	NT	6,560	NT	471	NT
Mercury	0.7	NT	0.49 J	NT	ND (0.08)	NT
Cyanide	200	NT	ND (3.6)	NT	ND (3.6)	NT

Notes:

All values reported in µg/l or parts per billion (ppb)

(1) = Groundwater standard or guidance value as referenced in NYSDEC TOGS 1.1.1 dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000

NS = No Standard or Guidance Value

ND (3.6) = Not detected at concentrations above the analytical laboratory detection limits shown in parenthesis

D = Data reported from a dilution

J = Estimated value

NT = Not Tested

2,140 = Exceeds groundwater standard or guidance value

ATTACHMENT A

TEST BORING LOGS

AND

MONITORING WELL INSTALLATION DIAGRAMS

Test Boring TB-01

Page 1 of 2

Project #:	4884S-13	Ground Elevation:	
Project Address:	211 Franklin Street Olean, NY	Datum:	
DAY Representative:	Z. Tennies	Date Started:	9/10/2013
Drilling Contractor:	Applus	Date Ended:	9/10/2013
Sampling Method:	Direct Push & Split Spoon	Borehole Depth:	27.0'
		Borehole Diameter:	4"

Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings

Water Level (Date): 18.8' (9/10/13) through augers

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
							0.0	Brown, fine to medium Sand, some Roots, little Red Brick (FILL)	**Monitoring Well MW-A**
1							0.0	Brown-Red, fine to medium SAND, little coase Gravel, damp	
	NA	S-1	0-4	69	NA	NA			
2							0.0		
3							0.0	...Gray-Black, trace fine Gravel	
4							0.0	Gray-Brown, SAND, trace fine Gravel, damp	
5							0.0		
	NA	S-2	4-8	38	NA	NA			
6							0.0		
7							0.0	...fine to medium SAND	
8							0.0		
	NA	S-3	8-10	10	NA	NA			
9							0.0	Gray-Brown, medium to coarse GRAVEL, some Sand, damp	**Test boring advanced to 10 feet via direct-push methods and completed to 27 feet with H S A with split spoon samples collected at 5-foot intervals.**
10							0.2	Gray-Brown, Silty fine to coarse SAND, little medium coarse Gravel, damp	
	NA	S-4	10-12	78	NA	NA			
11							0.0		
12									
13									
14							3.1		
	NA	S-5	14-16	75	54	NA			
15							14.7		
16									

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-01

Test Boring TB-01

Page 2 of 2

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Direct Push & Split Spoon

Ground Elevation:
Datum:
Date Started: 9/10/2013
Date Ended: 9/10/2013
Borehole Depth: 27.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 18.8'

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
							5.0		
17									
18									
19									
20							101	Very dense, Gray, Silty fine to coarse SAND and medium to coarse GRAVEL, moist petroleum/chemical odor	
21		S-6	20-22	67	57		25.7		
							81.1		
22									
23									
24									
25							13	Gray, Silty fine to medium SAND, wet, petroleum/chemical odor	
26		S-7	25-27	65	44		42.2	Dense, Gray, Silty fine to coarse SAND and medium to coarge GRAVEL, wet, petroleum/chemical odor	
							121		
27								End of Boring @ 27.0'	
28									
29									
30									
31									
32									

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-01

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DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

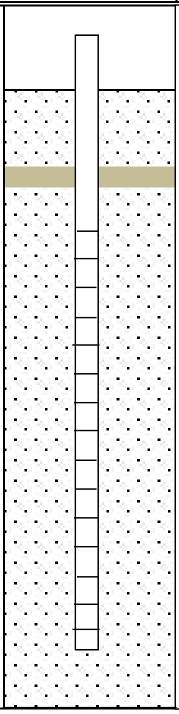
MONITORING WELL CONSTRUCTION DIAGRAM

MONITORING WELL MW-A

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, New York
DAY Representative: Z. Tennies
Drilling Contractor: Applus

Ground Elevation: 95.66'
Datum: 100'
Date Started: 9/10/2013
Date Ended: 9/10/2013
Water Level (Date): 77.34' (9-25-13)

Refer to Test Boring Log TB-01 for Soil Description



1.16 Height of Stickup (ft)
Ground Surface
4.0 Depth to Bottom of Bentonite Surface Patch (ft)
Backfill Type Soil
13.9 Depth to Top of Bentonite Seal (ft)
14.9 Depth to Bottom of Bentonite Seal (ft)
15.9 Depth to Top of Well Screen (ft)
4.0 Diameter of Borehole (in)
Backfill Type Sand
1.0 Inside Diameter of Well (in)
Type of Pipe PVC
Screen slot size 10 Slot
25.9 Depth to Bottom of Well Screen (ft)
27.0 Depth to Bottom of Borehole (ft)

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) NA = Not Available or Not Applicable

MONITORING WELL MW-A

day

DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS

AN AFFILIATE OF DAY ENGINEERING, P.C.

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Direct Push & Split Spoon

Test Boring TB-02

Page 1 of 2

Ground Elevation:
Datum:
Date Started: 9/10/2013
Date Ended: 9/11/2013
Borehole Depth: 28.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 20.61' (9/11/13) through augers

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
							0.2	Brown, medium to coarse Gravel, some Ash/Brick, damp (FILL)	**Monitoring Well MW-B**
1		S-1	0-2	100					
2							0.0	Brown, some Red Brick, trace Sand, damp (FILL)	
3		S-2	2-4	25	14		0.0		
4							0.0		
5		S-3	4-6	25	14		0.0		
6							0.0	...some Brick and Concrete material, damp (FILL)	
7		S-4	6-8	20	5		0.0		**Test boring advanced to 8 feet bgs via direct-push methods and completed to 28 feet bgs with H S A and split spoon samples**
8							0.1		
9							0.0		
10	16						0.0	Very dense, Gray-Brown, coarse SAND, some fine to coarse Gravel, moist	
11	32	S-5	10-12	82.5	74				
	42						0.2	Very dense, Gray-Brown, SILT, fine to coarse Sand, some fine to coarse Gravel, moist	
12	40								
	10						0.3		
13	35	S-6	12-14	60	65			Very dense, Gray-Brown, fine to coarse SAND, some fine to coarse Grave, trace Silt, moist	
	30						0.0		
14	32								
	19						0.1		
15	23	S-7	14-16	72.5	51				
	28						1.5		
16	43						2.6	Gray, Silty fine to medium SAND and medium to coarse Gravel, moist	
	50	S-8	16-16.5	10	50		0.0		

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-02

Test Boring TB-02

Page 2 of 2

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Direct Push & Split Spoon

Ground Elevation:
Datum:
Date Started: 9/10/2013
Date Ended: 9/11/2013
Borehole Depth: 28.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 20.61' (9/11/13) through augers

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
17									
18	37						41.9	Very dense, Gray-Brown, silty fine to coarse SAND, some medium to coarse Gravel, moist, chemical/petroleum odor	
	50	S-9	18-19.5	60	50+	117			
19	50/4						55.4		
20							8.5		
	37	S-10	20-21	45	50+	84.5			
21	50/4						31.1		
22	14						122		
	24	S-11	22-24	80	51	750		Gray, fine to coarse SAND and fine to coarge GRAVEL, wet, strong chemical/ petroleum odor	
23	27						359		
24	20								
	24						605		
25	24	S-12	24-25.8	75			237	...trace Silt	**Petroleum sheen observed at 25.0'**
	50						305		
26	50.3					278	190		
	37						701		
27	50/4	S-13	26-27	43	50+	67.2	283		
28								Bottom of Hole @ 28.0'	
29									
30									
31									
32									

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-02

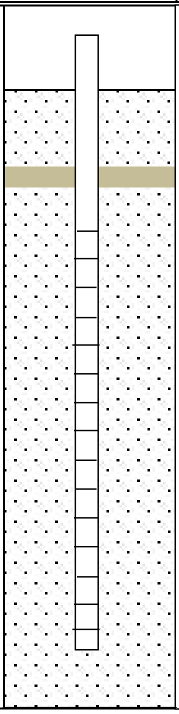
MONITORING WELL CONSTRUCTION DIAGRAM

MONITORING WELL MW-B

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, New York
DAY Representative: Z. Tennies
Drilling Contractor: Applus

Ground Elevation: 97.84'
Datum: 100'
Date Started: 9/11/2013
Date Ended: 9/11/2013
Water Level (Date): 77.27' (9-25-13)

Refer to Test Boring Log TB-02 for Soil Description



2.48 Height of Stickup (ft)
Ground Surface
2.0 Depth to Bottom of Concrete Surface Patch (ft)
Backfill Type Concrete
16.0 Depth to Top of Bentonite Seal (ft)
17.0 Depth to Bottom of Bentonite Seal (ft)
18.0 Depth to Top of Well Screen (ft)
4.0 Diameter of Borehole (in)
Backfill Type Sand
1.0 Inside Diameter of Well (in)
Type of Pipe PVC
Screen slot size 10 Slot
28.0 Depth to Bottom of Well Screen (ft)
28.0 Depth to Bottom of Borehole (ft)

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) NA = Not Available or Not Applicable

MONITORING WELL MW-B

Test Boring TB-03

Page 1 of 2

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Split Spoon

Ground Elevation:
Datum:
Date Started: 9/11/2013
Date Ended: 9/11/2013
Borehole Depth: 28.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 22.73' (9/12/13) through augers

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
	4						0.2	Gray-Brown, some crushed Rock, some fine to coarse Sand, damp (FILL)	**Monitoring Well MW-C**
1	5	S-1		100	11		0.0		
	6						0.2		
2	6								
	5						0.0		
3	6	S-2		50	11		0.0		
	5						0.0		
4	6								
	6						0.0	Dense, Brown, Silty medium to coarse SAND, some medium to coarse Gravel, damp	
5	7	S-3		43	13		0.0		
	6						0.0		
6	8								
	4						0.0	...very dense, trace fine Gravel, moist	
7	4	S-4		56	11		0.0		
	7						0.0		
8	7							...some fine Gravel	
	4						0.0	Dense, Brown, medium to coarse SAND and fine to medium GRAVEL, little Silt, moist	
9	6	S-5		39	10		0.0		
	4						0.0		
10	5								
	10						0.0	...very dense, Gray-Brown	
11	14	S-6		59	34		0.0		
	20						0.0		
12	25								
	10						0.0		
13	20	S-7		58	43		0.0		
	23						0.0		
14	25								
	8						0.2		
15	28	S-8		59	67		0.0		
	39						0.0		
	45						0.0		
16									

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-03

day

DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS

AN AFFILIATE OF DAY ENGINEERING, P.C.

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Split Spoon

Test Boring TB-03

Page 2 of 2

Ground Elevation:
Datum:
Date Started: 9/11/2013
Date Ended: 9/11/2013
Borehole Depth: 28.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 22.73' (9/12/13)

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
	35						0.0	Very dense, Gray-Brown, medium to coarse SAND and fine to coarse GRAVEL,	
17	44	S-9		58	94		0.4	little Silt, moist	
	50/4						0.0		
18	17						0.0		
19	39	S-10		46	79		0.0		
	40						0.0		
	25								
20	10						0.0		
21	11	S-11		58	21		0.0		
	10						0.0		
	9								
22	10						0.0	Medium dense, Gray-Brown, fine to coarse SAND, some fine to coarse GRAVEL,	
23	8	S-12		27	18		0.0	little Silt, wet	
	10						0.0		
	18								
24	15						0.8		
25	20	S-13		73	43		0.2	Very dense, Gray-Brown, fine to coarse SAND and fine to medium GRAVEL,	
	23						0.0	trace Silt	
	17						0.2		
26	18						0.0	...some fine rounded Gravel	
27	20	S-14		65	37		0.0		
	17						0.0		
	9								
28								End of Boring @ 28.0'	
29									
30									
31									
32									

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-03

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day
DAY ENVIRONMENTAL, INC.
ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

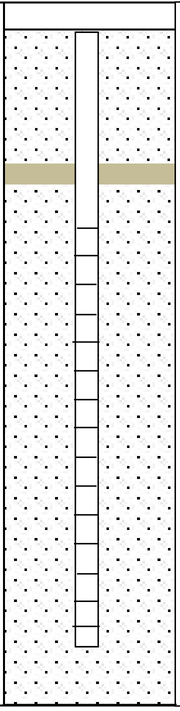
MONITORING WELL CONSTRUCTION DIAGRAM

MONITORING WELL MW-C

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, New York
DAY Representative: Z. Tennies
Drilling Contractor: Applus

Ground Elevation: 98.26'
Datum: 100'
Date Started: 9/11/2013
Date Ended: 9/12/2013
Water Level (Date): 75.65' (9-25-13)

Refer to Test Boring Log TB-03 for Soil Description



Ground Surface
0.43 Depth to Well Casing (ft)
2.0 Depth to Bottom of Bentonite Surface Patch (ft)
Backfill Type Bentonite/Soil
16.0 Depth to Top of Bentonite Seal (ft)
17.0 Depth to Bottom of Bentonite Seal (ft)
18.0 Depth to Top of Well Screen (ft)
4.0 Diameter of Borehole (in)
Backfill Type Sand
1.5 Inside Diameter of Well (in)
Type of Pipe PVC
Screen slot size 10 Slot
28.0 Depth to Bottom of Well Screen (ft)
28.0 Depth to Bottom of Borehole (ft)

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) NA = Not Available or Not Applicable

MONITORING WELL MW-C

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Split Spoon

Test Boring TB-04

Page 1 of 2

Ground Elevation:
Datum:
Date Started: 9/12/2013
Date Ended: 9/12/2013
Borehole Depth: 30.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 23.7' (9/12/13) through augers

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
	7						0.0	Brown, Sand and Gravel, little Roots, damp (FILL)	**Monitoring Well MW-D**
1	5	S-1	0-2	32	11				
	6						0.0		
2	5								
	4						0.0	Loose Brown, coarse SAND, some fine to medium Gravel, trace Silt, damp	
3	4	S-2	2-4	56	9				
	5						0.0		
4	5								
	7						0.0	...medium dense	
5	6	S-3	4-6	33	14				
	8						0.0		
6	12								
	15						0.0	Dense, Brown, fine to coarse SAND and coarse GRAVEL, trace Silt, damp	
7	18	S-4	6-8	61	39				
	21						0.0		
8	30								
	15						0.0	...very dense	
9	22	S-5	8-10	46	52				
	30						0.0		
10	40								
11									
12									
13									
14									
15	9						0.0	...some Silt, moist	
16	17	S-6	15-16	58	58				
	41						0.0		

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-04

Test Boring TB-04

Page 2 of 2

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Split Spoon

Ground Elevation:
Datum:
Date Started: 9/12/2013
Date Ended: 9/12/2013
Borehole Depth: 30.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 23.73' (9/12/13)

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
	35						0.0	Very dense, Brown, medium to coarse SAND and fine to coarse GRAVEL,	
							0.0	some Silt, moist	
17									
18									
19									
20									
21									
22	17						0.0		
	32	S-7	22-24	73	68		0.0		
23	36						0.0		
	31						0.0		
24	31						0.0	...Gray-Brown, little Silt	
	45	S-8	24-26	44			0.0		
25	50/5						0.0		
							0.0		
26	18						37.6	Very dense, Dark Gray, fine to coarse SAND and fine to coarse Gravel, some	
	25	S-9	26-28	55	57		157	Silt, wet	
27	32						153	...petroleum odor	
	20						60.1		
28	8						184	...Dense, fine to coarse SAND and medium to coarse GRAVEL, petroleum odor	
	17	S-10	28-30	70	40		279		
29	23						170		
	27						236		
30								End of Boring @ 30.0'	
31									
32									

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-04

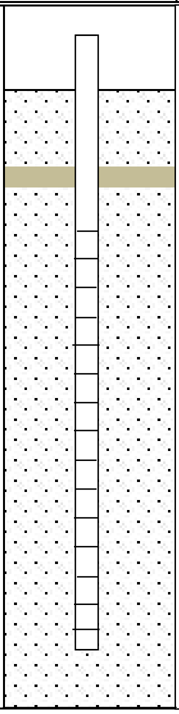
MONITORING WELL CONSTRUCTION DIAGRAM

MONITORING WELL MW-D

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, New York
DAY Representative: Z. Tennies
Drilling Contractor: Applus

Ground Elevation: 99.28'
Datum: 100'
Date Started: 9/12/2013
Date Ended: 9/12/2013
Water Level (Date): 75.57' (9-25-13)

Refer to Test Boring Log TB-04 for Soil Description



0.17 Height of Stickup (ft)

Ground Surface
2.0 Depth to Bottom of Bentonite Surface Patch (ft)
Backfill Type Soil
18.0 Depth to Top of Bentonite Seal (ft)
18.0 Depth to Bottom of Bentonite Seal (ft)

20.0 Depth to Top of Well Screen (ft)

4.0 Diameter of Borehole (in)

Backfill Type Sand

1.0 Inside Diameter of Well (in)

Type of Pipe PVC
Screen slot size 10 Slot

30.0 Depth to Bottom of Well Screen (ft)

30.0 Depth to Bottom of Borehole (ft)

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) NA = Not Available or Not Applicable

MONITORING WELL MW-D

Test Boring TB-05

Page 1 of 2

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Direct Push & Split Spoon

Ground Elevation:
Datum:
Date Started: 9/12/2013
Date Ended: 9/13/2013
Borehole Depth: 33.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 26.63' (9/13/13) through augers

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
		S-1	0-4	51			0.0	CONCRETE	**Monitoring Well MW-E**
1							0.0	Brown, Sand and Gravel, with some Red Brick and Concrete, damp (FILL)	
2							0.0		
3							0.0		
4		S-2	4-8	73			0.0		
5							0.0		
6							0.0		
7							0.0		
8		S-3	8-12	75			0.0		
9							0.0		
10							0.0		
11							0.0	Brown, medium to coarse SAND and fine GRAVEL, moist	
12		S-4	12-16	85			0.0		
13							0.0		
14							0.0		
15							0.0	Brown, Silty medium to coarse SAND, some fine Gravel, moist	
16									

Notes:
1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-05

day
DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Direct Push & Split Spoon

Test Boring TB-05

Page 2 of 2

Ground Elevation:
Datum:
Date Started: 9/12/2013
Date Ended: 9/13/2013
Borehole Depth: 33.0'
Borehole Diameter: 4"
Completion Method: ■ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date): 26.63' (9/13/13)

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
17									**Test boring advanced to 16.6 feet bgs via direct push methods and completed to 33.0 feet bgs with H S A with split spoon samples colelcted at 5-foot intervals**
18			16-20						
19									
20		S-5	20-21	10.5			0.0	Brown, Silty fine to coarse SAND, some fine Gravel, moist	
21									
22									
23									
24									
25									
26		S-6	25-27					...wet	
27									
28									
29									
30							0.6	...Gray-Brown, some fine to coarse Gravel	
31		S-7	30-32				0.2 0.4		
32								Bottom of Hole @ 33.0'	

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-05

day

DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS

AN AFFILIATE OF DAY ENGINEERING, P.C.

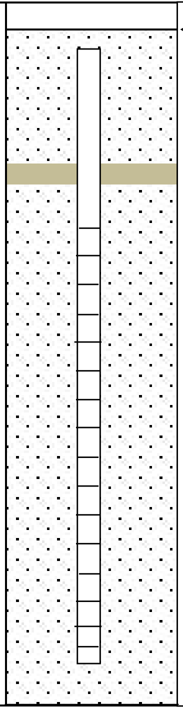
MONITORING WELL CONSTRUCTION DIAGRAM

MONITORING WELL MW-E

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, New York
DAY Representative: Z. Tennies
Drilling Contractor: Applus

Ground Elevation: 101.91'
Datum: 100'
Date Started: 9/13/2013
Date Ended: 9/13/2013
Water Level (Date): 75.65' (9-25-13)

Refer to Test Boring Log TB-05 for Soil Description



Ground Surface

0.14 Depth to Well Casing (ft)

2.0 Depth to Bottom of Bentonite Surface Patch (ft)
Backfill Type Concrete/Soil
21.0 Depth to Top of Bentonite Seal (ft)
22.0 Depth to Bottom of Bentonite Seal (ft)

23.0 Depth to Top of Well Screen (ft)

4.0 Diameter of Borehole (in)

Backfill Type Sand

1.0 Inside Diameter of Well (in)

Type of Pipe PVC
Screen slot size 10 Slot

33.0 Depth to Bottom of Well Screen (ft)

33.0 Depth to Bottom of Borehole (ft)

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) NA = Not Available or Not Applicable

MONITORING WELL MW-E

day
DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

Test Boring TB-06

Page 1 of 1

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Direct Push

Ground Elevation:
Datum:
Date Started: 9/10/2013
Date Ended: 9/10/2013
Borehole Depth: 12.0'
Borehole Diameter: 2"
Completion Method: ☐ Well Installed ☐ Backfilled with Grout ■ Backfilled with Cuttings
Water Level (Date):

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
	NA	S-1	0-4	58	NA	NA	0.7	Brown, some Roots, damp (FILL)	
								Red-Brown, Silty SAND, some fine to medium Gravel, damp	
1							0.6		
2							0.3		
3							0.2		
4	NA	S-2	4-8	45	NA	NA	1.2		
5							0.0	...Silty fine to medium SAND and coarse GRAVEL	
6							0.3		
7							0.3		
8	NA	S-3	8-12	86	NA	NA	0.2		
9							0.4		
10							0.3		
11							0.0		
12								Equipment Refusal @ 12.0'	
13									
14									
15									
16									

Notes: 1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-06

day
DAY ENVIRONMENTAL, INC.
ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

Test Boring TB-07

Page 1 of 1

Project #: 4884S-13
Project Address: 211 Franklin Street
Olean, NY
DAY Representative: Z. Tennies
Drilling Contractor: Applus
Sampling Method: Direct Push

Ground Elevation:
Datum:
Date Started: 9/13/2013
Date Ended: 9/13/2013
Borehole Depth: 4.0'
Borehole Diameter: 2"
Completion Method: ☐ Well Installed ☐ Backfilled with Grout ■ Backfilled with Cuttings
Water Level (Date):

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
							0.0	Brown-Black, some epoxy resin residue, some red brick, damp (FILL)	
1							0.4	Black, Silty, fine to medium SAND, with some Coal residue, some crushed Concrete, damp (FILL)	
2	NA	S-1	0-4	55	NA	NA	0.2	Brown, medium to coarse SAND, some medium Gravel, moist	
3							0.0		
4								Bottom of Hole @ 4.0'	
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

Notes:
1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

Test Boring TB-07

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ROCHESTER, NEW YORK 14606
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NEW YORK, NEW YORK 10170
(212) 986-8645
FAX (212) 986-8657

ATTACHMENT B

ANALYTICAL LABORATORY REPORTS

AND

CHAIN-OF-CUSTODY DOCUMENTATION

Report Date:
03-Oct-13 16:42

☑ Final Report
☐ Re-Issued Report
☐ Revised Report

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

Laboratory Report

Day Environmental, Inc.
1563 Lyell Avenue
Rochester, NY 14606
Attn: Ray Kampff

Project: 211 Franklin St - Olean, NY
Project #: 48845-13

Laboratory ID	Client Sample ID	Matrix	Date Sampled	Date Received
SB77308-01	MW-A	Ground Water	19-Sep-13 16:00	20-Sep-13 09:00
SB77308-02	MW-B	Ground Water	19-Sep-13 16:20	20-Sep-13 09:00
SB77308-03	MW-C	Ground Water	19-Sep-13 13:55	20-Sep-13 09:00
SB77308-04	MW-D	Ground Water	19-Sep-13 15:30	20-Sep-13 09:00
SB77308-05	MW-E	Ground Water	19-Sep-13 15:30	20-Sep-13 09:00
SB77308-06	Trip Blank	Trip Blank	19-Sep-13 00:00	20-Sep-13 09:00

I attest that the information contained within the report has been reviewed for accuracy and checked against the quality control requirements for each method. These results relate only to the sample(s) as received.
All applicable NELAC requirements have been met.

Massachusetts # M-MA138/MA1110
Connecticut # PH-0777
Florida # E87600/E87936
Maine # MA138
New Hampshire # 2538
New Jersey # MA011/MA012
New York # 11393/11840
Pennsylvania # 68-04426/68-02924
Rhode Island # 98
USDA # S-51435

Authorized by:

Nicole Leja

Nicole Leja
Laboratory Director

Spectrum Analytical holds certification in the State of New York for the analytes as indicated with an X in the "Cert." column within this report. Please note that the State of New York does not offer certification for all analytes. Please refer to our website for specific certification holdings in each state.
Please note that this report contains 41 pages of analytical data plus Chain of Custody document(s). When the Laboratory Report is indicated as revised, this report supersedes any previously dated reports for the laboratory ID(s) referenced above. Where this report identifies subcontracted analyses, copies of the subcontractor's test report are available upon request. This report may not be reproduced, except in full, without written approval from Spectrum Analytical, Inc.

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Please contact the Laboratory or Technical Director at 800-789-9115 with any questions regarding the data contained in this laboratory report.

CASE NARRATIVE:

The samples were received 1.1 degrees Celsius, please refer to the Chain of Custody for details specific to temperature upon receipt. An infrared thermometer with a tolerance of +/- 1.0 degrees Celsius was used immediately upon receipt of the samples.

If a Matrix Spike (MS), Matrix Spike Duplicate (MSD) or Duplicate (DUP) was not requested on the Chain of Custody, method criteria may have been fulfilled with a source sample not of this Sample Delivery Group.

See below for any non-conformances and issues relating to quality control samples and/or sample analysis/matrix.

Samples:

SB77308-01 *MW-A*

The pH of this sample has been adjusted in the laboratory for the tests listed below in accordance with the preservation requirements of the applicable methods.

Fingerprinting by GC

SB77308-02 *MW-B*

The pH of this sample has been adjusted in the laboratory for the tests listed below in accordance with the preservation requirements of the applicable methods.

Fingerprinting by GC

SB77308-03 *MW-C*

The pH of this sample has been adjusted in the laboratory for the tests listed below in accordance with the preservation requirements of the applicable methods.

Fingerprinting by GC

SB77308-04 *MW-D*

The pH of this sample has been adjusted in the laboratory for the tests listed below in accordance with the preservation requirements of the applicable methods.

Fingerprinting by GC

SB77308-05 *MW-E*

The pH of this sample has been adjusted in the laboratory for the tests listed below in accordance with the preservation requirements of the applicable methods.

Fingerprinting by GC

EPA 245.1/7470A

Spikes:

1323504-MS1 *Source: SB77308-02*

The spike recovery was outside acceptance limits for the MS, MSD and/or PS due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.

Mercury

1323504-MSD1 *Source: SB77308-02*

The RPD exceeded the QC control limits; however precision is demonstrated with acceptable RPD values for batch duplicate.

Mercury

The spike recovery was outside acceptance limits for the MS, MSD and/or PS due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.

Mercury

1323504-PS1 *Source: SB77308-02*

EPA 245.1/7470A

Spikes:

1323504-PS1 *Source: SB77308-02*

The spike recovery was outside acceptance limits for the MS, MSD and/or PS due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.

Mercury

Duplicates:

1323504-DUP1 *Source: SB77308-02*

The Reporting Limit has been raised to account for matrix interference.

Mercury

Samples:

SB77308-02 *MW-B*

The Reporting Limit has been raised to account for matrix interference.

Mercury

SW846 6010C

Spikes:

1323503-MS1 *Source: SB77308-04*

The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.

Aluminum
Calcium
Iron
Magnesium

The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

Potassium

1323503-MSD1 *Source: SB77308-04*

The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.

Aluminum
Calcium
Iron
Magnesium

The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

Potassium

1323503-PS1 *Source: SB77308-04*

The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.

Aluminum
Calcium
Iron
Magnesium
Sodium

SW846 6010C

Duplicates:

1323503-DUP1	*Source: SB77308-02*

Sample dilution required for high concentration of target analytes to be within the instrument calibration range.

Calcium
Magnesium
Manganese

The Reporting Limit has been raised to account for matrix interference.

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

Samples:

SB77308-02	*MW-B*

Sample dilution required for high concentration of target analytes to be within the instrument calibration range.

Calcium
Magnesium
Manganese

The Reporting Limit has been raised to account for matrix interference.

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

SW846 6010C

Samples:

SB77308-04 *MW-D*

Sample dilution required for high concentration of target analytes to be within the instrument calibration range.

Calcium
Magnesium

The Reporting Limit has been raised to account for matrix interference.

Silver

SW846 8100Mod.

Samples:

SB77308-01 *MW-A*

Sample dilution required for high concentration of target analytes to be within the instrument calibration range.

SB77308-02 *MW-B*

Sample dilution required for high concentration of target analytes to be within the instrument calibration range.

SW846 8260C

Calibration:

1309039

Analyte quantified by quadratic equation type calibration.

1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,2-Dibromo-3-chloropropane
1,3,5-Trichlorobenzene
1,3,5-Trimethylbenzene
1,4-Dioxane
2-Hexanone (MBK)
4-Isopropyltoluene
4-Methyl-2-pentanone (MIBK)
Acrylonitrile
Bromoform
cis-1,3-Dichloropropene
Dibromochloromethane
Hexachlorobutadiene
Naphthalene
n-Butylbenzene
n-Propylbenzene
sec-Butylbenzene
Styrene
Tert-amyl methyl ether
Tert-Butanol / butyl alcohol
tert-Butylbenzene
Tetrahydrofuran
trans-1,3-Dichloropropene

SW846 8260C

Calibration:

1309039

This affected the following samples:

1323343-BLK1
1323343-BS1
1323343-BSD1
MW-B
MW-E
S311250-ICV1
S311665-CCV1
Trip Blank

1309057

Analyte quantified by quadratic equation type calibration.

1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,3,5-Trichlorobenzene
Hexachlorobutadiene
Naphthalene
Tert-Butanol / butyl alcohol
trans-1,4-Dichloro-2-butene
Vinyl chloride

This affected the following samples:

1323478-BLK1
1323478-BS1
1323478-BSD1
MW-A
MW-C
MW-D
S311651-ICV1
S311744-CCV1

S311250-ICV1

Analyte percent recovery is outside individual acceptance criteria (80-120).

1,4-Dioxane (131%)
2-Hexanone (MBK) (124%)
4-Methyl-2-pentanone (MIBK) (126%)
Acetone (123%)
Tert-Butanol / butyl alcohol (125%)
Tetrahydrofuran (121%)

This affected the following samples:

1323343-BLK1
1323343-BS1
1323343-BSD1
MW-B
MW-E
S311665-CCV1
Trip Blank

S311651-ICV1

Analyte percent recovery is outside individual acceptance criteria (80-120).

Dichlorodifluoromethane (Freon12) (127%)
Trichlorofluoromethane (Freon 11) (121%)

SW846 8260C

Calibration:

S311651-ICV1

This affected the following samples:

1323478-BLK1
1323478-BS1
1323478-BSD1
MW-A
MW-C
MW-D
S311744-CCV1

Laboratory Control Samples:

1323343 BS/BSD

Ethyl tert-butyl ether percent recoveries (67/70) are outside individual acceptance criteria (70-130), but within overall method allowances. All reported results of the following samples are considered to have a potentially low bias:

MW-B
MW-E
Trip Blank

Tert-amyl methyl ether percent recoveries (61/72) are outside individual acceptance criteria (70-130), but within overall method allowances. All reported results of the following samples are considered to have a potentially low bias:

MW-B
MW-E
Trip Blank

Samples:

S311665-CCV1

Analyte percent difference is outside individual acceptance criteria (20), but within overall method allowances.

Ethyl tert-butyl ether (-24.8%)

Analyte percent drift is outside individual acceptance criteria (20), but within overall method allowances.

1,4-Dioxane (-21.8%)
Tert-amyl methyl ether (-29.0%)
Tert-Butanol / butyl alcohol (-23.9%)

This affected the following samples:

1323343-BLK1
1323343-BS1
1323343-BSD1
MW-B
MW-E
Trip Blank

SB77308-02 *MW-B*

Elevated Reporting Limits due to the presence of high levels of non-target analytes.

Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogates with three required by program methods.

4-Bromofluorobenzene

SW846 8270D

Calibration:

SW846 8270D

Calibration:

1309046

Analyte quantified by quadratic equation type calibration.

- 2,4-Dinitrophenol
- 3,3´-Dichlorobenzidine
- 4,6-Dinitro-2-methylphenol
- Benzidine
- Benzoic acid
- Di-n-octyl phthalate
- Hexachlorocyclopentadiene
- Pentachlorophenol

This affected the following samples:

- 1323267-BLK1
- 1323267-BS1
- 1323267-BSD1
- MW-A
- MW-B
- MW-D
- MW-E
- S311567-ICV1
- S311763-CCV1
- S311874-CCV1

S311567-ICV1

Analyte percent recovery is outside individual acceptance criteria (80-120).

- 4-Nitrophenol (121%)
- Benzidine (77%)

This affected the following samples:

- 1323267-BLK1
- 1323267-BS1
- 1323267-BSD1
- MW-A
- MW-B
- MW-D
- MW-E
- S311763-CCV1
- S311874-CCV1

Laboratory Control Samples:

1323267 BS/BSD

Pyridine percent recoveries (39/43) are outside individual acceptance criteria (40-140), but within overall method allowances. All reported results of the following samples are considered to have a potentially low bias:

- MW-A
- MW-B
- MW-D
- MW-E

1323267 BSD

Benzidine RPD 56% (20%) is outside individual acceptance criteria.

Hexachlorocyclopentadiene RPD 23% (20%) is outside individual acceptance criteria.

SW846 8270D

Samples:

S311763-CCV1

Analyte percent difference is outside individual acceptance criteria (20), but within overall method allowances.

2-Nitroaniline (23.0%)
3-Nitroaniline (20.3%)
Bis(2-chloroisopropyl)ether (34.4%)
Bis(2-ethylhexyl)phthalate (25.5%)
Butyl benzyl phthalate (25.5%)
N-Nitrosodi-n-propylamine (20.9%)

Analyte percent drift is outside individual acceptance criteria (20), but within overall method allowances.

2,4-Dinitrophenol (42.0%)
4,6-Dinitro-2-methylphenol (32.2%)

This affected the following samples:

1323267-BLK1
1323267-BS1
1323267-BSD1

S311874-CCV1

Analyte percent difference is outside individual acceptance criteria (20), but within overall method allowances.

2,4-Dinitrotoluene (20.3%)
2-Nitroaniline (24.1%)
3-Nitroaniline (20.9%)
Bis(2-chloroisopropyl)ether (23.6%)
Bis(2-ethylhexyl)phthalate (32.8%)
Butyl benzyl phthalate (30.5%)

Analyte percent drift is outside individual acceptance criteria (20), but within overall method allowances.

2,4-Dinitrophenol (37.0%)
4,6-Dinitro-2-methylphenol (29.7%)
Benzidine (41.4%)

This affected the following samples:

MW-A
MW-B
MW-D
MW-E

SB77308-01 *MW-A*

Elevated Reporting Limits due to the presence of high levels of non-target analytes.

The surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interference's.

2,4,6-Tribromophenol
2-Fluorobiphenyl
2-Fluorophenol
Nitrobenzene-d5
Phenol-d5
Terphenyl-dl4

SB77308-02 *MW-B*

Elevated Reporting Limits due to the presence of high levels of non-target analytes.

SW846 8270D

Samples:

SB77308-02	*MW-B*

The surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interference's.

2,4,6-Tribromophenol
2-Fluorobiphenyl
2-Fluorophenol
Nitrobenzene-d5
Phenol-d5
Terphenyl-dl4

Sample Acceptance Check Form

Client:	Day Environmental, Inc.
Project:	211 Franklin St - Olean, NY / 48845-13
Work Order:	SB77308
Sample(s) received on:	9/20/2013
Received by:	Vickie Knowles

The following outlines the condition of samples for the attached Chain of Custody upon receipt.

	Yes	**No**	**N/A**
1. Were custody seals present?	☐	☑	☐
2. Were custody seals intact?	☐	☐	☑
3. Were samples received at a temperature of ≤ 6°C?	☑	☐	☐
4. Were samples cooled on ice upon transfer to laboratory representative?	☑	☐	☐
5. Were samples refrigerated upon transfer to laboratory representative?	☐	☑	☐
6. Were sample containers received intact?	☑	☐	☐
7. Were samples properly labeled (labels affixed to sample containers and include sample ID, site location, and/or project number and the collection date)?	☑	☐	☐
8. Were samples accompanied by a Chain of Custody document?	☑	☐	☐
9. Does Chain of Custody document include proper, full, and complete documentation, which shall include sample ID, site location, and/or project number, date and time of collection, collector's name, preservation type, sample matrix and any special remarks concerning the sample?	☑	☐	☐
10. Did sample container labels agree with Chain of Custody document?	☑	☐	☐
11. Were samples received within method-specific holding times?	☑	☐	☐

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-A SB77308-01	48845-13	Ground Water	19-Sep-13 16:00	20-Sep-13

Volatile Organic Compounds

Volatile Organic Compounds by SW846 8260

Prepared by method SW846 5030 Water MS

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
76-13-1	1,1,2-Trichlorotrifluoroethane (Freon 113)	< 0.65	U	µg/l	1.00	0.65	1	SW846 8260C	30-Sep-13	30-Sep-13	JEG	1323478	X
67-64-1	Acetone	**10.1**		µg/l	10.0	2.56	1	"	"	"	"	"	X
107-13-1	Acrylonitrile	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
71-43-2	Benzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
108-86-1	Bromobenzene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
74-97-5	Bromochloromethane	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
75-27-4	Bromodichloromethane	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
75-25-2	Bromoform	< 0.60	U	µg/l	1.00	0.60	1	"	"	"	"	"	X
74-83-9	Bromomethane	< 1.14	U	µg/l	2.00	1.14	1	"	"	"	"	"	X
78-93-3	2-Butanone (MEK)	**2.40**	J	µg/l	10.0	1.93	1	"	"	"	"	"	X
104-51-8	n-Butylbenzene	< 0.56	U	µg/l	1.00	0.56	1	"	"	"	"	"	X
135-98-8	sec-Butylbenzene	< 0.82	U	µg/l	1.00	0.82	1	"	"	"	"	"	X
98-06-6	tert-Butylbenzene	**5.38**		µg/l	1.00	0.74	1	"	"	"	"	"	X
75-15-0	Carbon disulfide	< 1.28	U	µg/l	2.00	1.28	1	"	"	"	"	"	X
56-23-5	Carbon tetrachloride	< 0.55	U	µg/l	1.00	0.55	1	"	"	"	"	"	X
108-90-7	Chlorobenzene	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
75-00-3	Chloroethane	< 1.00	U	µg/l	2.00	1.00	1	"	"	"	"	"	X
67-66-3	Chloroform	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
74-87-3	Chloromethane	< 1.47	U	µg/l	2.00	1.47	1	"	"	"	"	"	X
95-49-8	2-Chlorotoluene	< 0.79	U	µg/l	1.00	0.79	1	"	"	"	"	"	X
106-43-4	4-Chlorotoluene	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
96-12-8	1,2-Dibromo-3-chloropropane	< 1.20	U	µg/l	2.00	1.20	1	"	"	"	"	"	X
124-48-1	Dibromochloromethane	< 0.34	U	µg/l	0.50	0.34	1	"	"	"	"	"	X
106-93-4	1,2-Dibromoethane (EDB)	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
74-95-3	Dibromomethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
106-46-7	1,4-Dichlorobenzene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
75-71-8	Dichlorodifluoromethane (Freon12)	< 0.45	U	µg/l	2.00	0.45	1	"	"	"	"	"	X
75-34-3	1,1-Dichloroethane	< 0.68	U	µg/l	1.00	0.68	1	"	"	"	"	"	X
107-06-2	1,2-Dichloroethane	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
75-35-4	1,1-Dichloroethene	< 0.49	U	µg/l	1.00	0.49	1	"	"	"	"	"	X
156-59-2	cis-1,2-Dichloroethene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
156-60-5	trans-1,2-Dichloroethene	< 0.83	U	µg/l	1.00	0.83	1	"	"	"	"	"	X
78-87-5	1,2-Dichloropropane	< 0.77	U	µg/l	1.00	0.77	1	"	"	"	"	"	X
142-28-9	1,3-Dichloropropane	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
594-20-7	2,2-Dichloropropane	< 0.87	U	µg/l	1.00	0.87	1	"	"	"	"	"	X
563-58-6	1,1-Dichloropropene	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
10061-01-5	cis-1,3-Dichloropropene	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
10061-02-6	trans-1,3-Dichloropropene	< 0.50	U	µg/l	0.50	0.50	1	"	"	"	"	"	X
100-41-4	Ethylbenzene	< 0.95	U	µg/l	1.00	0.95	1	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 0.49	U	µg/l	0.50	0.49	1	"	"	"	"	"	X
591-78-6	2-Hexanone (MBK)	< 0.66	U	µg/l	10.0	0.66	1	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-A SB77308-01	48845-13	Ground Water	19-Sep-13 16:00	20-Sep-13

Volatile Organic Compounds

Volatile Organic Compounds by SW846 8260

Prepared by method SW846 5030 Water MS

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
98-82-8	Isopropylbenzene	< 0.62	U	µg/l	1.00	0.62	1	SW846 8260C	30-Sep-13	30-Sep-13	JEG	1323478	X
99-87-6	4-Isopropyltoluene	< 0.61	U	µg/l	1.00	0.61	1	"	"	"	"	"	X
1634-04-4	Methyl tert-butyl ether	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
108-10-1	4-Methyl-2-pentanone (MIBK)	< 2.76	U	µg/l	10.0	2.76	1	"	"	"	"	"	X
75-09-2	Methylene chloride	< 0.95	U	µg/l	2.00	0.95	1	"	"	"	"	"	X
91-20-3	Naphthalene	**0.59**	J	µg/l	1.00	0.58	1	"	"	"	"	"	X
103-65-1	n-Propylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
100-42-5	Styrene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
630-20-6	1,1,1,2-Tetrachloroethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
79-34-5	1,1,2,2-Tetrachloroethane	< 0.32	U	µg/l	0.50	0.32	1	"	"	"	"	"	X
127-18-4	Tetrachloroethene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
108-88-3	Toluene	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
87-61-6	1,2,3-Trichlorobenzene	< 0.38	U	µg/l	1.00	0.38	1	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 0.36	U	µg/l	1.00	0.36	1	"	"	"	"	"	X
108-70-3	1,3,5-Trichlorobenzene	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	
71-55-6	1,1,1-Trichloroethane	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
79-00-5	1,1,2-Trichloroethane	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
79-01-6	Trichloroethene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
75-69-4	Trichlorofluoromethane (Freon 11)	< 0.63	U	µg/l	1.00	0.63	1	"	"	"	"	"	X
96-18-4	1,2,3-Trichloropropane	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
95-63-6	1,2,4-Trimethylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
108-67-8	1,3,5-Trimethylbenzene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
75-01-4	Vinyl chloride	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
179601-23-1	m,p-Xylene	< 1.64	U	µg/l	2.00	1.64	1	"	"	"	"	"	X
95-47-6	o-Xylene	< 0.88	U	µg/l	1.00	0.88	1	"	"	"	"	"	X
109-99-9	Tetrahydrofuran	< 1.44	U	µg/l	2.00	1.44	1	"	"	"	"	"	
60-29-7	Ethyl ether	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
994-05-8	Tert-amyl methyl ether	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
637-92-3	Ethyl tert-butyl ether	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
108-20-3	Di-isopropyl ether	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
75-65-0	Tert-Butanol / butyl alcohol	< 8.64	U	µg/l	10.0	8.64	1	"	"	"	"	"	X
123-91-1	1,4-Dioxane	< 12.0	U	µg/l	20.0	12.0	1	"	"	"	"	"	X
110-57-6	trans-1,4-Dichloro-2-butene	< 0.74	U	µg/l	5.00	0.74	1	"	"	"	"	"	X
64-17-5	Ethanol	< 35.0	U	µg/l	400	35.0	1	"	"	"	"	"	X
Surrogate recoveries:													
460-00-4	*4-Bromofluorobenzene*	*100*			*70-130 %*			"	"	"	"	"	
2037-26-5	*Toluene-d8*	*101*			*70-130 %*			"	"	"	"	"	
17060-07-0	*1,2-Dichloroethane-d4*	*105*			*70-130 %*			"	"	"	"	"	
1868-53-7	*Dibromofluoromethane*	*99*			*70-130 %*			"	"	"	"	"	

Tentatively Identified Compounds by GC/MS

Prepared by method SW846 5030 Water MS

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-A SB77308-01	48845-13	Ground Water	19-Sep-13 16:00	20-Sep-13

Volatile Organic Compounds

Tentatively Identified Compounds by GC/MS

Prepared by method SW846 5030 Water MS

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
488-23-3	Benzene, 1,2,3,4-tetramethyl-	22.9	TIC	µg/l			1	SW846 8260C TICs	30-Sep-13	30-Sep-13	JEG	1323478	
95-93-2	Benzene, 1,2,4,5-tetramethyl-	19.6	TIC	µg/l			1	"	"	"	"	"	
3454-07-7	Benzene, 1-ethenyl-4-ethyl-	10.8	TIC	µg/l			1	"	"	"	"	"	
002870-04-4	Benzene, 2-ethyl-1,3-dimethyl-	13.4	TIC	µg/l			1	"	"	"	"	"	
	Cyclohexane, 1,1,3-trimethyl-	10.7	TIC	µg/l			1	"	"	"	"	"	
	Cyclohexane, 1,1-dimethyl-	12.5	TIC	µg/l			1	"	"	"	"	"	
	Cyclohexane, 1,2-dimethyl-,...	19.0	TIC	µg/l			1	"	"	"	"	"	
004850-28-6	Cyclopentane, 1,2,4-trimeth...	13.3	TIC	µg/l			1	"	"	"	"	"	

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds R05

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
83-32-9	Acenaphthene	< 50.0	U, D	µg/l	278	50.0	50	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
208-96-8	Acenaphthylene	< 48.3	U, D	µg/l	278	48.3	50	"	"	"	"	"	X
62-53-3	Aniline	< 35.0	U, D	µg/l	278	35.0	50	"	"	"	"	"	X
120-12-7	Anthracene	< 50.0	U, D	µg/l	278	50.0	50	"	"	"	"	"	X
103-33-3	Azobenzene/Diphenyldiazene	< 41.7	U, D	µg/l	278	41.7	50	"	"	"	"	"	
92-87-5	Benzidine	< 243	U, D	µg/l	278	243	50	"	"	"	"	"	X
56-55-3	Benzo (a) anthracene	< 66.1	U, D	µg/l	278	66.1	50	"	"	"	"	"	X
50-32-8	Benzo (a) pyrene	< 48.3	U, D	µg/l	278	48.3	50	"	"	"	"	"	X
205-99-2	Benzo (b) fluoranthene	< 47.2	U, D	µg/l	278	47.2	50	"	"	"	"	"	X
191-24-2	Benzo (g,h,i) perylene	< 50.0	U, D	µg/l	278	50.0	50	"	"	"	"	"	X
207-08-9	Benzo (k) fluoranthene	< 61.7	U, D	µg/l	278	61.7	50	"	"	"	"	"	X
65-85-0	Benzoic acid	< 121	U, D	µg/l	278	121	50	"	"	"	"	"	X
100-51-6	Benzyl alcohol	< 51.7	U, D	µg/l	278	51.7	50	"	"	"	"	"	X
111-91-1	Bis(2-chloroethoxy)methane	< 38.9	U, D	µg/l	278	38.9	50	"	"	"	"	"	X
111-44-4	Bis(2-chloroethyl)ether	< 46.7	U, D	µg/l	278	46.7	50	"	"	"	"	"	X
108-60-1	Bis(2-chloroisopropyl)ether	< 54.4	U, D	µg/l	278	54.4	50	"	"	"	"	"	X
117-81-7	Bis(2-ethylhexyl)phthalate	< 56.7	U, D	µg/l	278	56.7	50	"	"	"	"	"	X
101-55-3	4-Bromophenyl phenyl ether	< 47.2	U, D	µg/l	278	47.2	50	"	"	"	"	"	X
85-68-7	Butyl benzyl phthalate	< 57.2	U, D	µg/l	278	57.2	50	"	"	"	"	"	X
86-74-8	Carbazole	< 178	U, D	µg/l	278	178	50	"	"	"	"	"	X
59-50-7	4-Chloro-3-methylphenol	< 52.8	U, D	µg/l	278	52.8	50	"	"	"	"	"	X
106-47-8	4-Chloroaniline	< 31.1	U, D	µg/l	278	31.1	50	"	"	"	"	"	X
91-58-7	2-Chloronaphthalene	< 48.3	U, D	µg/l	278	48.3	50	"	"	"	"	"	X
95-57-8	2-Chlorophenol	< 53.3	U, D	µg/l	278	53.3	50	"	"	"	"	"	X
7005-72-3	4-Chlorophenyl phenyl ether	< 49.4	U, D	µg/l	278	49.4	50	"	"	"	"	"	X
218-01-9	Chrysene	< 63.3	U, D	µg/l	278	63.3	50	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-A SB77308-01	48845-13	Ground Water	19-Sep-13 16:00	20-Sep-13

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds R05

Prepared by method SW846 3510C

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
53-70-3	Dibenzo (a,h) anthracene	< 51.7	U, D	µg/l	278	51.7	50	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
132-64-9	Dibenzofuran	< 48.9	U, D	µg/l	278	48.9	50	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 54.4	U, D	µg/l	278	54.4	50	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 53.3	U, D	µg/l	278	53.3	50	"	"	"	"	"	X
106-46-7	1,4-Dichlorobenzene	< 55.6	U, D	µg/l	278	55.6	50	"	"	"	"	"	X
91-94-1	3,3´-Dichlorobenzidine	< 37.8	U, D	µg/l	278	37.8	50	"	"	"	"	"	X
120-83-2	2,4-Dichlorophenol	< 45.6	U, D	µg/l	278	45.6	50	"	"	"	"	"	X
84-66-2	Diethyl phthalate	< 47.8	U, D	µg/l	278	47.8	50	"	"	"	"	"	X
131-11-3	Dimethyl phthalate	< 50.6	U, D	µg/l	278	50.6	50	"	"	"	"	"	X
105-67-9	2,4-Dimethylphenol	< 45.0	U, D	µg/l	278	45.0	50	"	"	"	"	"	X
84-74-2	Di-n-butyl phthalate	< 52.2	U, D	µg/l	278	52.2	50	"	"	"	"	"	X
534-52-1	4,6-Dinitro-2-methylphenol	< 37.2	U, D	µg/l	278	37.2	50	"	"	"	"	"	X
51-28-5	2,4-Dinitrophenol	< 159	U, D	µg/l	278	159	50	"	"	"	"	"	X
121-14-2	2,4-Dinitrotoluene	< 52.2	U, D	µg/l	278	52.2	50	"	"	"	"	"	X
606-20-2	2,6-Dinitrotoluene	< 52.2	U, D	µg/l	278	52.2	50	"	"	"	"	"	X
117-84-0	Di-n-octyl phthalate	< 43.3	U, D	µg/l	278	43.3	50	"	"	"	"	"	X
206-44-0	Fluoranthene	< 53.3	U, D	µg/l	278	53.3	50	"	"	"	"	"	X
86-73-7	Fluorene	< 50.0	U, D	µg/l	278	50.0	50	"	"	"	"	"	X
118-74-1	Hexachlorobenzene	< 51.7	U, D	µg/l	278	51.7	50	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 46.1	U, D	µg/l	278	46.1	50	"	"	"	"	"	X
77-47-4	Hexachlorocyclopentadiene	< 262	U, D	µg/l	278	262	50	"	"	"	"	"	X
67-72-1	Hexachloroethane	< 56.1	U, D	µg/l	278	56.1	50	"	"	"	"	"	X
193-39-5	Indeno (1,2,3-cd) pyrene	< 51.1	U, D	µg/l	278	51.1	50	"	"	"	"	"	X
78-59-1	Isophorone	< 46.1	U, D	µg/l	278	46.1	50	"	"	"	"	"	X
91-57-6	2-Methylnaphthalene	< 50.6	U, D	µg/l	278	50.6	50	"	"	"	"	"	X
95-48-7	2-Methylphenol	< 53.3	U, D	µg/l	278	53.3	50	"	"	"	"	"	X
108-39-4, 106-44-5	3 & 4-Methylphenol	< 52.2	U, D	µg/l	556	52.2	50	"	"	"	"	"	X
91-20-3	Naphthalene	< 49.4	U, D	µg/l	278	49.4	50	"	"	"	"	"	X
88-74-4	2-Nitroaniline	< 45.6	U, D	µg/l	278	45.6	50	"	"	"	"	"	X
99-09-2	3-Nitroaniline	< 35.6	U, D	µg/l	278	35.6	50	"	"	"	"	"	X
100-01-6	4-Nitroaniline	< 40.0	U, D	µg/l	1110	40.0	50	"	"	"	"	"	X
98-95-3	Nitrobenzene	< 52.8	U, D	µg/l	278	52.8	50	"	"	"	"	"	X
88-75-5	2-Nitrophenol	< 57.2	U, D	µg/l	278	57.2	50	"	"	"	"	"	X
100-02-7	4-Nitrophenol	< 155	U, D	µg/l	1110	155	50	"	"	"	"	"	X
62-75-9	N-Nitrosodimethylamine	< 56.1	U, D	µg/l	278	56.1	50	"	"	"	"	"	X
621-64-7	N-Nitrosodi-n-propylamine	< 51.1	U, D	µg/l	278	51.1	50	"	"	"	"	"	X
86-30-6	N-Nitrosodiphenylamine	< 53.3	U, D	µg/l	278	53.3	50	"	"	"	"	"	X
87-86-5	Pentachlorophenol	< 45.0	U, D	µg/l	1110	45.0	50	"	"	"	"	"	X
85-01-8	Phenanthrene	< 48.3	U, D	µg/l	278	48.3	50	"	"	"	"	"	X
108-95-2	Phenol	< 52.8	U, D	µg/l	278	52.8	50	"	"	"	"	"	X
129-00-0	Pyrene	< 71.1	U, D	µg/l	278	71.1	50	"	"	"	"	"	X
110-86-1	Pyridine	< 53.9	U, D	µg/l	278	53.9	50	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 51.1	U, D	µg/l	278	51.1	50	"	"	"	"	"	X

* Reportable Detection Limit

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-A SB77308-01	48845-13	Ground Water	19-Sep-13 16:00	20-Sep-13

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Semivolatile Organic Compounds by GCMS													
Semivolatile Organic Compounds			R05										
Prepared by method SW846 3510C													
90-12-0	1-Methylnaphthalene	< 51.7	U, D	µg/l	278	51.7	50	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	
95-95-4	2,4,5-Trichlorophenol	< 46.1	U, D	µg/l	278	46.1	50	"	"	"	"	"	X
88-06-2	2,4,6-Trichlorophenol	< 43.3	U, D	µg/l	278	43.3	50	"	"	"	"	"	X
82-68-8	Pentachloronitrobenzene	< 50.6	U, D	µg/l	278	50.6	50	"	"	"	"	"	X
95-94-3	1,2,4,5-Tetrachlorobenzene	< 53.3	U, D	µg/l	278	53.3	50	"	"	"	"	"	X
Surrogate recoveries:													
321-60-8	*2-Fluorobiphenyl*	*0*	S01, U		*30-130 %*			"	"	"	"	"	
367-12-4	*2-Fluorophenol*	*0*	S01, U		*15-110 %*			"	"	"	"	"	
4165-60-0	*Nitrobenzene-d5*	*0*	S01, U		*30-130 %*			"	"	"	"	"	
4165-62-2	*Phenol-d5*	*0*	S01, U		*15-110 %*			"	"	"	"	"	
1718-51-0	*Terphenyl-dl4*	*0*	S01, U		*30-130 %*			"	"	"	"	"	
118-79-6	*2,4,6-Tribromophenol*	*0*	S01, U		*15-110 %*			"	"	"	"	"	
Extractable Petroleum Hydrocarbons													
Fingerprinting by GC			GS1										
Prepared by method SW846 3510C													
8006-61-9	Gasoline	< 1.1	U, D	mg/l	1.1	1.1	5	SW846 8100Mod.	27-Sep-13	30-Sep-13	SEP	1323309	
68476-30-2	Fuel Oil #2	**Calculated as**		mg/l	1.1	0.9	5	"	"	"	"	"	
68476-31-3	Fuel Oil #4	< 0.1	U, D	mg/l	1.1	0.1	5	"	"	"	"	"	
68553-00-4	Fuel Oil #6	< 1.0	U, D	mg/l	1.1	1.0	5	"	"	"	"	"	
M09800000	Motor Oil	< 0.9	U, D	mg/l	1.1	0.9	5	"	"	"	"	"	
8032-32-4	Ligroin	< 0.3	U, D	mg/l	1.1	0.3	5	"	"	"	"	"	
J00100000	Aviation Fuel	< 0.3	U, D	mg/l	1.1	0.3	5	"	"	"	"	"	
	Hydraulic Oil	< 0.1	U, D	mg/l	1.1	0.1	5	"	"	"	"	"	
	Dielectric Fluid	< 0.3	U, D	mg/l	1.1	0.3	5	"	"	"	"	"	
	Unidentified	**139**	D	mg/l	1.1	0.3	5	"	"	"	"	"	
	Other Oil	**Calculated as**		mg/l	1.1	0.1	5	"	"	"	"	"	
	Total Petroleum Hydrocarbons	**139**	D	mg/l	1.1	0.1	5	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*66*			*40-140 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-B SB77308-02	48845-13	Ground Water	19-Sep-13 16:20	20-Sep-13

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Volatile Organic Compounds													
Volatile Organic Compounds by SW846 8260			R05										
Prepared by method SW846 5030 Water MS													
76-13-1	1,1,2-Trichlorotrifluoroethane (Freon 113)	< 647	U, D	µg/l	1000	647	1000	SW846 8260C	27-Sep-13	27-Sep-13	naa	1323343	X
67-64-1	Acetone	**4,260**	J, D	µg/l	10000	2560	1000	"	"	"	"	"	X
107-13-1	Acrylonitrile	< 475	U, D	µg/l	500	475	1000	"	"	"	"	"	X
71-43-2	Benzene	< 669	U, D	µg/l	1000	669	1000	"	"	"	"	"	X
108-86-1	Bromobenzene	< 721	U, D	µg/l	1000	721	1000	"	"	"	"	"	X
74-97-5	Bromochloromethane	< 710	U, D	µg/l	1000	710	1000	"	"	"	"	"	X
75-27-4	Bromodichloromethane	< 479	U, D	µg/l	500	479	1000	"	"	"	"	"	X
75-25-2	Bromoform	< 603	U, D	µg/l	1000	603	1000	"	"	"	"	"	X
74-83-9	Bromomethane	< 1140	U, D	µg/l	2000	1140	1000	"	"	"	"	"	X
78-93-3	2-Butanone (MEK)	< 1930	U, D	µg/l	10000	1930	1000	"	"	"	"	"	X
104-51-8	n-Butylbenzene	< 562	U, D	µg/l	1000	562	1000	"	"	"	"	"	X
135-98-8	sec-Butylbenzene	< 820	U, D	µg/l	1000	820	1000	"	"	"	"	"	X
98-06-6	tert-Butylbenzene	**3,130**	D	µg/l	1000	745	1000	"	"	"	"	"	X
75-15-0	Carbon disulfide	< 1280	U, D	µg/l	2000	1280	1000	"	"	"	"	"	X
56-23-5	Carbon tetrachloride	< 549	U, D	µg/l	1000	549	1000	"	"	"	"	"	X
108-90-7	Chlorobenzene	< 654	U, D	µg/l	1000	654	1000	"	"	"	"	"	X
75-00-3	Chloroethane	< 1000	U, D	µg/l	2000	1000	1000	"	"	"	"	"	X
67-66-3	Chloroform	< 689	U, D	µg/l	1000	689	1000	"	"	"	"	"	X
74-87-3	Chloromethane	< 1470	U, D	µg/l	2000	1470	1000	"	"	"	"	"	X
95-49-8	2-Chlorotoluene	< 791	U, D	µg/l	1000	791	1000	"	"	"	"	"	X
106-43-4	4-Chlorotoluene	< 731	U, D	µg/l	1000	731	1000	"	"	"	"	"	X
96-12-8	1,2-Dibromo-3-chloropropane	< 1200	U, D	µg/l	2000	1200	1000	"	"	"	"	"	X
124-48-1	Dibromochloromethane	< 343	U, D	µg/l	500	343	1000	"	"	"	"	"	X
106-93-4	1,2-Dibromoethane (EDB)	< 361	U, D	µg/l	500	361	1000	"	"	"	"	"	X
74-95-3	Dibromomethane	< 666	U, D	µg/l	1000	666	1000	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 668	U, D	µg/l	1000	668	1000	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 712	U, D	µg/l	1000	712	1000	"	"	"	"	"	X
106-46-7	1,4-Dichlorobenzene	< 624	U, D	µg/l	1000	624	1000	"	"	"	"	"	X
75-71-8	Dichlorodifluoromethane (Freon12)	< 447	U, D	µg/l	2000	447	1000	"	"	"	"	"	X
75-34-3	1,1-Dichloroethane	< 680	U, D	µg/l	1000	680	1000	"	"	"	"	"	X
107-06-2	1,2-Dichloroethane	< 781	U, D	µg/l	1000	781	1000	"	"	"	"	"	X
75-35-4	1,1-Dichloroethene	< 488	U, D	µg/l	1000	488	1000	"	"	"	"	"	X
156-59-2	cis-1,2-Dichloroethene	< 716	U, D	µg/l	1000	716	1000	"	"	"	"	"	X
156-60-5	trans-1,2-Dichloroethene	< 832	U, D	µg/l	1000	832	1000	"	"	"	"	"	X
78-87-5	1,2-Dichloropropane	< 771	U, D	µg/l	1000	771	1000	"	"	"	"	"	X
142-28-9	1,3-Dichloropropane	< 807	U, D	µg/l	1000	807	1000	"	"	"	"	"	X
594-20-7	2,2-Dichloropropane	< 872	U, D	µg/l	1000	872	1000	"	"	"	"	"	X
563-58-6	1,1-Dichloropropene	< 636	U, D	µg/l	1000	636	1000	"	"	"	"	"	X
10061-01-5	cis-1,3-Dichloropropene	< 364	U, D	µg/l	500	364	1000	"	"	"	"	"	X
10061-02-6	trans-1,3-Dichloropropene	< 499	U, D	µg/l	500	499	1000	"	"	"	"	"	X
100-41-4	Ethylbenzene	< 951	U, D	µg/l	1000	951	1000	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 489	U, D	µg/l	500	489	1000	"	"	"	"	"	X
591-78-6	2-Hexanone (MBK)	< 658	U, D	µg/l	10000	658	1000	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-B SB77308-02	48845-13	Ground Water	19-Sep-13 16:20	20-Sep-13

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Volatile Organic Compounds													
Volatile Organic Compounds by SW846 8260			R05										
Prepared by method SW846 5030 Water MS													
98-82-8	Isopropylbenzene	< 621	U, D	µg/l	1000	621	1000	SW846 8260C	27-Sep-13	27-Sep-13	naa	1323343	X
99-87-6	4-Isopropyltoluene	< 609	U, D	µg/l	1000	609	1000	"	"	"	"	"	X
1634-04-4	Methyl tert-butyl ether	< 652	U, D	µg/l	1000	652	1000	"	"	"	"	"	X
108-10-1	4-Methyl-2-pentanone (MIBK)	< 2760	U, D	µg/l	10000	2760	1000	"	"	"	"	"	X
75-09-2	Methylene chloride	< 947	U, D	µg/l	2000	947	1000	"	"	"	"	"	X
91-20-3	Naphthalene	< 579	U, D	µg/l	1000	579	1000	"	"	"	"	"	X
103-65-1	n-Propylbenzene	< 758	U, D	µg/l	1000	758	1000	"	"	"	"	"	X
100-42-5	Styrene	< 615	U, D	µg/l	1000	615	1000	"	"	"	"	"	X
630-20-6	1,1,1,2-Tetrachloroethane	< 672	U, D	µg/l	1000	672	1000	"	"	"	"	"	X
79-34-5	1,1,2,2-Tetrachloroethane	< 317	U, D	µg/l	500	317	1000	"	"	"	"	"	X
127-18-4	Tetrachloroethene	< 743	U, D	µg/l	1000	743	1000	"	"	"	"	"	X
108-88-3	Toluene	< 812	U, D	µg/l	1000	812	1000	"	"	"	"	"	X
87-61-6	1,2,3-Trichlorobenzene	< 376	U, D	µg/l	1000	376	1000	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 360	U, D	µg/l	1000	360	1000	"	"	"	"	"	X
108-70-3	1,3,5-Trichlorobenzene	< 784	U, D	µg/l	1000	784	1000	"	"	"	"	"	
71-55-6	1,1,1-Trichloroethane	< 582	U, D	µg/l	1000	582	1000	"	"	"	"	"	X
79-00-5	1,1,2-Trichloroethane	< 642	U, D	µg/l	1000	642	1000	"	"	"	"	"	X
79-01-6	Trichloroethene	< 755	U, D	µg/l	1000	755	1000	"	"	"	"	"	X
75-69-4	Trichlorofluoromethane (Freon 11)	< 628	U, D	µg/l	1000	628	1000	"	"	"	"	"	X
96-18-4	1,2,3-Trichloropropane	< 736	U, D	µg/l	1000	736	1000	"	"	"	"	"	X
95-63-6	1,2,4-Trimethylbenzene	< 757	U, D	µg/l	1000	757	1000	"	"	"	"	"	X
108-67-8	1,3,5-Trimethylbenzene	< 744	U, D	µg/l	1000	744	1000	"	"	"	"	"	X
75-01-4	Vinyl chloride	< 807	U, D	µg/l	1000	807	1000	"	"	"	"	"	X
179601-23-1	m,p-Xylene	< 1640	U, D	µg/l	2000	1640	1000	"	"	"	"	"	X
95-47-6	o-Xylene	< 882	U, D	µg/l	1000	882	1000	"	"	"	"	"	X
109-99-9	Tetrahydrofuran	< 1440	U, D	µg/l	2000	1440	1000	"	"	"	"	"	
60-29-7	Ethyl ether	< 693	U, D	µg/l	1000	693	1000	"	"	"	"	"	X
994-05-8	Tert-amyl methyl ether	< 719	U, D	µg/l	1000	719	1000	"	"	"	"	"	X
637-92-3	Ethyl tert-butyl ether	< 782	U, D	µg/l	1000	782	1000	"	"	"	"	"	X
108-20-3	Di-isopropyl ether	< 727	U, D	µg/l	1000	727	1000	"	"	"	"	"	X
75-65-0	Tert-Butanol / butyl alcohol	< 8640	U, D	µg/l	10000	8640	1000	"	"	"	"	"	X
123-91-1	1,4-Dioxane	< 12000	U, D	µg/l	20000	12000	1000	"	"	"	"	"	X
110-57-6	trans-1,4-Dichloro-2-butene	< 737	U, D	µg/l	5000	737	1000	"	"	"	"	"	X
64-17-5	Ethanol	< 35000	U, D	µg/l	400000	35000	1000	"	"	"	"	"	X
Surrogate recoveries:													
460-00-4	*4-Bromofluorobenzene*	*139*	SGCMSVOC		*70-130 %*			"	"	"	"	"	
2037-26-5	*Toluene-d8*	*107*			*70-130 %*			"	"	"	"	"	
17060-07-0	*1,2-Dichloroethane-d4*	*105*			*70-130 %*			"	"	"	"	"	
1868-53-7	*Dibromofluoromethane*	*105*			*70-130 %*			"	"	"	"	"	

Tentatively Identified Compounds by GC/MS

Prepared by method SW846 5030 Water MS

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-B SB77308-02	48845-13	Ground Water	19-Sep-13 16:20	20-Sep-13

Volatile Organic Compounds

Tentatively Identified Compounds by GC/MS

Prepared by method SW846 5030 Water MS

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
000591-21-9	1,3-Dimethylcyclohexane, c&t	**116,000**	TIC, D	µg/l			1000	SW846 8260C TICs	27-Sep-13	27-Sep-13	naa	1323343	
003728-56-1	1-Ethyl-4-methylcyclohexane	**69,400**	TIC, D	µg/l			1000	"	"	"	"	"	
	Cyclohexane, 1,1,3-trimethyl-	**78,300**	TIC, D	µg/l			1000	"	"	"	"	"	
	Cyclohexane, 1,2-dimethyl-	**57,800**	TIC, D	µg/l			1000	"	"	"	"	"	
006236-88-0	Cyclohexane, 1-ethyl-4-meth...	**104,000**	TIC, D	µg/l			1000	"	"	"	"	"	
	Heptane, 2,5-dimethyl-	**102,000**	TIC, D	µg/l			1000	"	"	"	"	"	
	Undecane, 5,6-dimethyl-	**87,700**	TIC, D	µg/l			1000	"	"	"	"	"	

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds R05

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
83-32-9	Acenaphthene	< 108	U, D	µg/l	602	108	100	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
208-96-8	Acenaphthylene	< 105	U, D	µg/l	602	105	100	"	"	"	"	"	X
62-53-3	Aniline	< 75.9	U, D	µg/l	602	75.9	100	"	"	"	"	"	X
120-12-7	Anthracene	< 108	U, D	µg/l	602	108	100	"	"	"	"	"	X
103-33-3	Azobenzene/Diphenyldiazene	< 90.4	U, D	µg/l	602	90.4	100	"	"	"	"	"	
92-87-5	Benzidine	< 527	U, D	µg/l	602	527	100	"	"	"	"	"	X
56-55-3	Benzo (a) anthracene	< 143	U, D	µg/l	602	143	100	"	"	"	"	"	X
50-32-8	Benzo (a) pyrene	< 105	U, D	µg/l	602	105	100	"	"	"	"	"	X
205-99-2	Benzo (b) fluoranthene	< 102	U, D	µg/l	602	102	100	"	"	"	"	"	X
191-24-2	Benzo (g,h,i) perylene	< 108	U, D	µg/l	602	108	100	"	"	"	"	"	X
207-08-9	Benzo (k) fluoranthene	< 134	U, D	µg/l	602	134	100	"	"	"	"	"	X
65-85-0	Benzoic acid	< 261	U, D	µg/l	602	261	100	"	"	"	"	"	X
100-51-6	Benzyl alcohol	< 112	U, D	µg/l	602	112	100	"	"	"	"	"	X
111-91-1	Bis(2-chloroethoxy)methane	< 84.3	U, D	µg/l	602	84.3	100	"	"	"	"	"	X
111-44-4	Bis(2-chloroethyl)ether	< 101	U, D	µg/l	602	101	100	"	"	"	"	"	X
108-60-1	Bis(2-chloroisopropyl)ether	< 118	U, D	µg/l	602	118	100	"	"	"	"	"	X
117-81-7	Bis(2-ethylhexyl)phthalate	< 123	U, D	µg/l	602	123	100	"	"	"	"	"	X
101-55-3	4-Bromophenyl phenyl ether	< 102	U, D	µg/l	602	102	100	"	"	"	"	"	X
85-68-7	Butyl benzyl phthalate	< 124	U, D	µg/l	602	124	100	"	"	"	"	"	X
86-74-8	Carbazole	< 387	U, D	µg/l	602	387	100	"	"	"	"	"	X
59-50-7	4-Chloro-3-methylphenol	< 114	U, D	µg/l	602	114	100	"	"	"	"	"	X
106-47-8	4-Chloroaniline	< 67.5	U, D	µg/l	602	67.5	100	"	"	"	"	"	X
91-58-7	2-Chloronaphthalene	< 105	U, D	µg/l	602	105	100	"	"	"	"	"	X
95-57-8	2-Chlorophenol	< 116	U, D	µg/l	602	116	100	"	"	"	"	"	X
7005-72-3	4-Chlorophenyl phenyl ether	< 107	U, D	µg/l	602	107	100	"	"	"	"	"	X
218-01-9	Chrysene	< 137	U, D	µg/l	602	137	100	"	"	"	"	"	X
53-70-3	Dibenzo (a,h) anthracene	< 112	U, D	µg/l	602	112	100	"	"	"	"	"	X
132-64-9	Dibenzofuran	< 106	U, D	µg/l	602	106	100	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 118	U, D	µg/l	602	118	100	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-B SB77308-02	48845-13	Ground Water	19-Sep-13 16:20	20-Sep-13

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds R05

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
541-73-1	1,3-Dichlorobenzene	< 116	U, D	µg/l	602	116	100	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
106-46-7	1,4-Dichlorobenzene	< 120	U, D	µg/l	602	120	100	"	"	"	"	"	X
91-94-1	3,3´-Dichlorobenzidine	< 81.9	U, D	µg/l	602	81.9	100	"	"	"	"	"	X
120-83-2	2,4-Dichlorophenol	< 98.8	U, D	µg/l	602	98.8	100	"	"	"	"	"	X
84-66-2	Diethyl phthalate	< 104	U, D	µg/l	602	104	100	"	"	"	"	"	X
131-11-3	Dimethyl phthalate	< 110	U, D	µg/l	602	110	100	"	"	"	"	"	X
105-67-9	2,4-Dimethylphenol	< 97.6	U, D	µg/l	602	97.6	100	"	"	"	"	"	X
84-74-2	Di-n-butyl phthalate	< 113	U, D	µg/l	602	113	100	"	"	"	"	"	X
534-52-1	4,6-Dinitro-2-methylphenol	< 80.7	U, D	µg/l	602	80.7	100	"	"	"	"	"	X
51-28-5	2,4-Dinitrophenol	< 346	U, D	µg/l	602	346	100	"	"	"	"	"	X
121-14-2	2,4-Dinitrotoluene	< 113	U, D	µg/l	602	113	100	"	"	"	"	"	X
606-20-2	2,6-Dinitrotoluene	< 113	U, D	µg/l	602	113	100	"	"	"	"	"	X
117-84-0	Di-n-octyl phthalate	< 94.0	U, D	µg/l	602	94.0	100	"	"	"	"	"	X
206-44-0	Fluoranthene	< 116	U, D	µg/l	602	116	100	"	"	"	"	"	X
86-73-7	Fluorene	< 108	U, D	µg/l	602	108	100	"	"	"	"	"	X
118-74-1	Hexachlorobenzene	< 112	U, D	µg/l	602	112	100	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 100	U, D	µg/l	602	100	100	"	"	"	"	"	X
77-47-4	Hexachlorocyclopentadiene	< 569	U, D	µg/l	602	569	100	"	"	"	"	"	X
67-72-1	Hexachloroethane	< 122	U, D	µg/l	602	122	100	"	"	"	"	"	X
193-39-5	Indeno (1,2,3-cd) pyrene	< 111	U, D	µg/l	602	111	100	"	"	"	"	"	X
78-59-1	Isophorone	< 100	U, D	µg/l	602	100	100	"	"	"	"	"	X
91-57-6	2-Methylnaphthalene	< 110	U, D	µg/l	602	110	100	"	"	"	"	"	X
95-48-7	2-Methylphenol	< 116	U, D	µg/l	602	116	100	"	"	"	"	"	X
108-39-4, 106-44-5	3 & 4-Methylphenol	< 113	U, D	µg/l	1200	113	100	"	"	"	"	"	X
91-20-3	Naphthalene	< 107	U, D	µg/l	602	107	100	"	"	"	"	"	X
88-74-4	2-Nitroaniline	< 98.8	U, D	µg/l	602	98.8	100	"	"	"	"	"	X
99-09-2	3-Nitroaniline	< 77.1	U, D	µg/l	602	77.1	100	"	"	"	"	"	X
100-01-6	4-Nitroaniline	< 86.7	U, D	µg/l	2410	86.7	100	"	"	"	"	"	X
98-95-3	Nitrobenzene	< 114	U, D	µg/l	602	114	100	"	"	"	"	"	X
88-75-5	2-Nitrophenol	< 124	U, D	µg/l	602	124	100	"	"	"	"	"	X
100-02-7	4-Nitrophenol	< 336	U, D	µg/l	2410	336	100	"	"	"	"	"	X
62-75-9	N-Nitrosodimethylamine	< 122	U, D	µg/l	602	122	100	"	"	"	"	"	X
621-64-7	N-Nitrosodi-n-propylamine	< 111	U, D	µg/l	602	111	100	"	"	"	"	"	X
86-30-6	N-Nitrosodiphenylamine	< 116	U, D	µg/l	602	116	100	"	"	"	"	"	X
87-86-5	Pentachlorophenol	< 97.6	U, D	µg/l	2410	97.6	100	"	"	"	"	"	X
85-01-8	Phenanthrene	< 105	U, D	µg/l	602	105	100	"	"	"	"	"	X
108-95-2	Phenol	< 114	U, D	µg/l	602	114	100	"	"	"	"	"	X
129-00-0	Pyrene	< 154	U, D	µg/l	602	154	100	"	"	"	"	"	X
110-86-1	Pyridine	< 117	U, D	µg/l	602	117	100	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 111	U, D	µg/l	602	111	100	"	"	"	"	"	X
90-12-0	1-Methylnaphthalene	< 112	U, D	µg/l	602	112	100	"	"	"	"	"	
95-95-4	2,4,5-Trichlorophenol	< 100	U, D	µg/l	602	100	100	"	"	"	"	"	X
88-06-2	2,4,6-Trichlorophenol	< 94.0	U, D	µg/l	602	94.0	100	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-B SB77308-02	48845-13	Ground Water	19-Sep-13 16:20	20-Sep-13

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds R05

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
82-68-8	Pentachloronitrobenzene	< 110	U, D	µg/l	602	110	100	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
95-94-3	1,2,4,5-Tetrachlorobenzene	< 116	U, D	µg/l	602	116	100	"	"	"	"	"	X

Surrogate recoveries:

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
321-60-8	*2-Fluorobiphenyl*	*0*	S01, U		*30-130 %*			"	"	"	"	"	
367-12-4	*2-Fluorophenol*	*0*	S01, U		*15-110 %*			"	"	"	"	"	
4165-60-0	*Nitrobenzene-d5*	*0*	S01, U		*30-130 %*			"	"	"	"	"	
4165-62-2	*Phenol-d5*	*0*	S01, U		*15-110 %*			"	"	"	"	"	
1718-51-0	*Terphenyl-dl4*	*0*	S01, U		*30-130 %*			"	"	"	"	"	
118-79-6	*2,4,6-Tribromophenol*	*0*	S01, U		*15-110 %*			"	"	"	"	"	

Extractable Petroleum Hydrocarbons

Fingerprinting by GC GS1

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
8006-61-9	Gasoline	< 11.4	U, D	mg/l	11.8	11.4	50	SW846 8100Mod.	27-Sep-13	01-Oct-13	SEP	1323309	
68476-30-2	Fuel Oil #2	**Calculated as**		mg/l	11.8	8.8	50	"	"	"	"	"	
68476-31-3	Fuel Oil #4	< 1.2	U, D	mg/l	11.8	1.2	50	"	"	"	"	"	
68553-00-4	Fuel Oil #6	< 10.1	U, D	mg/l	11.8	10.1	50	"	"	"	"	"	
M09800000	Motor Oil	< 9.5	U, D	mg/l	11.8	9.5	50	"	"	"	"	"	
8032-32-4	Ligroin	< 2.9	U, D	mg/l	11.8	2.9	50	"	"	"	"	"	
J00100000	Aviation Fuel	< 2.9	U, D	mg/l	11.8	2.9	50	"	"	"	"	"	
	Hydraulic Oil	< 1.2	U, D	mg/l	11.8	1.2	50	"	"	"	"	"	
	Dielectric Fluid	< 2.9	U, D	mg/l	11.8	2.9	50	"	"	"	"	"	
	Unidentified	**483**	D	mg/l	11.8	2.9	50	"	"	"	"	"	
	Other Oil	**Calculated as**		mg/l	11.8	1.2	50	"	"	"	"	"	
	Total Petroleum Hydrocarbons	**483**	D	mg/l	11.8	1.2	50	"	"	"	"	"	

Surrogate recoveries:

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
3386-33-2	*1-Chlorooctadecane*	*58*			*40-140 %*			"	"	"	"	"	

Total Metals by EPA 200/6000 Series Methods

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
	Preservation	**Lab Preserved**		N/A			1	EPA 200/6000 methods	25-Sep-13	25-Sep-13	LNB	1323140	

Total Metals by EPA 6000/7000 Series Methods

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
7440-22-4	Silver	< 0.0086	R01, U,LIV	mg/l	0.100	0.0086	1	SW846 6010C	30-Sep-13	01-Oct-13	edt	1323503	X
7429-90-5	Aluminum	**588**	R01,LIV	mg/l	0.250	0.0760	1	"	"	"	"	"	X
7440-38-2	Arsenic	**1.03**	R01,LIV	mg/l	0.0400	0.0181	1	"	"	"	"	"	X
7440-39-3	Barium	**5.86**	R01,LIV	mg/l	0.0500	0.0068	1	"	"	"	"	"	X
7440-41-7	Beryllium	**0.0257**	R01,LIV	mg/l	0.0200	0.0018	1	"	"	"	"	"	X
7440-70-2	Calcium	**2,840**	GS1, D,LIV	mg/l	2.00	0.367	2	"	"	01-Oct-13	"	"	X
7440-43-9	Cadmium	< 0.0082	R01, U,LIV	mg/l	0.0250	0.0082	1	"	"	01-Oct-13	"	"	X
7440-48-4	Cobalt	**0.484**	R01,LIV	mg/l	0.0500	0.0027	1	"	"	"	"	"	X
7440-47-3	Chromium	**2.14**	R01,LIV	mg/l	0.0500	0.0093	1	"	"	"	"	"	X
7440-50-8	Copper	**2.05**	R01,LIV	mg/l	0.0500	0.0110	1	"	"	"	"	"	X
7439-89-6	Iron	**1,220**	R01,LIV	mg/l	0.150	0.0745	1	"	"	01-Oct-13	"	"	X

This laboratory report is not valid without an authorized signature on the cover page.

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-B SB77308-02	48845-13	Ground Water	19-Sep-13 16:20	20-Sep-13

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
Total Metals by EPA 6000/7000 Series Methods													
7440-09-7	Potassium	**94.5**	R01,LIV	mg/l	5.00	0.595	1	SW846 6010C	30-Sep-13	01-Oct-13	JLM	1323503	X
7439-95-4	Magnesium	**557**	GS1, D,LIV	mg/l	0.200	0.0250	2	"	"	01-Oct-13	"	"	X
7439-96-5	Manganese	**59.5**	GS1, D,LIV	mg/l	0.0400	0.0230	2	"	"	"	"	"	X
7440-23-5	Sodium	**191**	R01,LIV	mg/l	2.50	0.325	1	"	"	01-Oct-13	"	"	X
7440-02-0	Nickel	**1.12**	R01,LIV	mg/l	0.0500	0.0073	1	"	"	01-Oct-13	"	"	X
7439-92-1	Lead	**1.85**	R01,LIV	mg/l	0.0750	0.0200	1	"	"	"	"	"	X
7440-36-0	Antimony	< 0.0142	R01, U,LIV	mg/l	0.0600	0.0142	1	"	"	"	"	"	X
7782-49-2	Selenium	< 0.0302	R01, U,LIV	mg/l	0.150	0.0302	1	"	"	"	"	"	X
7440-28-0	Thallium	**0.0485**	R01, J,LIV	mg/l	0.0500	0.0294	1	"	"	"	"	"	X
7440-62-2	Vanadium	**0.846**	R01,LIV	mg/l	0.0500	0.0094	1	"	"	"	"	"	X
7440-66-6	Zinc	**6.56**	R01,LIV	mg/l	0.0500	0.0196	1	"	"	"	"	"	X
Total Metals by EPA 200 Series Methods													
7439-97-6	Mercury	**0.00049**	R01, J,LIV	mg/l	0.00080	0.00031	1	EPA 245.1/7470A	30-Sep-13	02-Oct-13	LR	1323504	X
General Chemistry Parameters													
57-12-5	Cyanide (total)	< 0.00360	U	mg/l	0.00500	0.00360	1	EPA 335.4 / SW846 9012B	01-Oct-13	01-Oct-13	RLT	1323632	X

Sample Identification **MW-C** SB77308-03	Client Project #	Matrix	Collection Date/Time	Received
	48845-13	Ground Water	19-Sep-13 13:55	20-Sep-13

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*

Volatile Organic Compounds

Volatile Organic Compounds by SW846 8260

Prepared by method SW846 5030 Water MS

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
76-13-1	1,1,2-Trichlorotrifluoroethane (Freon 113)	< 0.65	U	µg/l	1.00	0.65	1	SW846 8260C	30-Sep-13	30-Sep-13	JEG	1323478	X
67-64-1	Acetone	< 2.56	U	µg/l	10.0	2.56	1	"	"	"	"	"	X
107-13-1	Acrylonitrile	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
71-43-2	Benzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
108-86-1	Bromobenzene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
74-97-5	Bromochloromethane	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
75-27-4	Bromodichloromethane	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
75-25-2	Bromoform	< 0.60	U	µg/l	1.00	0.60	1	"	"	"	"	"	X
74-83-9	Bromomethane	< 1.14	U	µg/l	2.00	1.14	1	"	"	"	"	"	X
78-93-3	2-Butanone (MEK)	< 1.93	U	µg/l	10.0	1.93	1	"	"	"	"	"	X
104-51-8	n-Butylbenzene	< 0.56	U	µg/l	1.00	0.56	1	"	"	"	"	"	X
135-98-8	sec-Butylbenzene	< 0.82	U	µg/l	1.00	0.82	1	"	"	"	"	"	X
98-06-6	tert-Butylbenzene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
75-15-0	Carbon disulfide	< 1.28	U	µg/l	2.00	1.28	1	"	"	"	"	"	X
56-23-5	Carbon tetrachloride	< 0.55	U	µg/l	1.00	0.55	1	"	"	"	"	"	X
108-90-7	Chlorobenzene	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
75-00-3	Chloroethane	< 1.00	U	µg/l	2.00	1.00	1	"	"	"	"	"	X
67-66-3	Chloroform	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
74-87-3	Chloromethane	< 1.47	U	µg/l	2.00	1.47	1	"	"	"	"	"	X
95-49-8	2-Chlorotoluene	< 0.79	U	µg/l	1.00	0.79	1	"	"	"	"	"	X
106-43-4	4-Chlorotoluene	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
96-12-8	1,2-Dibromo-3-chloropropane	< 1.20	U	µg/l	2.00	1.20	1	"	"	"	"	"	X
124-48-1	Dibromochloromethane	< 0.34	U	µg/l	0.50	0.34	1	"	"	"	"	"	X
106-93-4	1,2-Dibromoethane (EDB)	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
74-95-3	Dibromomethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
106-46-7	1,4-Dichlorobenzene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
75-71-8	Dichlorodifluoromethane (Freon12)	< 0.45	U	µg/l	2.00	0.45	1	"	"	"	"	"	X
75-34-3	1,1-Dichloroethane	< 0.68	U	µg/l	1.00	0.68	1	"	"	"	"	"	X
107-06-2	1,2-Dichloroethane	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
75-35-4	1,1-Dichloroethene	< 0.49	U	µg/l	1.00	0.49	1	"	"	"	"	"	X
156-59-2	cis-1,2-Dichloroethene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
156-60-5	trans-1,2-Dichloroethene	< 0.83	U	µg/l	1.00	0.83	1	"	"	"	"	"	X
78-87-5	1,2-Dichloropropane	< 0.77	U	µg/l	1.00	0.77	1	"	"	"	"	"	X
142-28-9	1,3-Dichloropropane	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
594-20-7	2,2-Dichloropropane	< 0.87	U	µg/l	1.00	0.87	1	"	"	"	"	"	X
563-58-6	1,1-Dichloropropene	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
10061-01-5	cis-1,3-Dichloropropene	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
10061-02-6	trans-1,3-Dichloropropene	< 0.50	U	µg/l	0.50	0.50	1	"	"	"	"	"	X
100-41-4	Ethylbenzene	< 0.95	U	µg/l	1.00	0.95	1	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 0.49	U	µg/l	0.50	0.49	1	"	"	"	"	"	X
591-78-6	2-Hexanone (MBK)	< 0.66	U	µg/l	10.0	0.66	1	"	"	"	"	"	X

This laboratory report is not valid without an authorized signature on the cover page.

* Reportable Detection Limit

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-C SB77308-03	48845-13	Ground Water	19-Sep-13 13:55	20-Sep-13

Volatile Organic Compounds

Volatile Organic Compounds by SW846 8260

Prepared by method SW846 5030 Water MS

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
98-82-8	Isopropylbenzene	< 0.62	U	µg/l	1.00	0.62	1	SW846 8260C	30-Sep-13	30-Sep-13	JEG	1323478	X
99-87-6	4-Isopropyltoluene	< 0.61	U	µg/l	1.00	0.61	1	"	"	"	"	"	X
1634-04-4	Methyl tert-butyl ether	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
108-10-1	4-Methyl-2-pentanone (MIBK)	< 2.76	U	µg/l	10.0	2.76	1	"	"	"	"	"	X
75-09-2	Methylene chloride	< 0.95	U	µg/l	2.00	0.95	1	"	"	"	"	"	X
91-20-3	Naphthalene	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
103-65-1	n-Propylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
100-42-5	Styrene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
630-20-6	1,1,1,2-Tetrachloroethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
79-34-5	1,1,2,2-Tetrachloroethane	< 0.32	U	µg/l	0.50	0.32	1	"	"	"	"	"	X
127-18-4	Tetrachloroethene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
108-88-3	Toluene	**0.84**	J	µg/l	1.00	0.81	1	"	"	"	"	"	X
87-61-6	1,2,3-Trichlorobenzene	< 0.38	U	µg/l	1.00	0.38	1	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 0.36	U	µg/l	1.00	0.36	1	"	"	"	"	"	X
108-70-3	1,3,5-Trichlorobenzene	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	
71-55-6	1,1,1-Trichloroethane	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
79-00-5	1,1,2-Trichloroethane	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
79-01-6	Trichloroethene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
75-69-4	Trichlorofluoromethane (Freon 11)	< 0.63	U	µg/l	1.00	0.63	1	"	"	"	"	"	X
96-18-4	1,2,3-Trichloropropane	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
95-63-6	1,2,4-Trimethylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
108-67-8	1,3,5-Trimethylbenzene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
75-01-4	Vinyl chloride	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
179601-23-1	m,p-Xylene	< 1.64	U	µg/l	2.00	1.64	1	"	"	"	"	"	X
95-47-6	o-Xylene	< 0.88	U	µg/l	1.00	0.88	1	"	"	"	"	"	X
109-99-9	Tetrahydrofuran	< 1.44	U	µg/l	2.00	1.44	1	"	"	"	"	"	
60-29-7	Ethyl ether	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
994-05-8	Tert-amyl methyl ether	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
637-92-3	Ethyl tert-butyl ether	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
108-20-3	Di-isopropyl ether	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
75-65-0	Tert-Butanol / butyl alcohol	< 8.64	U	µg/l	10.0	8.64	1	"	"	"	"	"	X
123-91-1	1,4-Dioxane	< 12.0	U	µg/l	20.0	12.0	1	"	"	"	"	"	X
110-57-6	trans-1,4-Dichloro-2-butene	< 0.74	U	µg/l	5.00	0.74	1	"	"	"	"	"	X
64-17-5	Ethanol	< 35.0	U	µg/l	400	35.0	1	"	"	"	"	"	X

Surrogate recoveries:

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
460-00-4	*4-Bromofluorobenzene*	*101*			*70-130 %*			"	"	"	"	"	
2037-26-5	*Toluene-d8*	*100*			*70-130 %*			"	"	"	"	"	
17060-07-0	*1,2-Dichloroethane-d4*	*105*			*70-130 %*			"	"	"	"	"	
1868-53-7	*Dibromofluoromethane*	*97*			*70-130 %*			"	"	"	"	"	

Tentatively Identified Compounds by GC/MS

Prepared by method SW846 5030 Water MS

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-C SB77308-03	48845-13	Ground Water	19-Sep-13 13:55	20-Sep-13

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Volatile Organic Compounds													
Tentatively Identified Compounds by GC/MS													
Prepared by method SW846 5030 Water MS													
	Tentatively Identified Compounds	**None found**		μg/l			1	SW846 8260C TICs	30-Sep-13	30-Sep-13	JEG	1323478	
Extractable Petroleum Hydrocarbons													
Fingerprinting by GC													
Prepared by method SW846 3510C													
8006-61-9	Gasoline	< 0.2	U	mg/l	0.2	0.2	1	SW846 8100Mod.	27-Sep-13	01-Oct-13	SEP	1323309	
68476-30-2	Fuel Oil #2	< 0.2	U	mg/l	0.2	0.2	1	"	"	"	"	"	
68476-31-3	Fuel Oil #4	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
68553-00-4	Fuel Oil #6	< 0.2	U	mg/l	0.2	0.2	1	"	"	"	"	"	
M09800000	Motor Oil	< 0.2	U	mg/l	0.2	0.2	1	"	"	"	"	"	
8032-32-4	Ligroin	< 0.06	U	mg/l	0.2	0.06	1	"	"	"	"	"	
J00100000	Aviation Fuel	< 0.06	U	mg/l	0.2	0.06	1	"	"	"	"	"	
	Hydraulic Oil	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
	Dielectric Fluid	< 0.06	U	mg/l	0.2	0.06	1	"	"	"	"	"	
	Unidentified	< 0.06	U	mg/l	0.2	0.06	1	"	"	"	"	"	
	Other Oil	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
	Total Petroleum Hydrocarbons	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*69*			*40-140 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-D SB77308-04	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
Volatile Organic Compounds													
Volatile Organic Compounds by SW846 8260													
Prepared by method SW846 5030 Water MS													
76-13-1	1,1,2-Trichlorotrifluoroethane (Freon 113)	< 0.65	U	µg/l	1.00	0.65	1	SW846 8260C	30-Sep-13	30-Sep-13	JEG	1323478	X
67-64-1	Acetone	< 2.56	U	µg/l	10.0	2.56	1	"	"	"	"	"	X
107-13-1	Acrylonitrile	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
71-43-2	Benzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
108-86-1	Bromobenzene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
74-97-5	Bromochloromethane	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
75-27-4	Bromodichloromethane	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
75-25-2	Bromoform	< 0.60	U	µg/l	1.00	0.60	1	"	"	"	"	"	X
74-83-9	Bromomethane	< 1.14	U	µg/l	2.00	1.14	1	"	"	"	"	"	X
78-93-3	2-Butanone (MEK)	< 1.93	U	µg/l	10.0	1.93	1	"	"	"	"	"	X
104-51-8	n-Butylbenzene	< 0.56	U	µg/l	1.00	0.56	1	"	"	"	"	"	X
135-98-8	sec-Butylbenzene	**1.05**		µg/l	1.00	0.82	1	"	"	"	"	"	X
98-06-6	tert-Butylbenzene	**1.90**		µg/l	1.00	0.74	1	"	"	"	"	"	X
75-15-0	Carbon disulfide	< 1.28	U	µg/l	2.00	1.28	1	"	"	"	"	"	X
56-23-5	Carbon tetrachloride	< 0.55	U	µg/l	1.00	0.55	1	"	"	"	"	"	X
108-90-7	Chlorobenzene	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
75-00-3	Chloroethane	< 1.00	U	µg/l	2.00	1.00	1	"	"	"	"	"	X
67-66-3	Chloroform	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
74-87-3	Chloromethane	< 1.47	U	µg/l	2.00	1.47	1	"	"	"	"	"	X
95-49-8	2-Chlorotoluene	< 0.79	U	µg/l	1.00	0.79	1	"	"	"	"	"	X
106-43-4	4-Chlorotoluene	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
96-12-8	1,2-Dibromo-3-chloropropane	< 1.20	U	µg/l	2.00	1.20	1	"	"	"	"	"	X
124-48-1	Dibromochloromethane	< 0.34	U	µg/l	0.50	0.34	1	"	"	"	"	"	X
106-93-4	1,2-Dibromoethane (EDB)	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
74-95-3	Dibromomethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
106-46-7	1,4-Dichlorobenzene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
75-71-8	Dichlorodifluoromethane (Freon12)	< 0.45	U	µg/l	2.00	0.45	1	"	"	"	"	"	X
75-34-3	1,1-Dichloroethane	< 0.68	U	µg/l	1.00	0.68	1	"	"	"	"	"	X
107-06-2	1,2-Dichloroethane	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
75-35-4	1,1-Dichloroethene	< 0.49	U	µg/l	1.00	0.49	1	"	"	"	"	"	X
156-59-2	cis-1,2-Dichloroethene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
156-60-5	trans-1,2-Dichloroethene	< 0.83	U	µg/l	1.00	0.83	1	"	"	"	"	"	X
78-87-5	1,2-Dichloropropane	< 0.77	U	µg/l	1.00	0.77	1	"	"	"	"	"	X
142-28-9	1,3-Dichloropropane	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
594-20-7	2,2-Dichloropropane	< 0.87	U	µg/l	1.00	0.87	1	"	"	"	"	"	X
563-58-6	1,1-Dichloropropene	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
10061-01-5	cis-1,3-Dichloropropene	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
10061-02-6	trans-1,3-Dichloropropene	< 0.50	U	µg/l	0.50	0.50	1	"	"	"	"	"	X
100-41-4	Ethylbenzene	< 0.95	U	µg/l	1.00	0.95	1	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 0.49	U	µg/l	0.50	0.49	1	"	"	"	"	"	X
591-78-6	2-Hexanone (MBK)	< 0.66	U	µg/l	10.0	0.66	1	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-D SB77308-04	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Volatile Organic Compounds													
Volatile Organic Compounds by SW846 8260													
Prepared by method SW846 5030 Water MS													
98-82-8	Isopropylbenzene	< 0.62	U	µg/l	1.00	0.62	1	SW846 8260C	30-Sep-13	30-Sep-13	JEG	1323478	X
99-87-6	4-Isopropyltoluene	< 0.61	U	µg/l	1.00	0.61	1	"	"	"	"	"	X
1634-04-4	Methyl tert-butyl ether	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
108-10-1	4-Methyl-2-pentanone (MIBK)	< 2.76	U	µg/l	10.0	2.76	1	"	"	"	"	"	X
75-09-2	Methylene chloride	< 0.95	U	µg/l	2.00	0.95	1	"	"	"	"	"	X
91-20-3	Naphthalene	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
103-65-1	n-Propylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
100-42-5	Styrene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
630-20-6	1,1,1,2-Tetrachloroethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
79-34-5	1,1,2,2-Tetrachloroethane	< 0.32	U	µg/l	0.50	0.32	1	"	"	"	"	"	X
127-18-4	Tetrachloroethene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
108-88-3	Toluene	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
87-61-6	1,2,3-Trichlorobenzene	< 0.38	U	µg/l	1.00	0.38	1	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 0.36	U	µg/l	1.00	0.36	1	"	"	"	"	"	X
108-70-3	1,3,5-Trichlorobenzene	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	
71-55-6	1,1,1-Trichloroethane	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
79-00-5	1,1,2-Trichloroethane	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
79-01-6	Trichloroethene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
75-69-4	Trichlorofluoromethane (Freon 11)	< 0.63	U	µg/l	1.00	0.63	1	"	"	"	"	"	X
96-18-4	1,2,3-Trichloropropane	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
95-63-6	1,2,4-Trimethylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
108-67-8	1,3,5-Trimethylbenzene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
75-01-4	Vinyl chloride	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
179601-23-1	m,p-Xylene	< 1.64	U	µg/l	2.00	1.64	1	"	"	"	"	"	X
95-47-6	o-Xylene	< 0.88	U	µg/l	1.00	0.88	1	"	"	"	"	"	X
109-99-9	Tetrahydrofuran	< 1.44	U	µg/l	2.00	1.44	1	"	"	"	"	"	
60-29-7	Ethyl ether	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
994-05-8	Tert-amyl methyl ether	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
637-92-3	Ethyl tert-butyl ether	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
108-20-3	Di-isopropyl ether	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
75-65-0	Tert-Butanol / butyl alcohol	< 8.64	U	µg/l	10.0	8.64	1	"	"	"	"	"	X
123-91-1	1,4-Dioxane	< 12.0	U	µg/l	20.0	12.0	1	"	"	"	"	"	X
110-57-6	trans-1,4-Dichloro-2-butene	< 0.74	U	µg/l	5.00	0.74	1	"	"	"	"	"	X
64-17-5	Ethanol	< 35.0	U	µg/l	400	35.0	1	"	"	"	"	"	X
Surrogate recoveries:													
460-00-4	*4-Bromofluorobenzene*	*101*			*70-130 %*			"	"	"	"	"	
2037-26-5	*Toluene-d8*	*101*			*70-130 %*			"	"	"	"	"	
17060-07-0	*1,2-Dichloroethane-d4*	*105*			*70-130 %*			"	"	"	"	"	
1868-53-7	*Dibromofluoromethane*	*99*			*70-130 %*			"	"	"	"	"	
Tentatively Identified Compounds by GC/MS													
Prepared by method SW846 5030 Water MS													

Sample Identification
MW-D
SB77308-04

Client Project #	Matrix	Collection Date/Time	Received
48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

Volatile Organic Compounds

Tentatively Identified Compounds by GC/MS

Prepared by method SW846 5030 Water MS

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
004912-92-9	1H-Indene, 2,3-dihydro-1,1-...	**10.7**	TIC	µg/l			1	SW846 8260C TICs	30-Sep-13	30-Sep-13	JEG	1323478	
020836-11-7	1H-Indene,2,3-dihydro-2,2-d...	**9.1**	TIC	µg/l			1	"	"	"	"	"	
001196-58-3	Benzene, (1-ethylpropyl)-	**8.0**	TIC	µg/l			1	"	"	"	"	"	
	Cyclohexane, 1,1,3-trimethyl-	**8.7**	TIC	µg/l			1	"	"	"	"	"	
000091-17-8	Naphthalene, decahydro-	**12.2**	TIC	µg/l			1	"	"	"	"	"	
032273-77-1	Pentalene, octahydro-1-methyl-	**10.9**	TIC	µg/l			1	"	"	"	"	"	

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
83-32-9	Acenaphthene	< 0.928	U	µg/l	5.15	0.928	1	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
208-96-8	Acenaphthylene	< 0.897	U	µg/l	5.15	0.897	1	"	"	"	"	"	X
62-53-3	Aniline	< 0.649	U	µg/l	5.15	0.649	1	"	"	"	"	"	X
120-12-7	Anthracene	< 0.928	U	µg/l	5.15	0.928	1	"	"	"	"	"	X
103-33-3	Azobenzene/Diphenyldiazene	< 0.773	U	µg/l	5.15	0.773	1	"	"	"	"	"	
92-87-5	Benzidine	< 4.51	U	µg/l	5.15	4.51	1	"	"	"	"	"	X
56-55-3	Benzo (a) anthracene	< 1.23	U	µg/l	5.15	1.23	1	"	"	"	"	"	X
50-32-8	Benzo (a) pyrene	< 0.897	U	µg/l	5.15	0.897	1	"	"	"	"	"	X
205-99-2	Benzo (b) fluoranthene	< 0.876	U	µg/l	5.15	0.876	1	"	"	"	"	"	X
191-24-2	Benzo (g,h,i) perylene	< 0.928	U	µg/l	5.15	0.928	1	"	"	"	"	"	X
207-08-9	Benzo (k) fluoranthene	< 1.14	U	µg/l	5.15	1.14	1	"	"	"	"	"	X
65-85-0	Benzoic acid	< 2.24	U	µg/l	5.15	2.24	1	"	"	"	"	"	X
100-51-6	Benzyl alcohol	< 0.959	U	µg/l	5.15	0.959	1	"	"	"	"	"	X
111-91-1	Bis(2-chloroethoxy)methane	< 0.722	U	µg/l	5.15	0.722	1	"	"	"	"	"	X
111-44-4	Bis(2-chloroethyl)ether	< 0.866	U	µg/l	5.15	0.866	1	"	"	"	"	"	X
108-60-1	Bis(2-chloroisopropyl)ether	< 1.01	U	µg/l	5.15	1.01	1	"	"	"	"	"	X
117-81-7	Bis(2-ethylhexyl)phthalate	< 1.05	U	µg/l	5.15	1.05	1	"	"	"	"	"	X
101-55-3	4-Bromophenyl phenyl ether	< 0.876	U	µg/l	5.15	0.876	1	"	"	"	"	"	X
85-68-7	Butyl benzyl phthalate	< 1.06	U	µg/l	5.15	1.06	1	"	"	"	"	"	X
86-74-8	Carbazole	< 3.31	U	µg/l	5.15	3.31	1	"	"	"	"	"	X
59-50-7	4-Chloro-3-methylphenol	< 0.979	U	µg/l	5.15	0.979	1	"	"	"	"	"	X
106-47-8	4-Chloroaniline	< 0.577	U	µg/l	5.15	0.577	1	"	"	"	"	"	X
91-58-7	2-Chloronaphthalene	< 0.897	U	µg/l	5.15	0.897	1	"	"	"	"	"	X
95-57-8	2-Chlorophenol	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
7005-72-3	4-Chlorophenyl phenyl ether	< 0.918	U	µg/l	5.15	0.918	1	"	"	"	"	"	X
218-01-9	Chrysene	< 1.18	U	µg/l	5.15	1.18	1	"	"	"	"	"	X
53-70-3	Dibenzo (a,h) anthracene	< 0.959	U	µg/l	5.15	0.959	1	"	"	"	"	"	X
132-64-9	Dibenzofuran	< 0.907	U	µg/l	5.15	0.907	1	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 1.01	U	µg/l	5.15	1.01	1	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X

This laboratory report is not valid without an authorized signature on the cover page.

* Reportable Detection Limit

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-D SB77308-04	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds

Prepared by method SW846 3510C

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
106-46-7	1,4-Dichlorobenzene	< 1.03	U	µg/l	5.15	1.03	1	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
91-94-1	3,3´-Dichlorobenzidine	< 0.701	U	µg/l	5.15	0.701	1	"	"	"	"	"	X
120-83-2	2,4-Dichlorophenol	< 0.845	U	µg/l	5.15	0.845	1	"	"	"	"	"	X
84-66-2	Diethyl phthalate	< 0.887	U	µg/l	5.15	0.887	1	"	"	"	"	"	X
131-11-3	Dimethyl phthalate	< 0.938	U	µg/l	5.15	0.938	1	"	"	"	"	"	X
105-67-9	2,4-Dimethylphenol	< 0.835	U	µg/l	5.15	0.835	1	"	"	"	"	"	X
84-74-2	Di-n-butyl phthalate	< 0.969	U	µg/l	5.15	0.969	1	"	"	"	"	"	X
534-52-1	4,6-Dinitro-2-methylphenol	< 0.691	U	µg/l	5.15	0.691	1	"	"	"	"	"	X
51-28-5	2,4-Dinitrophenol	< 2.96	U	µg/l	5.15	2.96	1	"	"	"	"	"	X
121-14-2	2,4-Dinitrotoluene	< 0.969	U	µg/l	5.15	0.969	1	"	"	"	"	"	X
606-20-2	2,6-Dinitrotoluene	< 0.969	U	µg/l	5.15	0.969	1	"	"	"	"	"	X
117-84-0	Di-n-octyl phthalate	< 0.804	U	µg/l	5.15	0.804	1	"	"	"	"	"	X
206-44-0	Fluoranthene	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
86-73-7	Fluorene	< 0.928	U	µg/l	5.15	0.928	1	"	"	"	"	"	X
118-74-1	Hexachlorobenzene	< 0.959	U	µg/l	5.15	0.959	1	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 0.856	U	µg/l	5.15	0.856	1	"	"	"	"	"	X
77-47-4	Hexachlorocyclopentadiene	< 4.87	U	µg/l	5.15	4.87	1	"	"	"	"	"	X
67-72-1	Hexachloroethane	< 1.04	U	µg/l	5.15	1.04	1	"	"	"	"	"	X
193-39-5	Indeno (1,2,3-cd) pyrene	< 0.948	U	µg/l	5.15	0.948	1	"	"	"	"	"	X
78-59-1	Isophorone	< 0.856	U	µg/l	5.15	0.856	1	"	"	"	"	"	X
91-57-6	2-Methylnaphthalene	< 0.938	U	µg/l	5.15	0.938	1	"	"	"	"	"	X
95-48-7	2-Methylphenol	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
108-39-4, 106-44-5	3 & 4-Methylphenol	< 0.969	U	µg/l	10.3	0.969	1	"	"	"	"	"	X
91-20-3	Naphthalene	< 0.918	U	µg/l	5.15	0.918	1	"	"	"	"	"	X
88-74-4	2-Nitroaniline	< 0.845	U	µg/l	5.15	0.845	1	"	"	"	"	"	X
99-09-2	3-Nitroaniline	< 0.660	U	µg/l	5.15	0.660	1	"	"	"	"	"	X
100-01-6	4-Nitroaniline	< 0.742	U	µg/l	20.6	0.742	1	"	"	"	"	"	X
98-95-3	Nitrobenzene	< 0.979	U	µg/l	5.15	0.979	1	"	"	"	"	"	X
88-75-5	2-Nitrophenol	< 1.06	U	µg/l	5.15	1.06	1	"	"	"	"	"	X
100-02-7	4-Nitrophenol	< 2.88	U	µg/l	20.6	2.88	1	"	"	"	"	"	X
62-75-9	N-Nitrosodimethylamine	< 1.04	U	µg/l	5.15	1.04	1	"	"	"	"	"	X
621-64-7	N-Nitrosodi-n-propylamine	< 0.948	U	µg/l	5.15	0.948	1	"	"	"	"	"	X
86-30-6	N-Nitrosodiphenylamine	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
87-86-5	Pentachlorophenol	< 0.835	U	µg/l	20.6	0.835	1	"	"	"	"	"	X
85-01-8	Phenanthrene	< 0.897	U	µg/l	5.15	0.897	1	"	"	"	"	"	X
108-95-2	Phenol	< 0.979	U	µg/l	5.15	0.979	1	"	"	"	"	"	X
129-00-0	Pyrene	< 1.32	U	µg/l	5.15	1.32	1	"	"	"	"	"	X
110-86-1	Pyridine	< 1.00	U	µg/l	5.15	1.00	1	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 0.948	U	µg/l	5.15	0.948	1	"	"	"	"	"	X
90-12-0	1-Methylnaphthalene	< 0.959	U	µg/l	5.15	0.959	1	"	"	"	"	"	
95-95-4	2,4,5-Trichlorophenol	< 0.856	U	µg/l	5.15	0.856	1	"	"	"	"	"	X
88-06-2	2,4,6-Trichlorophenol	< 0.804	U	µg/l	5.15	0.804	1	"	"	"	"	"	X
82-68-8	Pentachloronitrobenzene	< 0.938	U	µg/l	5.15	0.938	1	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-D SB77308-04	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
95-94-3	1,2,4,5-Tetrachlorobenzene	< 0.990	U	µg/l	5.15	0.990	1	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X

Surrogate recoveries:

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
321-60-8	*2-Fluorobiphenyl*	*62*			*30-130 %*			"	"	"	"	"	
367-12-4	*2-Fluorophenol*	*39*			*15-110 %*			"	"	"	"	"	
4165-60-0	*Nitrobenzene-d5*	*61*			*30-130 %*			"	"	"	"	"	
4165-62-2	*Phenol-d5*	*33*			*15-110 %*			"	"	"	"	"	
1718-51-0	*Terphenyl-dl4*	*84*			*30-130 %*			"	"	"	"	"	
118-79-6	*2,4,6-Tribromophenol*	*81*			*15-110 %*			"	"	"	"	"	

Extractable Petroleum Hydrocarbons

Fingerprinting by GC

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
8006-61-9	Gasoline	< 0.2	U	mg/l	0.2	0.2	1	SW846 8100Mod.	27-Sep-13	01-Oct-13	SEP	1323309	
68476-30-2	Fuel Oil #2	**Calculated as**		mg/l	0.2	0.2	1	"	"	"	"	"	
68476-31-3	Fuel Oil #4	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
68553-00-4	Fuel Oil #6	< 0.2	U	mg/l	0.2	0.2	1	"	"	"	"	"	
M09800000	Motor Oil	< 0.2	U	mg/l	0.2	0.2	1	"	"	"	"	"	
8032-32-4	Ligroin	**Calculated as**		mg/l	0.2	0.05	1	"	"	"	"	"	
J00100000	Aviation Fuel	< 0.05	U	mg/l	0.2	0.05	1	"	"	"	"	"	
	Hydraulic Oil	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
	Dielectric Fluid	< 0.05	U	mg/l	0.2	0.05	1	"	"	"	"	"	
	Unidentified	**7.3**		mg/l	0.2	0.05	1	"	"	"	"	"	
	Other Oil	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
	Total Petroleum Hydrocarbons	**7.3**		mg/l	0.2	0.02	1	"	"	"	"	"	

Surrogate recoveries:

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
3386-33-2	*1-Chlorooctadecane*	*84*			*40-140 %*			"	"	"	"	"	

Total Metals by EPA 200/6000 Series Methods

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
	Preservation	**Field Preserved**		N/A			1	EPA 200/6000 methods			LNB	1323140	

Total Metals by EPA 6000/7000 Series Methods

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
7440-22-4	Silver	< 0.0009	R01, U	mg/l	0.0100	0.0009	1	SW846 6010C	30-Sep-13	01-Oct-13	edt	1323503	X
7429-90-5	Aluminum	**28.9**		mg/l	0.0250	0.0076	1	"	"	"	"	"	X
7440-38-2	Arsenic	**0.0460**		mg/l	0.0040	0.0018	1	"	"	"	"	"	X
7440-39-3	Barium	**0.428**		mg/l	0.0050	0.0007	1	"	"	"	"	"	X
7440-41-7	Beryllium	**0.0016**	J	mg/l	0.0020	0.0002	1	"	"	"	"	"	X
7440-70-2	Calcium	**288**	GS1, D	mg/l	0.200	0.0367	2	"	"	01-Oct-13	"	"	X
7440-43-9	Cadmium	< 0.0008	U	mg/l	0.0025	0.0008	1	"	"	01-Oct-13	"	"	X
7440-48-4	Cobalt	**0.0233**		mg/l	0.0050	0.0003	1	"	"	"	"	"	X
7440-47-3	Chromium	**0.0574**		mg/l	0.0050	0.0009	1	"	"	"	"	"	X
7440-50-8	Copper	**0.167**		mg/l	0.0050	0.0011	1	"	"	"	"	"	X
7439-89-6	Iron	**59.8**		mg/l	0.0150	0.0074	1	"	"	01-Oct-13	"	"	X
7440-09-7	Potassium	**9.80**		mg/l	0.500	0.0595	1	"	"	"	"	"	X
7439-95-4	Magnesium	**67.9**	GS1, D	mg/l	0.0200	0.0025	2	"	"	01-Oct-13	"	"	X

* Reportable Detection Limit

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-D SB77308-04	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
Total Metals by EPA 6000/7000 Series Methods													
7439-96-5	Manganese	**2.73**		mg/l	0.0020	0.0012	1	SW846 6010C	30-Sep-13	01-Oct-13	edt	1323503	X
7440-23-5	Sodium	**98.0**		mg/l	0.250	0.0325	1	"	"	01-Oct-13	"	"	X
7440-02-0	Nickel	**0.0578**		mg/l	0.0050	0.0007	1	"	"	01-Oct-13	"	"	X
7439-92-1	Lead	**0.0784**		mg/l	0.0075	0.0020	1	"	"	"	"	"	X
7440-36-0	Antimony	< 0.0014	U	mg/l	0.0060	0.0014	1	"	"	"	"	"	X
7782-49-2	Selenium	< 0.0030	U	mg/l	0.0150	0.0030	1	"	"	"	"	"	X
7440-28-0	Thallium	< 0.0029	U	mg/l	0.0050	0.0029	1	"	"	"	"	"	X
7440-62-2	Vanadium	**0.0472**		mg/l	0.0050	0.0009	1	"	"	"	"	"	X
7440-66-6	Zinc	**0.471**		mg/l	0.0050	0.0020	1	"	"	"	"	"	X
Total Metals by EPA 200 Series Methods													
7439-97-6	Mercury	< 0.00008	U	mg/l	0.00020	0.00008	1	EPA 245.1/7470A	30-Sep-13	02-Oct-13	LR	1323504	X
General Chemistry Parameters													
57-12-5	Cyanide (total)	< 0.00360	U	mg/l	0.00500	0.00360	1	EPA 335.4 / SW846 9012B	26-Sep-13	27-Sep-13	RLT	1323263	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-E SB77308-05	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
Volatile Organic Compounds													
Volatile Organic Compounds by SW846 8260													
Prepared by method SW846 5030 Water MS													
76-13-1	1,1,2-Trichlorotrifluoroethane (Freon 113)	< 0.65	U	µg/l	1.00	0.65	1	SW846 8260C	27-Sep-13	27-Sep-13	naa	1323343	X
67-64-1	Acetone	**9.53**	J	µg/l	10.0	2.56	1	"	"	"	"	"	X
107-13-1	Acrylonitrile	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
71-43-2	Benzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
108-86-1	Bromobenzene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
74-97-5	Bromochloromethane	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
75-27-4	Bromodichloromethane	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
75-25-2	Bromoform	< 0.60	U	µg/l	1.00	0.60	1	"	"	"	"	"	X
74-83-9	Bromomethane	< 1.14	U	µg/l	2.00	1.14	1	"	"	"	"	"	X
78-93-3	2-Butanone (MEK)	< 1.93	U	µg/l	10.0	1.93	1	"	"	"	"	"	X
104-51-8	n-Butylbenzene	< 0.56	U	µg/l	1.00	0.56	1	"	"	"	"	"	X
135-98-8	sec-Butylbenzene	< 0.82	U	µg/l	1.00	0.82	1	"	"	"	"	"	X
98-06-6	tert-Butylbenzene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
75-15-0	Carbon disulfide	< 1.28	U	µg/l	2.00	1.28	1	"	"	"	"	"	X
56-23-5	Carbon tetrachloride	< 0.55	U	µg/l	1.00	0.55	1	"	"	"	"	"	X
108-90-7	Chlorobenzene	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
75-00-3	Chloroethane	< 1.00	U	µg/l	2.00	1.00	1	"	"	"	"	"	X
67-66-3	Chloroform	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
74-87-3	Chloromethane	< 1.47	U	µg/l	2.00	1.47	1	"	"	"	"	"	X
95-49-8	2-Chlorotoluene	< 0.79	U	µg/l	1.00	0.79	1	"	"	"	"	"	X
106-43-4	4-Chlorotoluene	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
96-12-8	1,2-Dibromo-3-chloropropane	< 1.20	U	µg/l	2.00	1.20	1	"	"	"	"	"	X
124-48-1	Dibromochloromethane	< 0.34	U	µg/l	0.50	0.34	1	"	"	"	"	"	X
106-93-4	1,2-Dibromoethane (EDB)	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
74-95-3	Dibromomethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
106-46-7	1,4-Dichlorobenzene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
75-71-8	Dichlorodifluoromethane (Freon12)	< 0.45	U	µg/l	2.00	0.45	1	"	"	"	"	"	X
75-34-3	1,1-Dichloroethane	< 0.68	U	µg/l	1.00	0.68	1	"	"	"	"	"	X
107-06-2	1,2-Dichloroethane	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
75-35-4	1,1-Dichloroethene	< 0.49	U	µg/l	1.00	0.49	1	"	"	"	"	"	X
156-59-2	cis-1,2-Dichloroethene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
156-60-5	trans-1,2-Dichloroethene	< 0.83	U	µg/l	1.00	0.83	1	"	"	"	"	"	X
78-87-5	1,2-Dichloropropane	< 0.77	U	µg/l	1.00	0.77	1	"	"	"	"	"	X
142-28-9	1,3-Dichloropropane	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
594-20-7	2,2-Dichloropropane	< 0.87	U	µg/l	1.00	0.87	1	"	"	"	"	"	X
563-58-6	1,1-Dichloropropene	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
10061-01-5	cis-1,3-Dichloropropene	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
10061-02-6	trans-1,3-Dichloropropene	< 0.50	U	µg/l	0.50	0.50	1	"	"	"	"	"	X
100-41-4	Ethylbenzene	< 0.95	U	µg/l	1.00	0.95	1	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 0.49	U	µg/l	0.50	0.49	1	"	"	"	"	"	X
591-78-6	2-Hexanone (MBK)	< 0.66	U	µg/l	10.0	0.66	1	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-E SB77308-05	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

Volatile Organic Compounds

Volatile Organic Compounds by SW846 8260

Prepared by method SW846 5030 Water MS

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
98-82-8	Isopropylbenzene	< 0.62	U	µg/l	1.00	0.62	1	SW846 8260C	27-Sep-13	27-Sep-13	naa	1323343	X
99-87-6	4-Isopropyltoluene	< 0.61	U	µg/l	1.00	0.61	1	"	"	"	"	"	X
1634-04-4	Methyl tert-butyl ether	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
108-10-1	4-Methyl-2-pentanone (MIBK)	< 2.76	U	µg/l	10.0	2.76	1	"	"	"	"	"	X
75-09-2	Methylene chloride	< 0.95	U	µg/l	2.00	0.95	1	"	"	"	"	"	X
91-20-3	Naphthalene	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
103-65-1	n-Propylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
100-42-5	Styrene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
630-20-6	1,1,1,2-Tetrachloroethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
79-34-5	1,1,2,2-Tetrachloroethane	< 0.32	U	µg/l	0.50	0.32	1	"	"	"	"	"	X
127-18-4	Tetrachloroethene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
108-88-3	Toluene	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
87-61-6	1,2,3-Trichlorobenzene	< 0.38	U	µg/l	1.00	0.38	1	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 0.36	U	µg/l	1.00	0.36	1	"	"	"	"	"	X
108-70-3	1,3,5-Trichlorobenzene	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	
71-55-6	1,1,1-Trichloroethane	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
79-00-5	1,1,2-Trichloroethane	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
79-01-6	Trichloroethene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
75-69-4	Trichlorofluoromethane (Freon 11)	< 0.63	U	µg/l	1.00	0.63	1	"	"	"	"	"	X
96-18-4	1,2,3-Trichloropropane	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
95-63-6	1,2,4-Trimethylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
108-67-8	1,3,5-Trimethylbenzene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
75-01-4	Vinyl chloride	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
179601-23-1	m,p-Xylene	< 1.64	U	µg/l	2.00	1.64	1	"	"	"	"	"	X
95-47-6	o-Xylene	< 0.88	U	µg/l	1.00	0.88	1	"	"	"	"	"	X
109-99-9	Tetrahydrofuran	< 1.44	U	µg/l	2.00	1.44	1	"	"	"	"	"	
60-29-7	Ethyl ether	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
994-05-8	Tert-amyl methyl ether	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
637-92-3	Ethyl tert-butyl ether	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
108-20-3	Di-isopropyl ether	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
75-65-0	Tert-Butanol / butyl alcohol	< 8.64	U	µg/l	10.0	8.64	1	"	"	"	"	"	X
123-91-1	1,4-Dioxane	< 12.0	U	µg/l	20.0	12.0	1	"	"	"	"	"	X
110-57-6	trans-1,4-Dichloro-2-butene	< 0.74	U	µg/l	5.00	0.74	1	"	"	"	"	"	X
64-17-5	Ethanol	< 35.0	U	µg/l	400	35.0	1	"	"	"	"	"	X
Surrogate recoveries:													
460-00-4	*4-Bromofluorobenzene*	*88*			*70-130 %*			"	"	"	"	"	
2037-26-5	*Toluene-d8*	*93*			*70-130 %*			"	"	"	"	"	
17060-07-0	*1,2-Dichloroethane-d4*	*107*			*70-130 %*			"	"	"	"	"	
1868-53-7	*Dibromofluoromethane*	*104*			*70-130 %*			"	"	"	"	"	

Tentatively Identified Compounds by GC/MS

Prepared by method SW846 5030 Water MS

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-E SB77308-05	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

Volatile Organic Compounds

Tentatively Identified Compounds by GC/MS

Prepared by method SW846 5030 Water MS

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
	Tentatively Identified Compounds	**None found**		µg/l			1	SW846 8260C TICs	27-Sep-13	27-Sep-13	naa	1323343	

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds

Prepared by method SW846 3510C

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
83-32-9	Acenaphthene	< 0.928	U	µg/l	5.15	0.928	1	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
208-96-8	Acenaphthylene	< 0.897	U	µg/l	5.15	0.897	1	"	"	"	"	"	X
62-53-3	Aniline	< 0.649	U	µg/l	5.15	0.649	1	"	"	"	"	"	X
120-12-7	Anthracene	< 0.928	U	µg/l	5.15	0.928	1	"	"	"	"	"	X
103-33-3	Azobenzene/Diphenyldiazene	< 0.773	U	µg/l	5.15	0.773	1	"	"	"	"	"	
92-87-5	Benzidine	< 4.51	U	µg/l	5.15	4.51	1	"	"	"	"	"	X
56-55-3	Benzo (a) anthracene	< 1.23	U	µg/l	5.15	1.23	1	"	"	"	"	"	X
50-32-8	Benzo (a) pyrene	< 0.897	U	µg/l	5.15	0.897	1	"	"	"	"	"	X
205-99-2	Benzo (b) fluoranthene	< 0.876	U	µg/l	5.15	0.876	1	"	"	"	"	"	X
191-24-2	Benzo (g,h,i) perylene	< 0.928	U	µg/l	5.15	0.928	1	"	"	"	"	"	X
207-08-9	Benzo (k) fluoranthene	< 1.14	U	µg/l	5.15	1.14	1	"	"	"	"	"	X
65-85-0	Benzoic acid	< 2.24	U	µg/l	5.15	2.24	1	"	"	"	"	"	X
100-51-6	Benzyl alcohol	< 0.959	U	µg/l	5.15	0.959	1	"	"	"	"	"	X
111-91-1	Bis(2-chloroethoxy)methane	< 0.722	U	µg/l	5.15	0.722	1	"	"	"	"	"	X
111-44-4	Bis(2-chloroethyl)ether	< 0.866	U	µg/l	5.15	0.866	1	"	"	"	"	"	X
108-60-1	Bis(2-chloroisopropyl)ether	< 1.01	U	µg/l	5.15	1.01	1	"	"	"	"	"	X
117-81-7	Bis(2-ethylhexyl)phthalate	**1.44**	J	µg/l	5.15	1.05	1	"	"	"	"	"	X
101-55-3	4-Bromophenyl phenyl ether	< 0.876	U	µg/l	5.15	0.876	1	"	"	"	"	"	X
85-68-7	Butyl benzyl phthalate	< 1.06	U	µg/l	5.15	1.06	1	"	"	"	"	"	X
86-74-8	Carbazole	< 3.31	U	µg/l	5.15	3.31	1	"	"	"	"	"	X
59-50-7	4-Chloro-3-methylphenol	< 0.979	U	µg/l	5.15	0.979	1	"	"	"	"	"	X
106-47-8	4-Chloroaniline	< 0.577	U	µg/l	5.15	0.577	1	"	"	"	"	"	X
91-58-7	2-Chloronaphthalene	< 0.897	U	µg/l	5.15	0.897	1	"	"	"	"	"	X
95-57-8	2-Chlorophenol	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
7005-72-3	4-Chlorophenyl phenyl ether	< 0.918	U	µg/l	5.15	0.918	1	"	"	"	"	"	X
218-01-9	Chrysene	< 1.18	U	µg/l	5.15	1.18	1	"	"	"	"	"	X
53-70-3	Dibenzo (a,h) anthracene	< 0.959	U	µg/l	5.15	0.959	1	"	"	"	"	"	X
132-64-9	Dibenzofuran	< 0.907	U	µg/l	5.15	0.907	1	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 1.01	U	µg/l	5.15	1.01	1	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
106-46-7	1,4-Dichlorobenzene	< 1.03	U	µg/l	5.15	1.03	1	"	"	"	"	"	X
91-94-1	3,3´-Dichlorobenzidine	< 0.701	U	µg/l	5.15	0.701	1	"	"	"	"	"	X
120-83-2	2,4-Dichlorophenol	< 0.845	U	µg/l	5.15	0.845	1	"	"	"	"	"	X
84-66-2	Diethyl phthalate	< 0.887	U	µg/l	5.15	0.887	1	"	"	"	"	"	X
131-11-3	Dimethyl phthalate	< 0.938	U	µg/l	5.15	0.938	1	"	"	"	"	"	X
105-67-9	2,4-Dimethylphenol	< 0.835	U	µg/l	5.15	0.835	1	"	"	"	"	"	X
84-74-2	Di-n-butyl phthalate	**4.07**	J	µg/l	5.15	0.969	1	"	"	"	"	"	X

This laboratory report is not valid without an authorized signature on the cover page.

* Reportable Detection Limit

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-E SB77308-05	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

Semivolatile Organic Compounds by GCMS

Semivolatile Organic Compounds

Prepared by method SW846 3510C

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
534-52-1	4,6-Dinitro-2-methylphenol	< 0.691	U	µg/l	5.15	0.691	1	SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	X
51-28-5	2,4-Dinitrophenol	< 2.96	U	µg/l	5.15	2.96	1	"	"	"	"	"	X
121-14-2	2,4-Dinitrotoluene	< 0.969	U	µg/l	5.15	0.969	1	"	"	"	"	"	X
606-20-2	2,6-Dinitrotoluene	< 0.969	U	µg/l	5.15	0.969	1	"	"	"	"	"	X
117-84-0	Di-n-octyl phthalate	< 0.804	U	µg/l	5.15	0.804	1	"	"	"	"	"	X
206-44-0	Fluoranthene	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
86-73-7	Fluorene	< 0.928	U	µg/l	5.15	0.928	1	"	"	"	"	"	X
118-74-1	Hexachlorobenzene	< 0.959	U	µg/l	5.15	0.959	1	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 0.856	U	µg/l	5.15	0.856	1	"	"	"	"	"	X
77-47-4	Hexachlorocyclopentadiene	< 4.87	U	µg/l	5.15	4.87	1	"	"	"	"	"	X
67-72-1	Hexachloroethane	< 1.04	U	µg/l	5.15	1.04	1	"	"	"	"	"	X
193-39-5	Indeno (1,2,3-cd) pyrene	< 0.948	U	µg/l	5.15	0.948	1	"	"	"	"	"	X
78-59-1	Isophorone	< 0.856	U	µg/l	5.15	0.856	1	"	"	"	"	"	X
91-57-6	2-Methylnaphthalene	< 0.938	U	µg/l	5.15	0.938	1	"	"	"	"	"	X
95-48-7	2-Methylphenol	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
108-39-4, 106-44-5	3 & 4-Methylphenol	< 0.969	U	µg/l	10.3	0.969	1	"	"	"	"	"	X
91-20-3	Naphthalene	< 0.918	U	µg/l	5.15	0.918	1	"	"	"	"	"	X
88-74-4	2-Nitroaniline	< 0.845	U	µg/l	5.15	0.845	1	"	"	"	"	"	X
99-09-2	3-Nitroaniline	< 0.660	U	µg/l	5.15	0.660	1	"	"	"	"	"	X
100-01-6	4-Nitroaniline	< 0.742	U	µg/l	20.6	0.742	1	"	"	"	"	"	X
98-95-3	Nitrobenzene	< 0.979	U	µg/l	5.15	0.979	1	"	"	"	"	"	X
88-75-5	2-Nitrophenol	< 1.06	U	µg/l	5.15	1.06	1	"	"	"	"	"	X
100-02-7	4-Nitrophenol	< 2.88	U	µg/l	20.6	2.88	1	"	"	"	"	"	X
62-75-9	N-Nitrosodimethylamine	< 1.04	U	µg/l	5.15	1.04	1	"	"	"	"	"	X
621-64-7	N-Nitrosodi-n-propylamine	< 0.948	U	µg/l	5.15	0.948	1	"	"	"	"	"	X
86-30-6	N-Nitrosodiphenylamine	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
87-86-5	Pentachlorophenol	< 0.835	U	µg/l	20.6	0.835	1	"	"	"	"	"	X
85-01-8	Phenanthrene	< 0.897	U	µg/l	5.15	0.897	1	"	"	"	"	"	X
108-95-2	Phenol	< 0.979	U	µg/l	5.15	0.979	1	"	"	"	"	"	X
129-00-0	Pyrene	< 1.32	U	µg/l	5.15	1.32	1	"	"	"	"	"	X
110-86-1	Pyridine	< 1.00	U	µg/l	5.15	1.00	1	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 0.948	U	µg/l	5.15	0.948	1	"	"	"	"	"	X
90-12-0	1-Methylnaphthalene	< 0.959	U	µg/l	5.15	0.959	1	"	"	"	"	"	
95-95-4	2,4,5-Trichlorophenol	< 0.856	U	µg/l	5.15	0.856	1	"	"	"	"	"	X
88-06-2	2,4,6-Trichlorophenol	< 0.804	U	µg/l	5.15	0.804	1	"	"	"	"	"	X
82-68-8	Pentachloronitrobenzene	< 0.938	U	µg/l	5.15	0.938	1	"	"	"	"	"	X
95-94-3	1,2,4,5-Tetrachlorobenzene	< 0.990	U	µg/l	5.15	0.990	1	"	"	"	"	"	X
Surrogate recoveries:													
321-60-8	*2-Fluorobiphenyl*	*59*			*30-130 %*			"	"	"	"	"	
367-12-4	*2-Fluorophenol*	*42*			*15-110 %*			"	"	"	"	"	
4165-60-0	*Nitrobenzene-d5*	*61*			*30-130 %*			"	"	"	"	"	
4165-62-2	*Phenol-d5*	*29*			*15-110 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
MW-E SB77308-05	48845-13	Ground Water	19-Sep-13 15:30	20-Sep-13

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Semivolatile Organic Compounds by GCMS													
Semivolatile Organic Compounds													
Prepared by method SW846 3510C													
1718-51-0	*Terphenyl-dl4*	*77*			*30-130 %*			SW846 8270D	26-Sep-13	01-Oct-13	JG	1323267	
118-79-6	*2,4,6-Tribromophenol*	*77*			*15-110 %*			"	"	"	"	"	
Extractable Petroleum Hydrocarbons													
Fingerprinting by GC													
Prepared by method SW846 3510C													
8006-61-9	Gasoline	< 0.2	U	mg/l	0.2	0.2	1	SW846 8100Mod.	27-Sep-13	01-Oct-13	SEP	1323309	
68476-30-2	Fuel Oil #2	< 0.2	U	mg/l	0.2	0.2	1	"	"	"	"	"	
68476-31-3	Fuel Oil #4	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
68553-00-4	Fuel Oil #6	< 0.2	U	mg/l	0.2	0.2	1	"	"	"	"	"	
M09800000	Motor Oil	< 0.2	U	mg/l	0.2	0.2	1	"	"	"	"	"	
8032-32-4	Ligroin	< 0.05	U	mg/l	0.2	0.05	1	"	"	"	"	"	
J00100000	Aviation Fuel	< 0.05	U	mg/l	0.2	0.05	1	"	"	"	"	"	
	Hydraulic Oil	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
	Dielectric Fluid	< 0.05	U	mg/l	0.2	0.05	1	"	"	"	"	"	
	Unidentified	< 0.05	U	mg/l	0.2	0.05	1	"	"	"	"	"	
	Other Oil	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
	Total Petroleum Hydrocarbons	< 0.02	U	mg/l	0.2	0.02	1	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*63*			*40-140 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Trip Blank SB77308-06	48845-13	Trip Blank	19-Sep-13 00:00	20-Sep-13

Volatile Organic Compounds

Volatile Organic Compounds by SW846 8260

Prepared by method SW846 5030 Water MS

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
76-13-1	1,1,2-Trichlorotrifluoroethane (Freon 113)	< 0.65	U	µg/l	1.00	0.65	1	SW846 8260C	27-Sep-13	27-Sep-13	naa	1323343	X
67-64-1	Acetone	< 2.56	U	µg/l	10.0	2.56	1	"	"	"	"	"	X
107-13-1	Acrylonitrile	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
71-43-2	Benzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
108-86-1	Bromobenzene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
74-97-5	Bromochloromethane	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
75-27-4	Bromodichloromethane	< 0.48	U	µg/l	0.50	0.48	1	"	"	"	"	"	X
75-25-2	Bromoform	< 0.60	U	µg/l	1.00	0.60	1	"	"	"	"	"	X
74-83-9	Bromomethane	< 1.14	U	µg/l	2.00	1.14	1	"	"	"	"	"	X
78-93-3	2-Butanone (MEK)	< 1.93	U	µg/l	10.0	1.93	1	"	"	"	"	"	X
104-51-8	n-Butylbenzene	< 0.56	U	µg/l	1.00	0.56	1	"	"	"	"	"	X
135-98-8	sec-Butylbenzene	< 0.82	U	µg/l	1.00	0.82	1	"	"	"	"	"	X
98-06-6	tert-Butylbenzene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
75-15-0	Carbon disulfide	< 1.28	U	µg/l	2.00	1.28	1	"	"	"	"	"	X
56-23-5	Carbon tetrachloride	< 0.55	U	µg/l	1.00	0.55	1	"	"	"	"	"	X
108-90-7	Chlorobenzene	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
75-00-3	Chloroethane	< 1.00	U	µg/l	2.00	1.00	1	"	"	"	"	"	X
67-66-3	Chloroform	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
74-87-3	Chloromethane	< 1.47	U	µg/l	2.00	1.47	1	"	"	"	"	"	X
95-49-8	2-Chlorotoluene	< 0.79	U	µg/l	1.00	0.79	1	"	"	"	"	"	X
106-43-4	4-Chlorotoluene	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
96-12-8	1,2-Dibromo-3-chloropropane	< 1.20	U	µg/l	2.00	1.20	1	"	"	"	"	"	X
124-48-1	Dibromochloromethane	< 0.34	U	µg/l	0.50	0.34	1	"	"	"	"	"	X
106-93-4	1,2-Dibromoethane (EDB)	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
74-95-3	Dibromomethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
95-50-1	1,2-Dichlorobenzene	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
541-73-1	1,3-Dichlorobenzene	< 0.71	U	µg/l	1.00	0.71	1	"	"	"	"	"	X
106-46-7	1,4-Dichlorobenzene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
75-71-8	Dichlorodifluoromethane (Freon12)	< 0.45	U	µg/l	2.00	0.45	1	"	"	"	"	"	X
75-34-3	1,1-Dichloroethane	< 0.68	U	µg/l	1.00	0.68	1	"	"	"	"	"	X
107-06-2	1,2-Dichloroethane	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
75-35-4	1,1-Dichloroethene	< 0.49	U	µg/l	1.00	0.49	1	"	"	"	"	"	X
156-59-2	cis-1,2-Dichloroethene	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
156-60-5	trans-1,2-Dichloroethene	< 0.83	U	µg/l	1.00	0.83	1	"	"	"	"	"	X
78-87-5	1,2-Dichloropropane	< 0.77	U	µg/l	1.00	0.77	1	"	"	"	"	"	X
142-28-9	1,3-Dichloropropane	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
594-20-7	2,2-Dichloropropane	< 0.87	U	µg/l	1.00	0.87	1	"	"	"	"	"	X
563-58-6	1,1-Dichloropropene	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
10061-01-5	cis-1,3-Dichloropropene	< 0.36	U	µg/l	0.50	0.36	1	"	"	"	"	"	X
10061-02-6	trans-1,3-Dichloropropene	< 0.50	U	µg/l	0.50	0.50	1	"	"	"	"	"	X
100-41-4	Ethylbenzene	< 0.95	U	µg/l	1.00	0.95	1	"	"	"	"	"	X
87-68-3	Hexachlorobutadiene	< 0.49	U	µg/l	0.50	0.49	1	"	"	"	"	"	X
591-78-6	2-Hexanone (MBK)	< 0.66	U	µg/l	10.0	0.66	1	"	"	"	"	"	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Trip Blank SB77308-06	48845-13	Trip Blank	19-Sep-13 00:00	20-Sep-13

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Volatile Organic Compounds													
Volatile Organic Compounds by SW846 8260													
Prepared by method SW846 5030 Water MS													
98-82-8	Isopropylbenzene	< 0.62	U	µg/l	1.00	0.62	1	SW846 8260C	27-Sep-13	27-Sep-13	naa	1323343	X
99-87-6	4-Isopropyltoluene	< 0.61	U	µg/l	1.00	0.61	1	"	"	"	"	"	X
1634-04-4	Methyl tert-butyl ether	< 0.65	U	µg/l	1.00	0.65	1	"	"	"	"	"	X
108-10-1	4-Methyl-2-pentanone (MIBK)	< 2.76	U	µg/l	10.0	2.76	1	"	"	"	"	"	X
75-09-2	Methylene chloride	< 0.95	U	µg/l	2.00	0.95	1	"	"	"	"	"	X
91-20-3	Naphthalene	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
103-65-1	n-Propylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
100-42-5	Styrene	< 0.62	U	µg/l	1.00	0.62	1	"	"	"	"	"	X
630-20-6	1,1,1,2-Tetrachloroethane	< 0.67	U	µg/l	1.00	0.67	1	"	"	"	"	"	X
79-34-5	1,1,2,2-Tetrachloroethane	< 0.32	U	µg/l	0.50	0.32	1	"	"	"	"	"	X
127-18-4	Tetrachloroethene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
108-88-3	Toluene	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
87-61-6	1,2,3-Trichlorobenzene	< 0.38	U	µg/l	1.00	0.38	1	"	"	"	"	"	X
120-82-1	1,2,4-Trichlorobenzene	< 0.36	U	µg/l	1.00	0.36	1	"	"	"	"	"	X
108-70-3	1,3,5-Trichlorobenzene	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	
71-55-6	1,1,1-Trichloroethane	< 0.58	U	µg/l	1.00	0.58	1	"	"	"	"	"	X
79-00-5	1,1,2-Trichloroethane	< 0.64	U	µg/l	1.00	0.64	1	"	"	"	"	"	X
79-01-6	Trichloroethene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
75-69-4	Trichlorofluoromethane (Freon 11)	< 0.63	U	µg/l	1.00	0.63	1	"	"	"	"	"	X
96-18-4	1,2,3-Trichloropropane	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
95-63-6	1,2,4-Trimethylbenzene	< 0.76	U	µg/l	1.00	0.76	1	"	"	"	"	"	X
108-67-8	1,3,5-Trimethylbenzene	< 0.74	U	µg/l	1.00	0.74	1	"	"	"	"	"	X
75-01-4	Vinyl chloride	< 0.81	U	µg/l	1.00	0.81	1	"	"	"	"	"	X
179601-23-1	m,p-Xylene	< 1.64	U	µg/l	2.00	1.64	1	"	"	"	"	"	X
95-47-6	o-Xylene	< 0.88	U	µg/l	1.00	0.88	1	"	"	"	"	"	X
109-99-9	Tetrahydrofuran	< 1.44	U	µg/l	2.00	1.44	1	"	"	"	"	"	
60-29-7	Ethyl ether	< 0.69	U	µg/l	1.00	0.69	1	"	"	"	"	"	X
994-05-8	Tert-amyl methyl ether	< 0.72	U	µg/l	1.00	0.72	1	"	"	"	"	"	X
637-92-3	Ethyl tert-butyl ether	< 0.78	U	µg/l	1.00	0.78	1	"	"	"	"	"	X
108-20-3	Di-isopropyl ether	< 0.73	U	µg/l	1.00	0.73	1	"	"	"	"	"	X
75-65-0	Tert-Butanol / butyl alcohol	< 8.64	U	µg/l	10.0	8.64	1	"	"	"	"	"	X
123-91-1	1,4-Dioxane	< 12.0	U	µg/l	20.0	12.0	1	"	"	"	"	"	X
110-57-6	trans-1,4-Dichloro-2-butene	< 0.74	U	µg/l	5.00	0.74	1	"	"	"	"	"	X
64-17-5	Ethanol	< 35.0	U	µg/l	400	35.0	1	"	"	"	"	"	X
Surrogate recoveries:													
460-00-4	*4-Bromofluorobenzene*	*81*			*70-130 %*			"	"	"	"	"	
2037-26-5	*Toluene-d8*	*93*			*70-130 %*			"	"	"	"	"	
17060-07-0	*1,2-Dichloroethane-d4*	*99*			*70-130 %*			"	"	"	"	"	
1868-53-7	*Dibromofluoromethane*	*102*			*70-130 %*			"	"	"	"	"	

Tentatively Identified Compounds by GC/MS TIC

Prepared by method SW846 5030 Water MS

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Trip Blank SB77308-06	48845-13	Trip Blank	19-Sep-13 00:00	20-Sep-13

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
Volatile Organic Compounds													
Tentatively Identified Compounds by GC/MS			TIC										
Prepared by method SW846 5030 Water MS													
000628-89-7	Ethanol, 2-(2-chloroethoxy)-	**1.5**		µg/l			1	SW846 8260C TICs	27-Sep-13	27-Sep-13	naa	1323343	

Notes and Definitions

D	Data reported from a dilution
GS1	Sample dilution required for high concentration of target analytes to be within the instrument calibration range.
J	Detected above the Method Detection Limit but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
QC2	Analyte out of acceptance range in QC spike but no reportable concentration present in sample.
QM2	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
QM5	The spike recovery was outside acceptance limits for the MS, MSD and/or PS due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.
QM7	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
QM9	The spike recovery for this QC sample is outside the established control limits. The sample results for the QC batch were accepted based on LCS/LCSD or SRM recoveries within the control limits.
QR2	The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on percent recoveries and completeness of QC data.
QR7	The RPD exceeded the QC control limits; however precision is demonstrated with acceptable RPD values for batch duplicate.
R01	The Reporting Limit has been raised to account for matrix interference.
R05	Elevated Reporting Limits due to the presence of high levels of non-target analytes.
S01	The surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interference's.
SGCMSVOC	Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogates with three required by program methods.
TIC	(Tentatively Identified Compounds) reported values are estimated concentrations of non-target analytes identified at greater than 10% of the nearest internal standard.
U	Analyte included in the analysis, but not detected at or above the MDL.
dry	Sample results reported on a dry weight basis
NR	Not Reported
RPD	Relative Percent Difference
LIV	The initial volume for this sample has been reduced due to sample matrix and/or historical data therefore elevating the reporting limit.

Interpretation of Total Petroleum Hydrocarbon Report

Petroleum identification is determined by comparing the GC fingerprint obtained from the sample with a library of GC fingerprints obtained from analyses of various petroleum products. Possible match categories are as follows:

Gasoline - includes regular, unleaded, premium, etc.
Fuel Oil #2 - includes home heating oil, #2 fuel oil, and diesel
Fuel Oil #4 - includes #4 fuel oil
Fuel Oil #6 - includes #6 fuel oil and bunker "C" oil
Motor Oil - includes virgin and waste automobile oil
Ligroin - includes mineral spirits, petroleum naphtha, vm&p naphtha
Aviation Fuel - includes kerosene, Jet A and JP-4
Other Oil - includes lubricating and cutting oil, and silicon oil

At times, the unidentified petroleum product is quantified using a calibration that most closely approximates the distribution of compounds in the sample. When this occurs, the result is qualified as Calculated as.

Laboratory Control Sample (LCS): A known matrix spiked with compound(s) representative of the target analytes, which is used to document laboratory performance.

Matrix Duplicate: An intra-laboratory split sample which is used to document the precision of a method in a given sample matrix.

Matrix Spike: An aliquot of a sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Method Blank: An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process.

Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

Reportable Detection Limit (RDL): The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. For many analytes the RDL analyte concentration is selected as the lowest non-zero standard in the calibration curve. While the RDL is approximately 5 to 10 times the MDL, the RDL for each sample takes into account the sample volume/weight, extract/digestate volume, cleanup procedures and, if applicable, dry weight correction. Sample RDLs are highly matrix-dependent.

Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. These compounds are spiked into all blanks, standards, and samples prior to analysis. Percent recoveries are calculated for each surrogate.

Continuing Calibration Verification: The calibration relationship established during the initial calibration must be verified at periodic intervals. Concentrations, intervals, and criteria are method specific.

Validated by:
June O'Connor
Nicole Leja

3B77308. JB

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

CHAIN OF CUSTODY RECORD

Page 1 of 1

Special Handling:
☒ Standard TAT - 7 to 10 business days
☐ Rush TAT - Date Needed: ______
- All TATs subject to laboratory approval.
- Min. 24-hour notification needed for rushes.
- Samples disposed of after 60 days unless otherwise instructed.

Report To: Day Environmental
1563 Lyell Ave.
Rochester New York, 14606

Telephone #: 585-454-0210
Project Mgr. Ray Kampff x108

Invoice To: DAY Environmental
1563 Lyell Ave.
Rochester New York, 14606

P.O. No.: ______ RQN: ______

Project No.: 48845-13
Site Name: 211 Franklin St.
Location: Olean State: NY
Sampler(s): Zack Tennies + Charles Hampton

1=$Na_2S_2O_3$ 2=HCl 3=H_2SO_4 4=HNO_3 5=NaOH 6=Ascorbic Acid 7=CH_3OH
8=$NaHSO_4$ 9=Deionized Water 10=H_3PO_4 11=______ 12=______

DW=Drinking Water GW=Groundwater WW=Wastewater
O=Oil SW=Surface Water SO=Soil SL=Sludge A=Air
X1=______ X2=______ X3=______

G=Grab C=Composite

QA/QC Reporting Notes:
* additional charges may apply

MA DEP MCP CAM Report: Yes ☐ No ☐
CT DPH RCP Report: Yes ☐ No ☐

QA/QC Reporting Level
☒ Standard ☐ No QC ☐ DQA*
☐ NY ASP A* ☐ NY ASP B*
☐ NJ Reduced* ☐ NJ Full*
☐ TIER II* ☐ TIER IV*
☐ Other ______

						Containers:					Analyses:								
										List preservative code below:	2	2		2	2				
Lab Id:	Sample Id:	Date:	Time:	Type	Matrix	# of VOA Vials	# of Amber Glass	# of Clear Glass	# of Plastic		VOCs 8260 Full list + TICS	TPH 8100	SVOCs 8270 Full	TAL metals	Cyanide	per client	see Attached	email	State-specific reporting standards:
77308-01	MW-A	9/19/13	16:00	G	GW	2	2				X	X	X						
02	MW-B	9/19/13	16:20	G	GW	2	2		2		X	X	X	X	X				
03	MW-C	9/19/13	13:55	G	GW	2	1				X	X							
04	MW-D	9/19/13	15:30	G	GW	2	2		2		X	X	X	X	X				
05	MW-E	9/19/13	15:30	G	GW	2	2				X	X	X						
06	Trip Blank			G	TB	2					X								per client see Attached email

2.1/1/1/1 IR 01

Relinquished by:	Received by:	Date:	Time:	Temp°C
Zachary Tennies		9/24/2013	09:00	
		9-24-13	1732	
		9/24/13	2100	

☐ EDD Format ______
☒ E-mail to rkampff@daymail.net

Condition upon receipt:
☐ Ambient ☒ Iced ☐ Refrigerated ☐ DI VOA Frozen ☐ Soil Jar Frozen

Sample Designation Key for ALS Report Samples

Sample Designation in ALS Report		Sample Designation in Phase II Report
TB-15A	to	TB-02
TB-12	to	TB-04
TB-17	to	TB-07

ALS

1565 Jefferson Rd., Bldg 300, Suite 360
Rochester, NY 14623
T: +1 585 288 5380
F: +1 585 288 8475
www.alsglobal.com

October 10, 2013

Mr. Ray Kampff
Day Environmental
1563 Lyell Ave.
Rochester, NY 14606

Re: Olean/48845-13
Service Request #R1306782

Dear Mr. Kampff:

Enclosed is an analytical data report for the above referenced facility. A total of three samples were received by our laboratory on September 16, 2013.

Any problems encountered with this project are addressed in a case narrative section which is presented later in this report.

This report consists of two (2) packages: the sample data package and the sample data summary package. All data presented in this package has been reviewed prior to report submission. If you should have any questions or concerns, please contact me at (585) 288-5380.

Thank you for your use of our services.

Sincerely,
ALS Environmental

Carl Beechler
Project Manager

Enc.

Page 1 of 64

Client:	Day Environmental, Inc.	**Service Request No.:**	R1306782
Project:	Olean/48845-13	**Date Received:**	9/16/13
Sample Matrix:	Soil		

CASE NARRATIVE – Page 1 of 2

All analyses were performed consistent with the quality assurance program of ALS Environmental (ALS). This report contains analytical results for samples designated for Tier IV deliverables. When appropriate to the method, method blank and LCS results have been reported with each analytical test.

Sample Receipt

Three samples were received for analysis at ALS Rochester on 9/17/13. The samples were received consistent with the accompanying chain of custody form. All samples were received within the appropriate temperature guidelines of 0-6°C. The samples were stored in a refrigerator between 1°C and 6°C upon receipt at the laboratory.

Volatile Organic Compounds by EPA Method 8260C

The Initial Calibration (ICAL), Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) criteria were met for all samples with the following except for the following compounds which were outside the ±20%Difference (%D) criteria for the CCV:

Acetone, Methyl Acetate, Methyl Ethyl Ketone, Cyclohexanone, Methyl Isobutyl Ketone and 2-Hexanone on the 9/20/13 run and
Bromoform on the 9/23/13 run.

Any hits for these compounds in samples associated with these runs should be considered as estimated.

A Library Search against the NIST/EPA library was conducted on each of the samples and blanks for the 8260C analysis. The 30 largest peaks, within 10% of the nearest Internal Standard, were searched. A summary of detected peaks is included following the Target data. Any analytes detected are quantitated based on the closest Internal Standard and are reported flagged with a "J" as estimated. The flag "N" on a TIC compound indicates the presumptive evidence of a particular compound.

Surrogate standard recoveries were within limits for all samples.

Internal Standard (IS) recoveries were acceptable.

Sample TB-12 (30') was analyzed at dilution due to matrix interference.

Site QC was not requested or performed. Batch QC is included in the report. All Laboratory Control Sample (LCS) and LCS Duplicate (LCSD) recoveries were within acceptable.

Hits between the MDL and MRL are flagged with a "J" as estimated.

All Method Blanks were free of contamination with the exception of 1,2,4-Trichlorobenzene on 9/23/13. No data is affected.

The samples were properly preserved and analyzed within the appropriate holding times.

No other analytical or quality control problems were encountered during analysis.

PCB by 8082A

The Initial Calibration (ICAL), Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) criteria were met for all samples

All surrogate standard recoveries were within acceptable limits.

All internal standard recoveries were within acceptable limits.

Sample TB-17 (3') was analyzed at dilution due to matrix interference.

Site QC was not requested or performed. Batch QC is included in the report. All Laboratory Control Sample (LCS) and LCS Duplicate (LCSD) recoveries were acceptable.

All Method Blanks were free of contamination.

The samples were extracted and analyzed within the appropriate holding times.

No other analytical or quality control problems were encountered during analysis

Semivolatile Organic Compounds by Method 8270D

The Initial Calibration (ICAL), Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) criteria were met for all samples except for the following CCV compounds:

Benzoic Acid, Benzaldehyde and 2,4-Dinitrophenol were outside the ± 20%D limits on the 9/23/13 run.

Any hits for these compounds associated with this CCV should be considered as estimated.

A Library Search against the NIST/EPA library was conducted on each of the samples and blanks for the 8270D analysis. The 20 largest peaks, within 10% of the nearest Internal Standard, were searched. A summary of detected peaks is included following the Target data. Any analytes detected are quantitated based on the closest Internal Standard and are reported flagged with a "J" as estimated. The flag "N" on a TIC compound indicates the presumptive evidence of a particular compound.

All surrogate standard recoveries were within acceptable limits.

All internal standard recoveries were within acceptable limits.

Sample TB-17 (3') was analyzed at dilution due to matrix interference.

Site QC was not requested or performed. Batch QC is included in the report. All Laboratory Control Sample (LCS) and LCS Duplicate (LCSD) recoveries were acceptable with the exception of Benzoic Acid in the LCS only as indicated by the "*" flag. No data is affected.

All Method Blanks were free of contamination.

The samples were extracted and analyzed within the appropriate holding times.

No other analytical or quality control problems were encountered during analysis.

Inorganic Parameters

Samples were analyzed for client specific inorganic parameters. Approved method references appear on report forms.

Hits between the MDL and MRL are flagged with a "J" as estimated.

The Initial Calibration (ICAL), Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) criteria were met for all samples.

Site QC was performed on sample TB-15A (24'). Several RPD calculations were outside acceptance limits. These RPD's have been flagged as "*". Matrix Spike recoveries were acceptable except for Nickel. This recovery is flagged as "N". Matrix interference is suspected. MS results are not applicable for Aluminum, Calcium, Iron, Magnesium and Manganese on this location. The analyte concentrations in the sample were more than four times higher than the added spike concentration, preventing accurate evaluation of the spike recovery. Batch QC is included in the report. All Laboratory Control Sample (LCS) recoveries were within QC limits.

All Method Blanks were free of contamination.

The samples were properly preserved and analyzed within the appropriate holding times for the methods.

No other analytical or QC problems were encountered during analysis.

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the details contained above Release of the data contained in this hard copy data package has been authorized by the Laboratory Manager or his designee, as verified by the following signature:

Approved by________________________ Date 10/10/13

ALS ASP/CLP Batching Form/Login Sheet

Client Proj #: 48845-13
Submission: R1306782
Client: Day Environmental, Incorporated
Client Rep: CBEECHLER
Project: Olean

Batch Complete: Yes
Diskette Requested: No
Date: 9/17/13
Custody Seal: Present/Absent:
Chain of Custody: Present/Absent:

Date Revised:
Date Due: 10/7/13
Protocol: MCAWW
Shipping No.:
SDG #: TB-15A (24")

CAS Job #	Client/EPA ID	Matrix	Requested Parameters	Date Sampled	Date Received	pH (Solids)	% Solids	Remarks Sample Condition
R1306782-001	TB-15A (24')	Soil	160.3 Modified, 7471B, 9012B, 8270D, 8260C, 8082A, 6010C	9/11/13	9/16/13			
R1306782-002	TB-17 (3')	Soil	8270D, 160.3 Modified	9/13/13	9/16/13			
R1306782-003	TB-12 (30')	Soil	8260C, 160.3 Modified, 8270D	9/12/13	9/16/13			

Folder Comments: Need 2 Week Data, VOA TICs & LL, SVOA TICs

ALS Environmental

REPORT QUALIFIERS AND DEFINITIONS

U	Analyte was analyzed for but not detected. The sample quantitation limit has been corrected for dilution and for percent moisture, unless otherwise noted in the case narrative.
J	Estimated value due to either being a Tentatively Identified Compound (TIC) or that the concentration is between the MRL and the MDL. Concentrations are not verified within the linear range of the calibration. For DoD: concentration >40% difference between two GC columns (pesticides/Arclors).
B	Analyte was also detected in the associated method blank at a concentration that may have contributed to the sample result.
E	Inorganics- Concentration is estimated due to the serial dilution was outside control limits.
E	Organics- Concentration has exceeded the calibration range for that specific analysis.
D	Concentration is a result of a dilution, typically a secondary analysis of the sample due to exceeding the calibration range or that a surrogate has been diluted out of the sample and cannot be assessed.
*	Indicates that a quality control parameter has exceeded laboratory limits. Under the "Notes" column of the Form I, this qualifier denotes analysis was performed out of Holding Time.
H	Analysis was performed out of hold time for tests that have an "immediate" hold time criteria.
#	Spike was diluted out.
+	Correlation coefficient for MSA is <0.995.
N	Inorganics- Matrix spike recovery was outside laboratory limits.
N	Organics- Presumptive evidence of a compound (reported as a TIC) based on the MS library search.
S	Concentration has been determined using Method of Standard Additions (MSA).
W	Post-Digestion Spike recovery is outside control limits and the sample absorbance is <50% of the spike absorbance.
P	Concentration >40% (25% for CLP) difference between the two GC columns.
C	Confirmed by GC/MS
Q	DoD reports: indicates a pesticide/Aroclor is not confirmed (≥100% Difference between two GC columns).
X	See Case Narrative for discussion.
MRL LOQ	Method Reporting Limit. Also known as: Limit of Quantitation (LOQ) The lowest concentration at which the method analyte may be reliably quantified under the method conditions.
MDL	Method Detection Limit. A statistical value derived from a study designed to provide the lowest concentration that will be detected 99% of the time. Values between the MDL and MRL are estimated (see J qualifier).
LOD	Limit of Detection. A value at or above the MDL which has been verified to be detectable.
ND	Non-Detect. Analyte was not detected at the concentration listed. Same as U qualifier.

ACCREDITED IN ACCORDANCE WITH nelac

Rochester Lab ID # for State Certifications[1]

NELAP Accredited	Maine ID #NY0032	New Hampshire ID # 294100 A/B
Connecticut ID # PH0556	Nebraska Accredited	
Delaware Accredited	Nevada ID # NY-00032	North Carolina #676
DoD ELAP #65817	New Jersey ID # NY004	Pennsylvania ID# 68-786
Florida ID # E87674	New York ID # 10145	Rhode Island ID # 158
Illinois ID #200047		Virginia #460167

[1] Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state or agency requirements. The test results meet requirements of the current NELAP/TNI standards or state or agency requirements, where applicable, except as noted in the laboratory case narrative provided. For a specific list of accredited analytes, refer to http://www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads/North-America-Downloads

INORGANIC PREPARATION METHODS

The preparation methods associated with this report are found in these tables unless discussed in the case narrative.

Water/Liquid Matrix

Analytical Method	Preparation Method
200.7	3010A
200.8	ILM05.3
6010C	3010A
6020A	ILM05.3
9014 Cyanide Reactivity	SW846 Ch7, 7.3.4.2
9034 Sulfide Reactivity	SW846 Ch7, 7.3.4.2
9034 Sulfide Acid Soluble	9030B
9056A Bomb (Halogens)	5050A
9066 Manual Distillation	9065
SM 4500-CN-E Residual Cyanide	SM 4500-CN-G
SM 4500-CN-E WAD Cyanide	SM 4500-CN-I

Solid/Soil/Non-Aqueous Matrix

Analytical Method	Preparation Method
6010C	3050B
6020A	3050B
6010C TCLP (1311) extract	3010A
6010 SPLP (1312) extract	3010A
7196A	3060A
7199	3060A
9056A Halogens/Halides	5050
300.0 Anions/ 350.1/ 353.2/ SM 2320B/ SM 5210B/ 9056A Anions	DI extraction

For analytical methods not listed, the preparation method is the same as the analytical method reference.

ALS Environmental

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM 10874

1565 Jefferson Road, Building 300, Suite 360 • Rochester, NY 14623 | +1 585 288 5380 +1 585 288 8475 (fax) PAGE 1 OF 1

Project Name: Olean, New York

Project Number: 48845-13

Project Manager: Ray Kampff

Report CC:

Company/Address:
Day Environmental
1563 Lyell Ave.
Rochester NY, 14606

Phone #: 585-454-0210

Email: rkampff@daymail.net

Sampler's Signature:

Sampler's Printed Name: Zachary Tenniel

ANALYSIS REQUESTED *(Include Method Number and Container Preservative)*

PRESERVATIVE	0	0	0		0	0		0

Preservative Key
0. NONE
1. HCL
2. HNO_3
3. H_2SO_4
4. NaOH
5. Zn. Acetate
6. MeOH
7. $NaHSO_4$
8. Other ______

CLIENT SAMPLE ID	FOR OFFICE USE ONLY LAB ID	SAMPLING DATE	SAMPLING TIME	MATRIX	NUMBER OF CONTAINERS	GC/MS VOAs ○ 8260 ○ 624 ○ CLP	GC/MS SVOAs ○ 8270 ○ 625	GC VOAs ○ 8021 ○ 601/602	PESTICIDES ○ 8081 ○ 608	PCBs ○ 8082 ○ 608	METALS, TOTAL (List in comments below)	METALS, DISSOLVED (List in comments below)	Cyanide 9012B							REMARKS/ ALTERNATE DESCRIPTION
TB-15A (24')		9/11/13	11:30	Soil	2	X	X			X	X		X							
TB-17 (3')		9/13/13	11:30	Soil	1		X													
TB-12 (30')		9/12/13	10:15	Soil	2	X	X	X												

SPECIAL INSTRUCTIONS/COMMENTS
Metals 6010C, 7471B

Results within 10 days (ASP cat. B)
Report within 15 days

See QAPP ☐

STATE WHERE SAMPLES WERE COLLECTED New York

TURNAROUND REQUIREMENTS

______ RUSH (SURCHARGES APPLY)

______ 1 day ______ 2 day ______ 3 day
______ 4 day ______ 5 day X 15 day

REQUESTED REPORT DATE
______

REPORT REQUIREMENTS

______ I. Results Only

______ II. Results + QC Summaries (LCS, DUP, MS/MSD as required)

______ III. Results + QC and Calibration Summaries

______ IV. Data Validation Report with Raw Data

Edata ____ Yes ____

INVOICE INFORMATION

PO #

BILL TO:
DAY
1563 Lyell Ave.
Rochester NY, 14606

R1306782 5
Day Environmental, Incorporated
Olean

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	
Signature	Signature Daniel Ward	Signature	Signature	Signature	
Printed Name WILLIAM BATISTE	Printed Name ALS	Printed Name	Printed Name	Printed Name	Printed Name
Firm DAY Environmental	Firm 9/16/13 / 1630	Firm	Firm	Firm	Firm
Date/Time 9.16.13 / 1630	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

Distribution: White - Lab Copy; Yellow - Return to Originator

Cooler Receipt and Preservation Check Form

Project/Client Day Env. Folder Number R1306712.

Cooler received on 9/16/13 by: DJW COURIER: ALS UPS FEDEX VELOCITY [✓ CLIENT]

1. Were custody seals on outside of cooler? YES [✓ NO]
2. Were custody papers properly filled out (ink, signed, etc.)? YES NO
3. Did all bottles arrive in good condition (unbroken)? [✓ YES] NO
4. Did VOA vials, Alkalinity, or Sulfide have significant* air bubbles? YES NO [✓ N/A]
5. Were ~~Ice~~ or Ice packs present? [✓ YES] NO
6. Where did the bottles originate? ~~ALS/ROC~~, CLIENT
7. Soil VOA samples received as: [✓ ~~Bulk Jar~~] Encore TerraCore Lab5035set ~~N/A~~ DJW 9/16/13
8. Temperature of cooler(s) upon receipt: 4.3° ____ ____ ____ ____

Is the temperature within 0° - 6° C?: [✓ Y] N Y N Y N Y N Y N

If No, Explain Below Date/Time Temperatures Taken: 9/16/13/1639

Thermometer ID: ~~IR GUN#3~~ / IR GUN#4 Reading From: ~~Temp Blank~~ / Sample Bottle

If out of Temperature, note packing/ice condition &Client Approval to Run Samples:

All Samples held in storage location R002 by DJW on 9/16/13 at 1639

5035 samples placed in storage location ____ by ____ on ____ at ____

PC Secondary Review: C 9/20/13

Cooler Breakdown: Date: 9/17/13 Time: 0842 by: JFS

1. Were all bottle labels complete (*i.e.* analysis, preservation, etc.)? [✓ YES] NO
2. Did all bottle labels and tags agree with custody papers? [✓ YES] NO
3. Were correct containers used for the tests indicated? [✓ YES] NO
4. Air Samples: Cassettes / Tubes Intact Canisters Pressurized Tedlar® Bags Inflated [✓ N/A]

Explain any discrepancies:

pH	Reagent	YES	NO	Lot Received	Exp	Sample ID	Vol. Added	Lot Added	Final pH
≥12	NaOH								
≤2	HNO_3								
≤2	H_2SO_4								
<4	$NaHSO_4$								
Residual Chlorine (-)	For TCN Phenol and 522			If present, contact PM to add ascorbic acid Or sodium sulfite (522)					
	$Na_2S_2O_3$	-	-						
	Zn Aceta	-	-						
	HCl	*	*						

*Not to be tested before analysis – pH tested and recorded by VOAs or GenChem on a separate worksheet

Yes = All samples OK

No = Samples were preserved at lab as listed

PM OK to Adjust: ____

Bottle lot numbers: 100812-300, 031113-1J

Other Comments:

PC Secondary Review: ____

*significant air bubbles: VOA > 5-6 mm : WC >1 in. diameter

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/11/13 1130
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Analyzed:	9/23/13 14:31
Sample Name:	TB-15A (24')	**Units:**	µg/Kg
Lab Code:	R1306782-001	**Basis:**	Dry
		Percent Solids:	91.4

Volatile Organic Compounds by GC/MS

Analytical Method:	8260C	**Analysis Lot:**	359621
Data File Name:	I:\ACQUDATA\msvoa10\data\092313\F2266.D\	**Instrument Name:**	R-MS-10
		Dilution Factor:	125

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
71-55-6	1,1,1-Trichloroethane (TCA)	680	U	680	52	
79-34-5	1,1,2,2-Tetrachloroethane	680	U	680	28	
79-00-5	1,1,2-Trichloroethane	680	U	680	57	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	680	U	680	62	
75-34-3	1,1-Dichloroethane (1,1-DCA)	680	U	680	43	
75-35-4	1,1-Dichloroethene (1,1-DCE)	680	U	680	73	
87-61-6	1,2,3-Trichlorobenzene	680	U	680	36	
96-18-4	1,2,3-Trichloropropane	680	U	680	130	
120-82-1	1,2,4-Trichlorobenzene	680	U	680	33	
95-63-6	1,2,4-Trimethylbenzene	680	U	680	28	
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	680	U	680	110	
106-93-4	1,2-Dibromoethane	680	U	680	68	
95-50-1	1,2-Dichlorobenzene	680	U	680	40	
107-06-2	1,2-Dichloroethane	680	U	680	44	
78-87-5	1,2-Dichloropropane	680	U	680	52	
108-67-8	1,3,5-Trimethylbenzene	680	U	680	28	
541-73-1	1,3-Dichlorobenzene	680	U	680	28	
142-28-9	1,3-Dichloropropane	680	U	680	31	
106-46-7	1,4-Dichlorobenzene	680	U	680	46	
78-93-3	2-Butanone (MEK)	680	U	680	220	
591-78-6	2-Hexanone	680	U	680	80	
99-87-6	4-Isopropyltoluene	680	U	680	46	
108-10-1	4-Methyl-2-pentanone	680	U	680	69	
67-64-1	Acetone	680	U	680	150	
71-43-2	Benzene	680	U	680	37	
75-27-4	Bromodichloromethane	680	U	680	35	
75-25-2	Bromoform	680	U	680	89	
74-83-9	Bromomethane	680	U	680	62	
75-15-0	Carbon Disulfide	680	U	680	42	
56-23-5	Carbon Tetrachloride	680	U	680	36	
108-90-7	Chlorobenzene	680	U	680	39	
75-00-3	Chloroethane	680	U	680	52	
67-66-3	Chloroform	680	U	680	59	
74-87-3	Chloromethane	680	U	680	63	
110-82-7	Cyclohexane	680	U	680	69	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/11/13 1130
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Analyzed:	9/23/13 14:31
Sample Name:	TB-15A (24')	**Units:**	µg/Kg
Lab Code:	R1306782-001	**Basis:**	Dry
		Percent Solids:	91.4

Volatile Organic Compounds by GC/MS

Analytical Method:	8260C	**Analysis Lot:**	359621
Data File Name:	I:\ACQUDATA\msvoa10\data\092313\F2266.D\	**Instrument Name:**	R-MS-10
		Dilution Factor:	125

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
124-48-1	Dibromochloromethane	680	U	680	32	
75-71-8	Dichlorodifluoromethane (CFC 12)	680	U	680	47	
75-09-2	Dichloromethane	680	U	680	63	
100-41-4	Ethylbenzene	680	U	680	43	
98-82-8	Isopropylbenzene (Cumene)	680	U	680	44	
79-20-9	Methyl Acetate	680	U	680	80	
1634-04-4	Methyl tert-Butyl Ether	680	U	680	33	
108-87-2	Methylcyclohexane	**2700**		680	55	
91-20-3	Naphthalene	680	U	680	32	
100-42-5	Styrene	680	U	680	28	
127-18-4	Tetrachloroethene (PCE)	680	U	680	28	
108-88-3	Toluene	680	U	680	47	
79-01-6	Trichloroethene (TCE)	680	U	680	28	
75-69-4	Trichlorofluoromethane (CFC 11)	680	U	680	57	
75-01-4	Vinyl Chloride	680	U	680	44	
1330-20-7	Xylenes, Total	2100	U	2100	120	
156-59-2	cis-1,2-Dichloroethene	680	U	680	35	
10061-01-5	cis-1,3-Dichloropropene	680	U	680	36	
179601-23-1	m,p-Xylenes	1400	U	1400	74	
104-51-8	n-Butylbenzene	680	U	680	28	
103-65-1	n-Propylbenzene	680	U	680	35	
95-47-6	o-Xylene	680	U	680	40	
135-98-8	sec-Butylbenzene	680	U	680	43	
98-06-6	tert-Butylbenzene	**160**	**J**	680	43	
156-60-5	trans-1,2-Dichloroethene	680	U	680	52	
10061-02-6	trans-1,3-Dichloropropene	680	U	680	33	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
4-Bromofluorobenzene	93	85-122	9/23/13 14:31	
Dibromofluoromethane	107	89-119	9/23/13 14:31	
Toluene-d8	96	87-121	9/23/13 14:31	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/11/13
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Analyzed:	9/23/13 1431

Tentatively Identified Compounds (TIC)
Volatile Organic Compounds by GC/MS

Sample Name:	TB-15A (24')	**Units:**	µg/Kg
Lab Code:	R1306782-001	**Basis:**	Dry
		Percent Solids:	91.4

Analytical Method: 8260C

CAS #	Analyte Name	RT	Result	Q
006876-23-9	Cyclohexane, 1,2-dimethyl-, trans-	7.76	**7300**	JN
002216-30-0	Heptane, 2,5-dimethyl-	8.26	**8200**	JN
003073-66-3	Cyclohexane, 1,1,3-trimethyl-	8.40	**7300**	JN
007667-60-9	Cyclohexane, 1,2,4-trimethyl-, (1.	8.62	**11000**	JN
	unknown	9.10	**9400**	J
004926-78-7	Cyclohexane, 1-ethyl-4-methyl-, ci	9.14	**6200**	JN
	unknown	9.37	**12000**	J
	unknown	9.45	**6600**	J
	unknown	9.57	**8000**	J
	unknown	9.65	**5700**	J
	unknown	9.68	**8200**	J
	unknown	9.82	**17000**	J
	unknown	10.02	**6700**	J
004291-79-6	Cyclohexane, 1-methyl-2-propyl-	10.23	**5400**	JN
	unknown	10.78	**4800**	J
000493-02-7	Naphthalene, decahydro-, trans-	11.13	**5400**	JN
	unknown	11.27	**5100**	J
	unknown	11.35	**8200**	J
	unknown	11.99	**5700**	J
	unknown	12.09	**7000**	J

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/12/13 1015
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Analyzed:	9/20/13 17:23
Sample Name:	TB-12 (30')	**Units:**	µg/Kg
Lab Code:	R1306782-003	**Basis:**	Dry
		Percent Solids:	90.1

Volatile Organic Compounds by GC/MS

Analytical Method:	8260C	**Analysis Lot:**	359508
Data File Name:	I:\ACQUDATA\msvoa10\data\092013\F2208.D\	**Instrument Name:**	R-MS-10
		Dilution Factor:	125

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
71-55-6	1,1,1-Trichloroethane (TCA)	690	U	690	53	
79-34-5	1,1,2,2-Tetrachloroethane	690	U	690	28	
79-00-5	1,1,2-Trichloroethane	690	U	690	57	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	690	U	690	63	
75-34-3	1,1-Dichloroethane (1,1-DCA)	690	U	690	44	
75-35-4	1,1-Dichloroethene (1,1-DCE)	690	U	690	74	
87-61-6	1,2,3-Trichlorobenzene	690	U	690	37	
96-18-4	1,2,3-Trichloropropane	690	U	690	130	
120-82-1	1,2,4-Trichlorobenzene	690	U	690	34	
95-63-6	1,2,4-Trimethylbenzene	690	U	690	28	
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	690	U	690	110	
106-93-4	1,2-Dibromoethane	690	U	690	68	
95-50-1	1,2-Dichlorobenzene	690	U	690	41	
107-06-2	1,2-Dichloroethane	690	U	690	45	
78-87-5	1,2-Dichloropropane	690	U	690	53	
108-67-8	1,3,5-Trimethylbenzene	690	U	690	28	
541-73-1	1,3-Dichlorobenzene	690	U	690	28	
142-28-9	1,3-Dichloropropane	690	U	690	31	
106-46-7	1,4-Dichlorobenzene	690	U	690	46	
78-93-3	2-Butanone (MEK)	690	U	690	220	
591-78-6	2-Hexanone	690	U	690	81	
99-87-6	4-Isopropyltoluene	690	U	690	46	
108-10-1	4-Methyl-2-pentanone	690	U	690	70	
67-64-1	Acetone	690	U	690	160	
71-43-2	Benzene	690	U	690	38	
75-27-4	Bromodichloromethane	690	U	690	35	
75-25-2	Bromoform	690	U	690	91	
74-83-9	Bromomethane	690	U	690	63	
75-15-0	Carbon Disulfide	690	U	690	42	
56-23-5	Carbon Tetrachloride	690	U	690	37	
108-90-7	Chlorobenzene	690	U	690	39	
75-00-3	Chloroethane	690	U	690	53	
67-66-3	Chloroform	690	U	690	60	
74-87-3	Chloromethane	690	U	690	64	
110-82-7	Cyclohexane	690	U	690	70	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/12/13 1015
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Analyzed:	9/20/13 17:23
Sample Name:	TB-12 (30')	**Units:**	µg/Kg
Lab Code:	R1306782-003	**Basis:**	Dry
		Percent Solids:	90.1

Volatile Organic Compounds by GC/MS

Analytical Method:	8260C	**Analysis Lot:**	359508
Data File Name:	I:\ACQUDATA\msvoa10\data\092013\F2208.D\	**Instrument Name:**	R-MS-10
		Dilution Factor:	125

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
124-48-1	Dibromochloromethane	690	U	690	32	
75-71-8	Dichlorodifluoromethane (CFC 12)	690	U	690	48	
75-09-2	Dichloromethane	690	U	690	64	
100-41-4	Ethylbenzene	690	U	690	44	
98-82-8	Isopropylbenzene (Cumene)	690	U	690	45	
79-20-9	Methyl Acetate	690	U	690	81	
1634-04-4	Methyl tert-Butyl Ether	690	U	690	34	
108-87-2	Methylcyclohexane	690	U	690	56	
91-20-3	Naphthalene	690	U	690	32	
100-42-5	Styrene	690	U	690	28	
127-18-4	Tetrachloroethene (PCE)	690	U	690	28	
108-88-3	Toluene	690	U	690	48	
79-01-6	Trichloroethene (TCE)	690	U	690	28	
75-69-4	Trichlorofluoromethane (CFC 11)	690	U	690	57	
75-01-4	Vinyl Chloride	690	U	690	45	
1330-20-7	Xylenes, Total	2100	U	2100	120	
156-59-2	cis-1,2-Dichloroethene	690	U	690	35	
10061-01-5	cis-1,3-Dichloropropene	690	U	690	37	
179601-23-1	m,p-Xylenes	1400	U	1400	75	
104-51-8	n-Butylbenzene	690	U	690	28	
103-65-1	n-Propylbenzene	690	U	690	35	
95-47-6	o-Xylene	690	U	690	41	
135-98-8	sec-Butylbenzene	690	U	690	44	
98-06-6	tert-Butylbenzene	690	U	690	44	
156-60-5	trans-1,2-Dichloroethene	690	U	690	53	
10061-02-6	trans-1,3-Dichloropropene	690	U	690	34	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
4-Bromofluorobenzene	108	85-122	9/20/13 17:23	
Dibromofluoromethane	104	89-119	9/20/13 17:23	
Toluene-d8	99	87-121	9/20/13 17:23	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/12/13
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Analyzed:	9/20/13 1723

Tentatively Identified Compounds (TIC)
Volatile Organic Compounds by GC/MS

Sample Name:	TB-12 (30')	**Units:**	µg/Kg
Lab Code:	R1306782-003	**Basis:**	Dry
		Percent Solids:	90.1

Analytical Method: 8260C

CAS #	Analyte Name	RT	Result	Q
	unknown	9.24	**3500**	J
004923-78-8	Cyclohexane, 1-ethyl-2-methyl-, tr	9.38	**6700**	JN
	unknown	9.55	**5200**	J
	unknown	9.68	**5200**	J
	unknown	9.74	**4600**	J
	unknown	9.79	**5800**	J
	unknown	10.01	**7800**	J
	unknown	10.14	**6000**	J
	unknown	10.29	**4200**	J
	unknown	10.33	**2500**	J
	unknown	10.55	**5200**	J
	unknown	10.64	**3000**	J
	unknown	10.70	**7800**	J
	unknown	11.14	**5500**	J
	unknown	11.18	**2400**	J
	unknown	11.24	**3600**	J
	unknown	11.28	**3100**	J
002207-04-7	Cyclohexane, 1,4-dimethyl-, trans-	11.35	**6400**	JN
002958-76-1	Naphthalene, decahydro-2-methyl-	11.60	**3800**	JN
002958-76-1	Naphthalene, decahydro-2-methyl-	11.74	**2800**	JN

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Analyzed:	9/20/13 14:49
Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311427-01	**Basis:**	Dry

Volatile Organic Compounds by GC/MS

Analytical Method:	8260C	**Analysis Lot:**	359508
Data File Name:	I:\ACQUDATA\msvoa10\data\092013\F2203.D\	**Instrument Name:**	R-MS-10
		Dilution Factor:	50

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
71-55-6	1,1,1-Trichloroethane (TCA)	250	U	250	19	
79-34-5	1,1,2,2-Tetrachloroethane	250	U	250	10	
79-00-5	1,1,2-Trichloroethane	250	U	250	21	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	250	U	250	23	
75-34-3	1,1-Dichloroethane (1,1-DCA)	250	U	250	16	
75-35-4	1,1-Dichloroethene (1,1-DCE)	250	U	250	27	
87-61-6	1,2,3-Trichlorobenzene	250	U	250	13	
96-18-4	1,2,3-Trichloropropane	250	U	250	45	
120-82-1	1,2,4-Trichlorobenzene	250	U	250	12	
95-63-6	1,2,4-Trimethylbenzene	250	U	250	10	
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	250	U	250	40	
106-93-4	1,2-Dibromoethane	250	U	250	25	
95-50-1	1,2-Dichlorobenzene	250	U	250	15	
107-06-2	1,2-Dichloroethane	250	U	250	16	
78-87-5	1,2-Dichloropropane	250	U	250	19	
108-67-8	1,3,5-Trimethylbenzene	250	U	250	10	
541-73-1	1,3-Dichlorobenzene	250	U	250	10	
142-28-9	1,3-Dichloropropane	250	U	250	12	
106-46-7	1,4-Dichlorobenzene	250	U	250	17	
78-93-3	2-Butanone (MEK)	250	U	250	77	
591-78-6	2-Hexanone	250	U	250	29	
99-87-6	4-Isopropyltoluene	250	U	250	17	
108-10-1	4-Methyl-2-pentanone	250	U	250	25	
67-64-1	Acetone	250	U	250	55	
71-43-2	Benzene	250	U	250	14	
75-27-4	Bromodichloromethane	250	U	250	13	
75-25-2	Bromoform	250	U	250	33	
74-83-9	Bromomethane	250	U	250	23	
75-15-0	Carbon Disulfide	250	U	250	15	
56-23-5	Carbon Tetrachloride	250	U	250	13	
108-90-7	Chlorobenzene	250	U	250	15	
75-00-3	Chloroethane	250	U	250	19	
67-66-3	Chloroform	250	U	250	22	
74-87-3	Chloromethane	250	U	250	23	
110-82-7	Cyclohexane	250	U	250	25	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Analyzed:	9/20/13 14:49
Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311427-01	**Basis:**	Dry

Volatile Organic Compounds by GC/MS

Analytical Method:	8260C	**Analysis Lot:**	359508
Data File Name:	I:\ACQUDATA\msvoa10\data\092013\F2203.D\	**Instrument Name:**	R-MS-10
		Dilution Factor:	50

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
124-48-1	Dibromochloromethane	250	U	250	12	
75-71-8	Dichlorodifluoromethane (CFC 12)	250	U	250	17	
75-09-2	Dichloromethane	250	U	250	23	
100-41-4	Ethylbenzene	250	U	250	16	
98-82-8	Isopropylbenzene (Cumene)	250	U	250	16	
79-20-9	Methyl Acetate	250	U	250	29	
1634-04-4	Methyl tert-Butyl Ether	250	U	250	12	
108-87-2	Methylcyclohexane	250	U	250	20	
91-20-3	Naphthalene	250	U	250	12	
100-42-5	Styrene	250	U	250	10	
127-18-4	Tetrachloroethene (PCE)	250	U	250	10	
108-88-3	Toluene	250	U	250	17	
79-01-6	Trichloroethene (TCE)	250	U	250	10	
75-69-4	Trichlorofluoromethane (CFC 11)	250	U	250	21	
75-01-4	Vinyl Chloride	250	U	250	16	
1330-20-7	Xylenes, Total	750	U	750	42	
156-59-2	cis-1,2-Dichloroethene	250	U	250	13	
10061-01-5	cis-1,3-Dichloropropene	250	U	250	13	
179601-23-1	m,p-Xylenes	500	U	500	27	
104-51-8	n-Butylbenzene	250	U	250	10	
103-65-1	n-Propylbenzene	250	U	250	13	
95-47-6	o-Xylene	250	U	250	15	
135-98-8	sec-Butylbenzene	250	U	250	16	
98-06-6	tert-Butylbenzene	250	U	250	16	
156-60-5	trans-1,2-Dichloroethene	250	U	250	19	
10061-02-6	trans-1,3-Dichloropropene	250	U	250	12	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
4-Bromofluorobenzene	94	85-122	9/20/13 14:49	
Dibromofluoromethane	105	89-119	9/20/13 14:49	
Toluene-d8	97	87-121	9/20/13 14:49	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Analyzed:	9/20/13 1449

Tentatively Identified Compounds (TIC)
Volatile Organic Compounds by GC/MS

Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311427-01	**Basis:**	Dry

Analytical Method: 8260C

CAS #	Analyte Name	RT	Result Q

No Tentatively Identified Compounds Detected.

Comments:

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Analyzed:	9/23/13 10:59
Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311593-01	**Basis:**	Dry

Volatile Organic Compounds by GC/MS

Analytical Method:	8260C	**Analysis Lot:**	359621
Data File Name:	I:\ACQUDATA\msvoa10\data\092313\F2260.D\	**Instrument Name:**	R-MS-10
		Dilution Factor:	50

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
71-55-6	1,1,1-Trichloroethane (TCA)	250	U	250	19	
79-34-5	1,1,2,2-Tetrachloroethane	250	U	250	10	
79-00-5	1,1,2-Trichloroethane	250	U	250	21	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	250	U	250	23	
75-34-3	1,1-Dichloroethane (1,1-DCA)	250	U	250	16	
75-35-4	1,1-Dichloroethene (1,1-DCE)	250	U	250	27	
87-61-6	1,2,3-Trichlorobenzene	250	U	250	13	
96-18-4	1,2,3-Trichloropropane	250	U	250	45	
120-82-1	1,2,4-Trichlorobenzene	**13**	J	250	12	
95-63-6	1,2,4-Trimethylbenzene	250	U	250	10	
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	250	U	250	40	
106-93-4	1,2-Dibromoethane	250	U	250	25	
95-50-1	1,2-Dichlorobenzene	250	U	250	15	
107-06-2	1,2-Dichloroethane	250	U	250	16	
78-87-5	1,2-Dichloropropane	250	U	250	19	
108-67-8	1,3,5-Trimethylbenzene	250	U	250	10	
541-73-1	1,3-Dichlorobenzene	250	U	250	10	
142-28-9	1,3-Dichloropropane	250	U	250	12	
106-46-7	1,4-Dichlorobenzene	250	U	250	17	
78-93-3	2-Butanone (MEK)	250	U	250	77	
591-78-6	2-Hexanone	250	U	250	29	
99-87-6	4-Isopropyltoluene	250	U	250	17	
108-10-1	4-Methyl-2-pentanone	250	U	250	25	
67-64-1	Acetone	250	U	250	55	
71-43-2	Benzene	250	U	250	14	
75-27-4	Bromodichloromethane	250	U	250	13	
75-25-2	Bromoform	250	U	250	33	
74-83-9	Bromomethane	250	U	250	23	
75-15-0	Carbon Disulfide	250	U	250	15	
56-23-5	Carbon Tetrachloride	250	U	250	13	
108-90-7	Chlorobenzene	250	U	250	15	
75-00-3	Chloroethane	250	U	250	19	
67-66-3	Chloroform	250	U	250	22	
74-87-3	Chloromethane	250	U	250	23	
110-82-7	Cyclohexane	250	U	250	25	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Analyzed:	9/23/13 10:59
Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311593-01	**Basis:**	Dry

Volatile Organic Compounds by GC/MS

Analytical Method:	8260C	**Analysis Lot:**	359621
Data File Name:	I:\ACQUDATA\msvoa10\data\092313\F2260.D\	**Instrument Name:**	R-MS-10
		Dilution Factor:	50

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
124-48-1	Dibromochloromethane	250	U	250	12	
75-71-8	Dichlorodifluoromethane (CFC 12)	250	U	250	17	
75-09-2	Dichloromethane	250	U	250	23	
100-41-4	Ethylbenzene	250	U	250	16	
98-82-8	Isopropylbenzene (Cumene)	250	U	250	16	
79-20-9	Methyl Acetate	250	U	250	29	
1634-04-4	Methyl tert-Butyl Ether	250	U	250	12	
108-87-2	Methylcyclohexane	250	U	250	20	
91-20-3	Naphthalene	250	U	250	12	
100-42-5	Styrene	250	U	250	10	
127-18-4	Tetrachloroethene (PCE)	250	U	250	10	
108-88-3	Toluene	250	U	250	17	
79-01-6	Trichloroethene (TCE)	250	U	250	10	
75-69-4	Trichlorofluoromethane (CFC 11)	250	U	250	21	
75-01-4	Vinyl Chloride	250	U	250	16	
1330-20-7	Xylenes, Total	750	U	750	42	
156-59-2	cis-1,2-Dichloroethene	250	U	250	13	
10061-01-5	cis-1,3-Dichloropropene	250	U	250	13	
179601-23-1	m,p-Xylenes	500	U	500	27	
104-51-8	n-Butylbenzene	250	U	250	10	
103-65-1	n-Propylbenzene	250	U	250	13	
95-47-6	o-Xylene	250	U	250	15	
135-98-8	sec-Butylbenzene	250	U	250	16	
98-06-6	tert-Butylbenzene	250	U	250	16	
156-60-5	trans-1,2-Dichloroethene	250	U	250	19	
10061-02-6	trans-1,3-Dichloropropene	250	U	250	12	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
4-Bromofluorobenzene	89	85-122	9/23/13 10:59	
Dibromofluoromethane	106	89-119	9/23/13 10:59	
Toluene-d8	94	87-121	9/23/13 10:59	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Analyzed:	9/23/13 1059

Tentatively Identified Compounds (TIC)
Volatile Organic Compounds by GC/MS

Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311593-01	**Basis:**	Dry

Analytical Method: 8260C

CAS #	Analyte Name	RT	Result	Q

No Tentatively Identified Compounds Detected.

Comments:

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/20/13
Sample Matrix:	Soil		

Lab Control Sample Summary
Volatile Organic Compounds by GC/MS

Analytical Method: 8260C

Units: µg/Kg
Basis: Dry

Analysis Lot: 359508

	Lab Control Sample RQ1311427-02			
Analyte Name	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**
1,1,1-Trichloroethane (TCA)	16.3	20.0	82	67 - 121
1,1,2,2-Tetrachloroethane	18.6	20.0	93	72 - 124
1,1,2-Trichloroethane	18.9	20.0	94	81 - 117
1,1,2-Trichloro-1,2,2-trifluoroethane	18.4	20.0	92	60 - 123
1,1-Dichloroethane (1,1-DCA)	17.5	20.0	88	76 - 128
1,1-Dichloroethene (1,1-DCE)	20.8	20.0	104	74 - 135
1,2,3-Trichlorobenzene	20.4	20.0	102	67 - 135
1,2,3-Trichloropropane	17.7	20.0	89	72 - 123
1,2,4-Trichlorobenzene	19.6	20.0	98	70 - 130
1,2,4-Trimethylbenzene	16.0	20.0	80	72 - 127
1,2-Dibromo-3-chloropropane (DBCP)	18.3	20.0	92	64 - 131
1,2-Dibromoethane	19.1	20.0	96	81 - 118
1,2-Dichlorobenzene	18.1	20.0	90	80 - 119
1,2-Dichloroethane	16.4	20.0	82	72 - 130
1,2-Dichloropropane	17.8	20.0	89	80 - 119
1,3,5-Trimethylbenzene	16.2	20.0	81	71 - 128
1,3-Dichlorobenzene	17.7	20.0	88	79 - 121
1,3-Dichloropropane	18.8	20.0	94	81 - 115
1,4-Dichlorobenzene	17.8	20.0	89	79 - 119
2-Butanone (MEK)	15.6	20.0	78	60 - 133
2-Hexanone	15.2	20.0	76	61 - 131
4-Isopropyltoluene	16.4	20.0	82	71 - 130
4-Methyl-2-pentanone	16.4	20.0	82	61 - 132
Acetone	12.8	20.0	64	61 - 138
Benzene	18.1	20.0	90	76 - 118
Bromodichloromethane	18.9	20.0	95	79 - 123
Bromoform	20.2	20.0	101	72 - 128
Bromomethane	22.0	20.0	110	46 - 157
Carbon Disulfide	24.4	20.0	122	61 - 144
Carbon Tetrachloride	17.8	20.0	89	64 - 129
Chlorobenzene	18.1	20.0	90	80 - 121
Chloroethane	18.8	20.0	94	69 - 128
Chloroform	18.2	20.0	91	75 - 123

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client: Day Environmental, Incorporated
Project: Olean/48845-13
Sample Matrix: Soil

Service Request: R1306782
Date Analyzed: 9/20/13

Lab Control Sample Summary
Volatile Organic Compounds by GC/MS

Analytical Method: 8260C

Units: µg/Kg
Basis: Dry

Analysis Lot: 359508

Analyte Name	Lab Control Sample RQ1311427-02 Result	Spike Amount	% Rec	% Rec Limits
Chloromethane	17.5	20.0	87	55 - 139
Cyclohexane	14.9	20.0	75	55 - 132
Dibromochloromethane	19.7	20.0	99	78 - 127
Dichlorodifluoromethane (CFC 12)	19.5	20.0	97	45 - 147
Dichloromethane	19.4	20.0	97	73 - 122
Ethylbenzene	17.2	20.0	86	75 - 123
Isopropylbenzene (Cumene)	16.4	20.0	82	75 - 139
Methyl Acetate	13.8	20.0	69	65 - 131
Methyl tert-Butyl Ether	16.6	20.0	83	75 - 116
Methylcyclohexane	16.8	20.0	84	59 - 127
Naphthalene	18.3	20.0	92	71 - 139
Styrene	17.2	20.0	86	80 - 121
Tetrachloroethene (PCE)	17.9	20.0	89	71 - 127
Toluene	17.5	20.0	87	77 - 120
Trichloroethene (TCE)	19.4	20.0	97	75 - 122
Trichlorofluoromethane (CFC 11)	18.7	20.0	94	64 - 134
Vinyl Chloride	19.4	20.0	97	68 - 139
Xylenes, Total	50.5	60.0	84	77 - 122
cis-1,2-Dichloroethene	18.9	20.0	94	77 - 123
cis-1,3-Dichloropropene	17.3	20.0	86	77 - 125
m,p-Xylenes	33.8	40.0	85	77 - 124
n-Butylbenzene	16.5	20.0	82	65 - 135
n-Propylbenzene	16.9	20.0	84	69 - 132
o-Xylene	16.7	20.0	83	77 - 131
sec-Butylbenzene	16.3	20.0	81	67 - 131
tert-Butylbenzene	15.8	20.0	79	70 - 126
trans-1,2-Dichloroethene	18.2	20.0	91	72 - 120
trans-1,3-Dichloropropene	16.2	20.0	81	69 - 127

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/23/13
Sample Matrix:	Soil		

Lab Control Sample Summary
Volatile Organic Compounds by GC/MS

Analytical Method: 8260C

Units: µg/Kg
Basis: Dry

Analysis Lot: 359621

Analyte Name	**Lab Control Sample** **RQ1311593-02** **Result**	**Spike Amount**	**% Rec**	**% Rec Limits**
1,1,1-Trichloroethane (TCA)	17.8	20.0	89	67 - 121
1,1,2,2-Tetrachloroethane	21.3	20.0	106	72 - 124
1,1,2-Trichloroethane	18.5	20.0	92	81 - 117
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0	20.0	100	60 - 123
1,1-Dichloroethane (1,1-DCA)	18.2	20.0	91	76 - 128
1,1-Dichloroethene (1,1-DCE)	22.1	20.0	111	74 - 135
1,2,3-Trichlorobenzene	21.8	20.0	109	67 - 135
1,2,3-Trichloropropane	19.8	20.0	99	72 - 123
1,2,4-Trichlorobenzene	21.3	20.0	107	70 - 130
1,2,4-Trimethylbenzene	18.8	20.0	94	72 - 127
1,2-Dibromo-3-chloropropane (DBCP)	21.9	20.0	110	64 - 131
1,2-Dibromoethane	21.1	20.0	106	81 - 118
1,2-Dichlorobenzene	20.1	20.0	101	80 - 119
1,2-Dichloroethane	18.8	20.0	94	72 - 130
1,2-Dichloropropane	18.2	20.0	91	80 - 119
1,3,5-Trimethylbenzene	18.4	20.0	92	71 - 128
1,3-Dichlorobenzene	19.7	20.0	99	79 - 121
1,3-Dichloropropane	19.7	20.0	99	81 - 115
1,4-Dichlorobenzene	19.8	20.0	99	79 - 119
2-Butanone (MEK)	19.6	20.0	98	60 - 133
2-Hexanone	19.4	20.0	97	61 - 131
4-Isopropyltoluene	19.2	20.0	96	71 - 130
4-Methyl-2-pentanone	19.5	20.0	98	61 - 132
Acetone	19.0	20.0	95	61 - 138
Benzene	18.0	20.0	90	76 - 118
Bromodichloromethane	20.2	20.0	101	79 - 123
Bromoform	21.8	20.0	109	72 - 128
Bromomethane	20.5	20.0	102	46 - 157
Carbon Disulfide	21.3	20.0	106	61 - 144
Carbon Tetrachloride	18.5	20.0	93	64 - 129
Chlorobenzene	19.5	20.0	97	80 - 121
Chloroethane	18.0	20.0	90	69 - 128
Chloroform	19.2	20.0	96	75 - 123

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/23/13
Sample Matrix:	Soil		

Lab Control Sample Summary
Volatile Organic Compounds by GC/MS

Analytical Method: 8260C

Units: µg/Kg
Basis: Dry

Analysis Lot: 359621

	Lab Control Sample RQ1311593-02			
Analyte Name	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**
Chloromethane	19.3	20.0	96	55 - 139
Cyclohexane	19.2	20.0	96	55 - 132
Dibromochloromethane	22.2	20.0	111	78 - 127
Dichlorodifluoromethane (CFC 12)	19.8	20.0	99	45 - 147
Dichloromethane	19.8	20.0	99	73 - 122
Ethylbenzene	18.4	20.0	92	75 - 123
Isopropylbenzene (Cumene)	17.9	20.0	90	75 - 139
Methyl Acetate	18.6	20.0	93	65 - 131
Methyl tert-Butyl Ether	18.0	20.0	90	75 - 116
Methylcyclohexane	17.6	20.0	88	59 - 127
Naphthalene	20.4	20.0	102	71 - 139
Styrene	18.3	20.0	92	80 - 121
Tetrachloroethene (PCE)	18.9	20.0	94	71 - 127
Toluene	17.2	20.0	86	77 - 120
Trichloroethene (TCE)	19.8	20.0	99	75 - 122
Trichlorofluoromethane (CFC 11)	19.4	20.0	97	64 - 134
Vinyl Chloride	18.8	20.0	94	68 - 139
Xylenes, Total	54.3	60.0	90	77 - 122
cis-1,2-Dichloroethene	19.5	20.0	97	77 - 123
cis-1,3-Dichloropropene	17.7	20.0	89	77 - 125
m,p-Xylenes	36.4	40.0	91	77 - 124
n-Butylbenzene	18.5	20.0	92	65 - 135
n-Propylbenzene	19.3	20.0	97	69 - 132
o-Xylene	17.8	20.0	89	77 - 131
sec-Butylbenzene	18.7	20.0	94	67 - 131
tert-Butylbenzene	18.1	20.0	90	70 - 126
trans-1,2-Dichloroethene	18.5	20.0	92	72 - 120
trans-1,3-Dichloropropene	17.8	20.0	89	69 - 127

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/11/13 1130
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 13:36
Sample Name:	TB-15A (24')	**Units:**	µg/Kg
Lab Code:	R1306782-001	**Basis:**	Dry
		Percent Solids:	91.4

Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Analysis Lot:**	359856
Prep Method:	EPA 3541	**Extraction Lot:**	191738
Data File Name:	I:\ACQUDATA\5973A\DATA\092313\CT061.D\	**Instrument Name:**	R-MS-51
		Dilution Factor:	1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
95-95-4	2,4,5-Trichlorophenol	360	U	360	64	
88-06-2	2,4,6-Trichlorophenol	360	U	360	53	
120-83-2	2,4-Dichlorophenol	360	U	360	49	
105-67-9	2,4-Dimethylphenol	360	U	360	40	
51-28-5	2,4-Dinitrophenol	1900	U	1900	160	
121-14-2	2,4-Dinitrotoluene	360	U	360	78	
606-20-2	2,6-Dinitrotoluene	360	U	360	60	
91-58-7	2-Chloronaphthalene	360	U	360	38	
95-57-8	2-Chlorophenol	360	U	360	38	
91-57-6	2-Methylnaphthalene	360	U	360	37	
95-48-7	2-Methylphenol	360	U	360	47	
88-74-4	2-Nitroaniline	1900	U	1900	300	
88-75-5	2-Nitrophenol	360	U	360	54	
91-94-1	3,3'-Dichlorobenzidine	360	U	360	66	
	3- and 4-Methylphenol Coelution	360	U	360	55	
99-09-2	3-Nitroaniline	1900	U	1900	340	
534-52-1	4,6-Dinitro-2-methylphenol	1900	U	1900	530	
101-55-3	4-Bromophenyl Phenyl Ether	360	U	360	65	
59-50-7	4-Chloro-3-methylphenol	360	U	360	40	
106-47-8	4-Chloroaniline	360	U	360	70	
7005-72-3	4-Chlorophenyl Phenyl Ether	360	U	360	51	
100-01-6	4-Nitroaniline	1900	U	1900	400	
100-02-7	4-Nitrophenol	1900	U	1900	270	
83-32-9	Acenaphthene	360	U	360	52	
208-96-8	Acenaphthylene	360	U	360	49	
98-86-2	Acetophenone	360	U	360	71	
62-53-3	Aniline	360	U	360	56	
120-12-7	Anthracene	360	U	360	57	
1912-24-9	Atrazine	360	U	360	150	
56-55-3	Benz(a)anthracene	360	U	360	56	
100-52-7	Benzaldehyde	1900	U	1900	95	
50-32-8	Benzo(a)pyrene	360	U	360	61	
205-99-2	Benzo(b)fluoranthene	360	U	360	88	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/11/13 1130
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 13:36
Sample Name:	TB-15A (24')	**Units:**	µg/Kg
Lab Code:	R1306782-001	**Basis:**	Dry
		Percent Solids:	91.4

Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Analysis Lot:**	359856
Prep Method:	EPA 3541	**Extraction Lot:**	191738
Data File Name:	I:\ACQUDATA\5973A\DATA\092313\CT061.D\	**Instrument Name:**	R-MS-51
		Dilution Factor:	1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
191-24-2	Benzo(g,h,i)perylene	360	U	360	69	
207-08-9	Benzo(k)fluoranthene	360	U	360	65	
65-85-0	Benzoic Acid	1900	U	1900	650	
92-52-4	Biphenyl	360	U	360	38	
108-60-1	2,2'-Oxybis(1-chloropropane)	360	U	360	44	
111-91-1	Bis(2-chloroethoxy)methane	360	U	360	50	
111-44-4	Bis(2-chloroethyl) Ether	360	U	360	37	
117-81-7	Bis(2-ethylhexyl) Phthalate	**180**	J	360	50	
85-68-7	Butyl Benzyl Phthalate	360	U	360	56	
105-60-2	Caprolactam	360	U	360	66	
86-74-8	Carbazole	360	U	360	50	
218-01-9	Chrysene	**57**	J	360	51	
84-74-2	Di-n-butyl Phthalate	360	U	360	100	
117-84-0	Di-n-octyl Phthalate	360	U	360	70	
53-70-3	Dibenz(a,h)anthracene	360	U	360	98	
132-64-9	Dibenzofuran	360	U	360	40	
84-66-2	Diethyl Phthalate	360	U	360	47	
131-11-3	Dimethyl Phthalate	360	U	360	52	
206-44-0	Fluoranthene	360	U	360	58	
86-73-7	Fluorene	360	U	360	46	
118-74-1	Hexachlorobenzene	360	U	360	55	
87-68-3	Hexachlorobutadiene	360	U	360	40	
77-47-4	Hexachlorocyclopentadiene	360	U	360	58	
67-72-1	Hexachloroethane	360	U	360	50	
193-39-5	Indeno(1,2,3-cd)pyrene	360	U	360	60	
78-59-1	Isophorone	360	U	360	48	
621-64-7	N-Nitrosodi-n-propylamine	360	U	360	41	
86-30-6	N-Nitrosodiphenylamine	360	U	360	57	
91-20-3	Naphthalene	360	U	360	37	
98-95-3	Nitrobenzene	360	U	360	39	
608-93-5	Pentachlorobenzene	360	U	360	37	
82-68-8	Pentachloronitrobenzene (PCNB)	360	U	360	46	
87-86-5	Pentachlorophenol (PCP)	1900	U	1900	300	

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Analytical Report

Client: Day Environmental, Incorporated
Project: Olean/48845-13
Sample Matrix: Soil

Service Request: R1306782
Date Collected: 9/11/13 1130
Date Received: 9/16/13
Date Extracted: 9/18/13
Date Analyzed: 9/23/13 13:36

Sample Name: TB-15A (24')
Lab Code: R1306782-001

Units: µg/Kg
Basis: Dry
Percent Solids: 91.4

Semivolatile Organic Compounds by GC/MS

Analytical Method: 8270D
Prep Method: EPA 3541
Data File Name: I:\ACQUDATA\5973A\DATA\092313\CT061.D\

Analysis Lot: 359856
Extraction Lot: 191738
Instrument Name: R-MS-51
Dilution Factor: 1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
85-01-8	Phenanthrene	**350**	J	360	49	
108-95-2	Phenol	360	U	360	40	
129-00-0	Pyrene	360	U	360	70	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
2,4,6-Tribromophenol	75	41-151	9/23/13 13:36	
2-Fluorobiphenyl	83	47-126	9/23/13 13:36	
2-Fluorophenol	65	16-129	9/23/13 13:36	
Nitrobenzene-d5	80	39-136	9/23/13 13:36	
Phenol-d6	73	10-145	9/23/13 13:36	
Terphenyl-d14	85	35-152	9/23/13 13:36	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/11/13
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 1336

Tentatively Identified Compounds (TIC)
Semivolatile Organic Compounds by GC/MS

Sample Name:	TB-15A (24')	**Units:**	µg/Kg
Lab Code:	R1306782-001	**Basis:**	Dry
		Percent Solids:	91.4

Prep Method: EPA 3541
Analytical Method: 8270D

CAS #	Analyte Name	RT	Result	Q
	unknown	5.84	**2000**	J
	unknown	5.95	**1900**	J
	unknown	6.18	**1700**	J
000493-02-7	Naphthalene, decahydro-, trans-	6.86	**2500**	JN
	unknown	7.01	**3000**	J
	unknown	7.20	**1400**	J
002958-76-1	Naphthalene, decahydro-2-methyl-	7.34	**2300**	JN
	unknown	7.50	**1900**	J
	unknown	7.81	**2100**	J
	unknown	7.88	**3200**	J
	unknown	8.53	**5900**	J
	unknown	8.59	**2000**	J
	unknown	8.92	**2600**	J
	unknown	9.16	**2200**	J
	unknown hydrocarbon	9.43	**6000**	J
	unknown	10.18	**6700**	J
	unknown hydrocarbon	10.97	**1500**	J
	unknown	11.78	**3700**	J
	unknown hydrocarbon	12.27	**2500**	J
	unknown hydrocarbon	13.12	**1500**	J

Comments:

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/13/13 1130
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 14:13
Sample Name:	TB-17 (3')	**Units:**	µg/Kg
Lab Code:	R1306782-002	**Basis:**	Dry
		Percent Solids:	84.8

Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Analysis Lot:**	359856
Prep Method:	EPA 3541	**Extraction Lot:**	191738
Data File Name:	I:\ACQUDATA\5973A\DATA\092313\CT062.D\	**Instrument Name:**	R-MS-51
		Dilution Factor:	3

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
95-95-4	2,4,5-Trichlorophenol	1200	U	1200	210	
88-06-2	2,4,6-Trichlorophenol	1200	U	1200	180	
120-83-2	2,4-Dichlorophenol	1200	U	1200	160	
105-67-9	2,4-Dimethylphenol	1200	U	1200	130	
51-28-5	2,4-Dinitrophenol	6000	U	6000	500	
121-14-2	2,4-Dinitrotoluene	1200	U	1200	250	
606-20-2	2,6-Dinitrotoluene	1200	U	1200	200	
91-58-7	2-Chloronaphthalene	1200	U	1200	130	
95-57-8	2-Chlorophenol	1200	U	1200	130	
91-57-6	2-Methylnaphthalene	1200	U	1200	120	
95-48-7	2-Methylphenol	1200	U	1200	160	
88-74-4	2-Nitroaniline	6000	U	6000	970	
88-75-5	2-Nitrophenol	1200	U	1200	180	
91-94-1	3,3'-Dichlorobenzidine	1200	U	1200	220	
	3- and 4-Methylphenol Coelution	1200	U	1200	180	
99-09-2	3-Nitroaniline	6000	U	6000	1100	
534-52-1	4,6-Dinitro-2-methylphenol	6000	U	6000	1700	
101-55-3	4-Bromophenyl Phenyl Ether	1200	U	1200	210	
59-50-7	4-Chloro-3-methylphenol	1200	U	1200	130	
106-47-8	4-Chloroaniline	1200	U	1200	230	
7005-72-3	4-Chlorophenyl Phenyl Ether	1200	U	1200	170	
100-01-6	4-Nitroaniline	6000	U	6000	1300	
100-02-7	4-Nitrophenol	6000	U	6000	850	
83-32-9	Acenaphthene	1200	U	1200	170	
208-96-8	Acenaphthylene	1200	U	1200	160	
98-86-2	Acetophenone	1200	U	1200	230	
62-53-3	Aniline	1200	U	1200	190	
120-12-7	Anthracene	1200	U	1200	190	
1912-24-9	Atrazine	1200	U	1200	470	
56-55-3	Benz(a)anthracene	**260**	J	1200	180	
100-52-7	Benzaldehyde	6000	U	6000	310	
50-32-8	Benzo(a)pyrene	**420**	J	1200	200	
205-99-2	Benzo(b)fluoranthene	**360**	J	1200	290	

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Analytical Report

Client: Day Environmental, Incorporated
Project: Olean/48845-13
Sample Matrix: Soil

Service Request: R1306782
Date Collected: 9/13/13 1130
Date Received: 9/16/13
Date Extracted: 9/18/13
Date Analyzed: 9/23/13 14:13

Sample Name: TB-17 (3')
Lab Code: R1306782-002

Units: µg/Kg
Basis: Dry
Percent Solids: 84.8

Semivolatile Organic Compounds by GC/MS

Analytical Method: 8270D
Prep Method: EPA 3541
Data File Name: I:\ACQUDATA\5973A\DATA\092313\CT062.D\

Analysis Lot: 359856
Extraction Lot: 191738
Instrument Name: R-MS-51
Dilution Factor: 3

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
191-24-2	Benzo(g,h,i)perylene	**360**	J	1200	230	
207-08-9	Benzo(k)fluoranthene	**350**	J	1200	210	
65-85-0	Benzoic Acid	6000	U	6000	2100	
92-52-4	Biphenyl	1200	U	1200	120	
108-60-1	2,2'-Oxybis(1-chloropropane)	1200	U	1200	150	
111-91-1	Bis(2-chloroethoxy)methane	1200	U	1200	170	
111-44-4	Bis(2-chloroethyl) Ether	1200	U	1200	120	
117-81-7	Bis(2-ethylhexyl) Phthalate	1200	U	1200	170	
85-68-7	Butyl Benzyl Phthalate	1200	U	1200	180	
105-60-2	Caprolactam	1200	U	1200	220	
86-74-8	Carbazole	1200	U	1200	170	
218-01-9	Chrysene	290	J	1200	170	
84-74-2	Di-n-butyl Phthalate	**420**	J	1200	330	
117-84-0	Di-n-octyl Phthalate	1200	U	1200	230	
53-70-3	Dibenz(a,h)anthracene	1200	U	1200	320	
132-64-9	Dibenzofuran	1200	U	1200	130	
84-66-2	Diethyl Phthalate	1200	U	1200	160	
131-11-3	Dimethyl Phthalate	1200	U	1200	170	
206-44-0	Fluoranthene	**450**	J	1200	190	
86-73-7	Fluorene	1200	U	1200	150	
118-74-1	Hexachlorobenzene	1200	U	1200	180	
87-68-3	Hexachlorobutadiene	1200	U	1200	130	
77-47-4	Hexachlorocyclopentadiene	1200	U	1200	190	
67-72-1	Hexachloroethane	1200	U	1200	170	
193-39-5	Indeno(1,2,3-cd)pyrene	**300**	J	1200	200	
78-59-1	Isophorone	1200	U	1200	160	
621-64-7	N-Nitrosodi-n-propylamine	1200	U	1200	140	
86-30-6	N-Nitrosodiphenylamine	1200	U	1200	190	
91-20-3	Naphthalene	1200	U	1200	120	
98-95-3	Nitrobenzene	1200	U	1200	130	
608-93-5	Pentachlorobenzene	1200	U	1200	120	
82-68-8	Pentachloronitrobenzene (PCNB)	1200	U	1200	150	
87-86-5	Pentachlorophenol (PCP)	6000	U	6000	970	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client: Day Environmental, Incorporated
Project: Olean/48845-13
Sample Matrix: Soil

Service Request: R1306782
Date Collected: 9/13/13 1130
Date Received: 9/16/13
Date Extracted: 9/18/13
Date Analyzed: 9/23/13 14:13

Sample Name: TB-17 (3')
Lab Code: R1306782-002

Units: µg/Kg
Basis: Dry
Percent Solids: 84.8

Semivolatile Organic Compounds by GC/MS

Analytical Method: 8270D
Prep Method: EPA 3541
Data File Name: I:\ACQUDATA\5973A\DATA\092313\CT062.D\

Analysis Lot: 359856
Extraction Lot: 191738
Instrument Name: R-MS-51
Dilution Factor: 3

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
85-01-8	Phenanthrene	**240**	J	1200	160	
108-95-2	Phenol	1200	U	1200	130	
129-00-0	Pyrene	**400**	J	1200	230	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
2,4,6-Tribromophenol	62	41-151	9/23/13 14:13	
2-Fluorobiphenyl	66	47-126	9/23/13 14:13	
2-Fluorophenol	47	16-129	9/23/13 14:13	
Nitrobenzene-d5	57	39-136	9/23/13 14:13	
Phenol-d6	56	10-145	9/23/13 14:13	
Terphenyl-d14	82	35-152	9/23/13 14:13	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/13/13
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 1413

Tentatively Identified Compounds (TIC)
Semivolatile Organic Compounds by GC/MS

Sample Name:	TB-17 (3')	**Units:**	µg/Kg
Lab Code:	R1306782-002	**Basis:**	Dry
		Percent Solids:	84.8

Prep Method: EPA 3541
Analytical Method: 8270D

CAS #	Analyte Name	RT	Result	Q
	No Tentatively Identified Compounds Detected.			

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/12/13 1015
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 14:50
Sample Name:	TB-12 (30')	**Units:**	µg/Kg
Lab Code:	R1306782-003	**Basis:**	Dry
		Percent Solids:	90.1

Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Analysis Lot:**	359856
Prep Method:	EPA 3541	**Extraction Lot:**	191738
Data File Name:	I:\ACQUDATA\5973A\DATA\092313\CT063.D\	**Instrument Name:**	R-MS-51
		Dilution Factor:	1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
95-95-4	2,4,5-Trichlorophenol	370	U	370	64	
88-06-2	2,4,6-Trichlorophenol	370	U	370	54	
120-83-2	2,4-Dichlorophenol	370	U	370	49	
105-67-9	2,4-Dimethylphenol	370	U	370	41	
51-28-5	2,4-Dinitrophenol	1900	U	1900	160	
121-14-2	2,4-Dinitrotoluene	370	U	370	79	
606-20-2	2,6-Dinitrotoluene	370	U	370	61	
91-58-7	2-Chloronaphthalene	370	U	370	39	
95-57-8	2-Chlorophenol	370	U	370	39	
91-57-6	2-Methylnaphthalene	370	U	370	37	
95-48-7	2-Methylphenol	370	U	370	48	
88-74-4	2-Nitroaniline	1900	U	1900	310	
88-75-5	2-Nitrophenol	370	U	370	55	
91-94-1	3,3'-Dichlorobenzidine	370	U	370	67	
	3- and 4-Methylphenol Coelution	370	U	370	56	
99-09-2	3-Nitroaniline	1900	U	1900	340	
534-52-1	4,6-Dinitro-2-methylphenol	1900	U	1900	540	
101-55-3	4-Bromophenyl Phenyl Ether	370	U	370	66	
59-50-7	4-Chloro-3-methylphenol	370	U	370	41	
106-47-8	4-Chloroaniline	370	U	370	71	
7005-72-3	4-Chlorophenyl Phenyl Ether	370	U	370	52	
100-01-6	4-Nitroaniline	1900	U	1900	400	
100-02-7	4-Nitrophenol	1900	U	1900	270	
83-32-9	Acenaphthene	370	U	370	53	
208-96-8	Acenaphthylene	370	U	370	49	
98-86-2	Acetophenone	370	U	370	72	
62-53-3	Aniline	370	U	370	57	
120-12-7	Anthracene	370	U	370	58	
1912-24-9	Atrazine	370	U	370	150	
56-55-3	Benz(a)anthracene	370	U	370	57	
100-52-7	Benzaldehyde	1900	U	1900	96	
50-32-8	Benzo(a)pyrene	370	U	370	61	
205-99-2	Benzo(b)fluoranthene	370	U	370	89	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/12/13 1015
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 14:50
Sample Name:	TB-12 (30')	**Units:**	µg/Kg
Lab Code:	R1306782-003	**Basis:**	Dry
		Percent Solids:	90.1

Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Analysis Lot:**	359856
Prep Method:	EPA 3541	**Extraction Lot:**	191738
Data File Name:	I:\ACQUDATA\5973A\DATA\092313\CT063.D\	**Instrument Name:**	R-MS-51
		Dilution Factor:	1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
191-24-2	Benzo(g,h,i)perylene	370	U	370	70	
207-08-9	Benzo(k)fluoranthene	370	U	370	66	
65-85-0	Benzoic Acid	1900	U	1900	660	
92-52-4	Biphenyl	370	U	370	38	
108-60-1	2,2'-Oxybis(1-chloropropane)	370	U	370	44	
111-91-1	Bis(2-chloroethoxy)methane	370	U	370	51	
111-44-4	Bis(2-chloroethyl) Ether	370	U	370	37	
117-81-7	Bis(2-ethylhexyl) Phthalate	**80**	**J**	370	51	
85-68-7	Butyl Benzyl Phthalate	370	U	370	56	
105-60-2	Caprolactam	370	U	370	67	
86-74-8	Carbazole	370	U	370	51	
218-01-9	Chrysene	370	U	370	52	
84-74-2	Di-n-butyl Phthalate	370	U	370	110	
117-84-0	Di-n-octyl Phthalate	370	U	370	71	
53-70-3	Dibenz(a,h)anthracene	370	U	370	99	
132-64-9	Dibenzofuran	370	U	370	41	
84-66-2	Diethyl Phthalate	370	U	370	48	
131-11-3	Dimethyl Phthalate	370	U	370	53	
206-44-0	Fluoranthene	370	U	370	59	
86-73-7	Fluorene	370	U	370	46	
118-74-1	Hexachlorobenzene	370	U	370	56	
87-68-3	Hexachlorobutadiene	370	U	370	41	
77-47-4	Hexachlorocyclopentadiene	370	U	370	59	
67-72-1	Hexachloroethane	370	U	370	51	
193-39-5	Indeno(1,2,3-cd)pyrene	370	U	370	61	
78-59-1	Isophorone	370	U	370	49	
621-64-7	N-Nitrosodi-n-propylamine	370	U	370	42	
86-30-6	N-Nitrosodiphenylamine	370	U	370	57	
91-20-3	Naphthalene	370	U	370	37	
98-95-3	Nitrobenzene	370	U	370	39	
608-93-5	Pentachlorobenzene	370	U	370	38	
82-68-8	Pentachloronitrobenzene (PCNB)	370	U	370	47	
87-86-5	Pentachlorophenol (PCP)	1900	U	1900	310	

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Analytical Report

Client: Day Environmental, Incorporated
Project: Olean/48845-13
Sample Matrix: Soil

Service Request: R1306782
Date Collected: 9/12/13 1015
Date Received: 9/16/13
Date Extracted: 9/18/13
Date Analyzed: 9/23/13 14:50

Sample Name: TB-12 (30')
Lab Code: R1306782-003

Units: µg/Kg
Basis: Dry
Percent Solids: 90.1

Semivolatile Organic Compounds by GC/MS

Analytical Method: 8270D
Prep Method: EPA 3541
Data File Name: I:\ACQUDATA\5973A\DATA\092313\CT063.D\

Analysis Lot: 359856
Extraction Lot: 191738
Instrument Name: R-MS-51
Dilution Factor: 1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
85-01-8	Phenanthrene	370	U	370	50	
108-95-2	Phenol	370	U	370	41	
129-00-0	Pyrene	370	U	370	71	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
2,4,6-Tribromophenol	79	41-151	9/23/13 14:50	
2-Fluorobiphenyl	79	47-126	9/23/13 14:50	
2-Fluorophenol	68	16-129	9/23/13 14:50	
Nitrobenzene-d5	74	39-136	9/23/13 14:50	
Phenol-d6	74	10-145	9/23/13 14:50	
Terphenyl-d14	70	35-152	9/23/13 14:50	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/12/13
Sample Matrix:	Soil	**Date Received:**	9/16/13
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 1450

Tentatively Identified Compounds (TIC)
Semivolatile Organic Compounds by GC/MS

Sample Name:	TB-12 (30')	**Units:**	µg/Kg
Lab Code:	R1306782-003	**Basis:**	Dry
		Percent Solids:	90.1

Prep Method: EPA 3541
Analytical Method: 8270D

CAS #	Analyte Name	RT	Result	Q
	unknown	5.36	**370**	J
	unknown	5.44	**690**	J
	unknown	5.59	**320**	J
	unknown	5.76	**450**	J
	unknown	5.96	**1400**	J
	unknown	6.19	**1800**	J
	unknown	6.28	**1000**	J
	unknown	6.34	**540**	J
	unknown	6.53	**990**	J
	unknown	6.73	**640**	J
	unknown	6.85	**880**	J
	unknown	6.90	**670**	J
	unknown	6.97	**420**	J
	unknown	7.02	**1100**	J
	unknown	7.25	**350**	J
	unknown	7.29	**630**	J
002958-76-1	Naphthalene, decahydro-2-methyl-	7.34	**870**	JN
	unknown	7.73	**350**	J
	unknown	7.81	**590**	J
	unknown	8.91	**380**	J

Comments:

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Analytical Report

Client: Day Environmental, Incorporated
Project: Olean/48845-13
Sample Matrix: Soil

Service Request: R1306782
Date Collected: NA
Date Received: NA
Date Extracted: 9/18/13
Date Analyzed: 9/23/13 11:43

Sample Name: Method Blank
Lab Code: RQ1311212-01

Units: µg/Kg
Basis: Dry

Semivolatile Organic Compounds by GC/MS

Analytical Method: 8270D
Prep Method: EPA 3541
Data File Name: I:\ACQUDATA\5973A\DATA\092313\CT058.D\

Analysis Lot: 359856
Extraction Lot: 191738
Instrument Name: R-MS-51
Dilution Factor: 1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
95-95-4	2,4,5-Trichlorophenol	330	U	330	58	
88-06-2	2,4,6-Trichlorophenol	330	U	330	49	
120-83-2	2,4-Dichlorophenol	330	U	330	44	
105-67-9	2,4-Dimethylphenol	330	U	330	37	
51-28-5	2,4-Dinitrophenol	1700	U	1700	140	
121-14-2	2,4-Dinitrotoluene	330	U	330	71	
606-20-2	2,6-Dinitrotoluene	330	U	330	55	
91-58-7	2-Chloronaphthalene	330	U	330	35	
95-57-8	2-Chlorophenol	330	U	330	35	
91-57-6	2-Methylnaphthalene	330	U	330	33	
95-48-7	2-Methylphenol	330	U	330	43	
88-74-4	2-Nitroaniline	1700	U	1700	280	
88-75-5	2-Nitrophenol	330	U	330	49	
91-94-1	3,3'-Dichlorobenzidine	330	U	330	60	
	3- and 4-Methylphenol Coelution	330	U	330	50	
99-09-2	3-Nitroaniline	1700	U	1700	310	
534-52-1	4,6-Dinitro-2-methylphenol	1700	U	1700	480	
101-55-3	4-Bromophenyl Phenyl Ether	330	U	330	59	
59-50-7	4-Chloro-3-methylphenol	330	U	330	37	
106-47-8	4-Chloroaniline	330	U	330	64	
7005-72-3	4-Chlorophenyl Phenyl Ether	330	U	330	47	
100-01-6	4-Nitroaniline	1700	U	1700	360	
100-02-7	4-Nitrophenol	1700	U	1700	240	
83-32-9	Acenaphthene	330	U	330	48	
208-96-8	Acenaphthylene	330	U	330	44	
98-86-2	Acetophenone	330	U	330	65	
62-53-3	Aniline	330	U	330	51	
120-12-7	Anthracene	330	U	330	52	
1912-24-9	Atrazine	330	U	330	140	
56-55-3	Benz(a)anthracene	330	U	330	51	
100-52-7	Benzaldehyde	1700	U	1700	87	
50-32-8	Benzo(a)pyrene	330	U	330	55	
205-99-2	Benzo(b)fluoranthene	330	U	330	80	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 11:43
Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311212-01	**Basis:**	Dry

Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Analysis Lot:**	359856
Prep Method:	EPA 3541	**Extraction Lot:**	191738
Data File Name:	I:\ACQUDATA\5973A\DATA\092313\CT058.D\	**Instrument Name:**	R-MS-51
		Dilution Factor:	1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
191-24-2	Benzo(g,h,i)perylene	330	U	330	63	
207-08-9	Benzo(k)fluoranthene	330	U	330	59	
65-85-0	Benzoic Acid	1700	U	1700	600	
92-52-4	Biphenyl	330	U	330	34	
108-60-1	2,2'-Oxybis(1-chloropropane)	330	U	330	40	
111-91-1	Bis(2-chloroethoxy)methane	330	U	330	46	
111-44-4	Bis(2-chloroethyl) Ether	330	U	330	33	
117-81-7	Bis(2-ethylhexyl) Phthalate	330	U	330	46	
85-68-7	Butyl Benzyl Phthalate	330	U	330	51	
105-60-2	Caprolactam	330	U	330	61	
86-74-8	Carbazole	330	U	330	46	
218-01-9	Chrysene	330	U	330	47	
84-74-2	Di-n-butyl Phthalate	330	U	330	91	
117-84-0	Di-n-octyl Phthalate	330	U	330	64	
53-70-3	Dibenz(a,h)anthracene	330	U	330	89	
132-64-9	Dibenzofuran	330	U	330	37	
84-66-2	Diethyl Phthalate	330	U	330	43	
131-11-3	Dimethyl Phthalate	330	U	330	48	
206-44-0	Fluoranthene	330	U	330	53	
86-73-7	Fluorene	330	U	330	42	
118-74-1	Hexachlorobenzene	330	U	330	51	
87-68-3	Hexachlorobutadiene	330	U	330	37	
77-47-4	Hexachlorocyclopentadiene	330	U	330	53	
67-72-1	Hexachloroethane	330	U	330	46	
193-39-5	Indeno(1,2,3-cd)pyrene	330	U	330	55	
78-59-1	Isophorone	330	U	330	44	
621-64-7	N-Nitrosodi-n-propylamine	330	U	330	38	
86-30-6	N-Nitrosodiphenylamine	330	U	330	52	
91-20-3	Naphthalene	330	U	330	33	
98-95-3	Nitrobenzene	330	U	330	35	
608-93-5	Pentachlorobenzene	330	U	330	34	
82-68-8	Pentachloronitrobenzene (PCNB)	330	U	330	42	
87-86-5	Pentachlorophenol (PCP)	1700	U	1700	280	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 11:43
Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311212-01	**Basis:**	Dry

Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Analysis Lot:**	359856
Prep Method:	EPA 3541	**Extraction Lot:**	191738
Data File Name:	I:\ACQUDATA\5973A\DATA\092313\CT058.D\	**Instrument Name:**	R-MS-51
		Dilution Factor:	1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
85-01-8	Phenanthrene	330	U	330	45	
108-95-2	Phenol	330	U	330	37	
129-00-0	Pyrene	330	U	330	64	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
2,4,6-Tribromophenol	72	41-151	9/23/13 11:43	
2-Fluorobiphenyl	64	47-126	9/23/13 11:43	
2-Fluorophenol	56	16-129	9/23/13 11:43	
Nitrobenzene-d5	57	39-136	9/23/13 11:43	
Phenol-d6	63	10-145	9/23/13 11:43	
Terphenyl-d14	82	35-152	9/23/13 11:43	

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Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Extracted:	9/18/13
		Date Analyzed:	9/23/13 1143

Tentatively Identified Compounds (TIC)
Semivolatile Organic Compounds by GC/MS

Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311212-01	**Basis:**	Dry

Prep Method: EPA 3541
Analytical Method: 8270D

CAS #	Analyte Name	RT	Result Q

No Tentatively Identified Compounds Detected.

Comments:

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/23/13
Sample Matrix:	Soil		

Lab Control Sample Summary
Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Units:**	µg/Kg
Prep Method:	EPA 3541	**Basis:**	Dry
		Extraction Lot:	191738

	Lab Control Sample RQ1311212-02			Duplicate Lab Control Sample RQ1311212-03					
Analyte Name	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
2,4,5-Trichlorophenol	2480	3330	75	2620	3330	79	47 - 131	5	30
2,4,6-Trichlorophenol	2530	3330	76	2680	3330	80	46 - 136	5	30
2,4-Dichlorophenol	2540	3330	76	2600	3330	78	39 - 135	2	30
2,4-Dimethylphenol	2140	3330	64	2250	3330	67	31 - 135	5	30
2,4-Dinitrophenol	2090	3330	63	2730	3330	82	10 - 148	26	30
2,4-Dinitrotoluene	2730	3330	82	2930	3330	88	45 - 152	7	30
2,6-Dinitrotoluene	2660	3330	80	2790	3330	84	50 - 146	5	30
2-Chloronaphthalene	2370	3330	71	2530	3330	76	41 - 124	7	30
2-Chlorophenol	2420	3330	72	2610	3330	78	39 - 123	8	30
2-Methylnaphthalene	2370	3330	71	2390	3330	72	33 - 125	1	30
2-Methylphenol	2440	3330	73	2610	3330	78	38 - 123	7	30
2-Nitroaniline	2530	3330	76	2680	3330	81	44 - 139	6	30
2-Nitrophenol	2590	3330	78	2680	3330	80	47 - 128	3	30
3,3'-Dichlorobenzidine	2010	3330	60	2210	3330	66	19 - 111	9	30
3- and 4-Methylphenol Coelution	4710	6670	71	5040	6670	76	42 - 114	7	30
3-Nitroaniline	2270	3330	68	2430	3330	73	43 - 106	7	30
4,6-Dinitro-2-methylphenol	2500	3330	75	2800	3330	84	29 - 141	12	30
4-Bromophenyl Phenyl Ether	2440	3330	73	2590	3330	78	45 - 137	6	30
4-Chloro-3-methylphenol	2550	3330	76	2670	3330	80	42 - 140	4	30
4-Chloroaniline	2370	3330	71	2450	3330	73	34 - 101	3	30
4-Chlorophenyl Phenyl Ether	2500	3330	75	2620	3330	79	47 - 132	5	30
4-Nitroaniline	2310	3330	69	2490	3330	75	34 - 131	8	30
4-Nitrophenol	2170	3330	65	2610	3330	78	10 - 130	18	30
Acenaphthene	2450	3330	73	2600	3330	78	43 - 133	6	30
Acenaphthylene	2450	3330	74	2550	3330	76	45 - 133	4	30
Acetophenone	2490	3330	75	2580	3330	78	44 - 114	4	30
Aniline	2190	3330	66	2420	3330	73	18 - 108	10	30
Anthracene	2430	3330	73	2510	3330	75	48 - 129	3	30
Atrazine	2920	3330	87	3090	3330	93	39 - 151	6	30
Benz(a)anthracene	2430	3330	73	2550	3330	76	48 - 129	5	30
Benzaldehyde	3860	3330	116	4200	3330	126	62 - 200	8	30
Benzo(a)pyrene	2480	3330	74	2630	3330	79	45 - 125	6	30
Benzo(b)fluoranthene	2620	3330	79	2850	3330	85	45 - 136	8	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/23/13
Sample Matrix:	Soil		

Lab Control Sample Summary
Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Units:**	µg/Kg
Prep Method:	EPA 3541	**Basis:**	Dry
		Extraction Lot:	191738

	Lab Control Sample RQ1311212-02			**Duplicate Lab Control Sample** RQ1311212-03					
Analyte Name	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
Benzo(g,h,i)perylene	2540	3330	76	2720	3330	82	51 - 131	7	30
Benzo(k)fluoranthene	2680	3330	80	2800	3330	84	43 - 131	4	30
Benzoic Acid	1700 U	3330	0 *	977	3330	29	10 - 92	NC	30
Biphenyl	2490	3330	75	2580	3330	77	35 - 131	4	30
2,2'-Oxybis(1-chloropropane)	2700	3330	81	2810	3330	84	38 - 138	4	30
Bis(2-chloroethoxy)methane	2490	3330	75	2510	3330	75	48 - 123	<1	30
Bis(2-chloroethyl) Ether	2360	3330	71	2360	3330	71	44 - 111	<1	30
Bis(2-ethylhexyl) Phthalate	2670	3330	80	2830	3330	85	50 - 142	6	30
Butyl Benzyl Phthalate	2610	3330	78	2740	3330	82	46 - 137	5	30
Caprolactam	2420	3330	72	2650	3330	79	42 - 112	9	30
Carbazole	2420	3330	73	2560	3330	77	40 - 140	6	30
Chrysene	2400	3330	72	2520	3330	76	48 - 128	5	30
Di-n-butyl Phthalate	2590	3330	78	2680	3330	81	36 - 164	4	30
Di-n-octyl Phthalate	2940	3330	88	3110	3330	93	48 - 137	6	30
Dibenz(a,h)anthracene	2450	3330	74	2610	3330	78	50 - 135	6	30
Dibenzofuran	2410	3330	72	2530	3330	76	45 - 126	5	30
Diethyl Phthalate	2540	3330	76	2650	3330	80	46 - 141	5	30
Dimethyl Phthalate	2550	3330	76	2670	3330	80	48 - 139	5	30
Fluoranthene	2420	3330	73	2500	3330	75	46 - 138	4	30
Fluorene	2480	3330	74	2600	3330	78	46 - 134	5	30
Hexachlorobenzene	2420	3330	72	2530	3330	76	41 - 138	5	30
Hexachlorobutadiene	2140	3330	64	2190	3330	66	10 - 142	2	30
Hexachlorocyclopentadiene	2370	3330	71	2490	3330	75	10 - 133	5	30
Hexachloroethane	2110	3330	63	2140	3330	64	10 - 129	2	30
Indeno(1,2,3-cd)pyrene	2500	3330	75	2650	3330	79	48 - 128	6	30
Isophorone	2380	3330	71	2420	3330	72	44 - 122	2	30
N-Nitrosodi-n-propylamine	2470	3330	74	2560	3330	77	44 - 126	4	30
N-Nitrosodiphenylamine	2560	3330	77	2690	3330	81	43 - 156	5	30
Naphthalene	2310	3330	69	2330	3330	70	31 - 123	<1	30
Nitrobenzene	2380	3330	71	2420	3330	73	35 - 134	2	30
Pentachlorophenol (PCP)	2140	3330	64	2460	3330	74	17 - 150	14	30
Phenanthrene	2500	3330	75	2590	3330	78	45 - 140	4	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/23/13
Sample Matrix:	Soil		

Lab Control Sample Summary
Semivolatile Organic Compounds by GC/MS

Analytical Method:	8270D	**Units:**	µg/Kg
Prep Method:	EPA 3541	**Basis:**	Dry
		Extraction Lot:	191738

	Lab Control Sample RQ1311212-02			Duplicate Lab Control Sample RQ1311212-03					
Analyte Name	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
Phenol	2300	3330	69	2480	3330	74	10 - 144	7	30
Pyrene	2560	3330	77	2690	3330	81	45 - 132	5	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client: Day Environmental, Incorporated
Project: Olean/48845-13
Sample Matrix: Soil

Service Request: R1306782
Date Collected: 9/11/13 1130
Date Received: 9/16/13
Date Extracted: 9/20/13
Date Analyzed: 9/24/13 11:20

Sample Name: TB-15A (24')
Lab Code: R1306782-001

Units: µg/Kg
Basis: Dry
Percent Solids: 91.4

Polychlorinated Biphenyls (PCBs) by GC

Analytical Method: 8082A
Prep Method: EPA 3541
Data File Name: I:\ACQUDATA\GCEXT4\DATA\092413\NM771.D\

Analysis Lot: 360033
Extraction Lot: 192209
Instrument Name: R-GC-56
Dilution Factor: 1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
12674-11-2	Aroclor 1016	36	U	36	19	
11104-28-2	Aroclor 1221	73	U	73	38	
11141-16-5	Aroclor 1232	36	U	36	19	
53469-21-9	Aroclor 1242	36	U	36	19	
12672-29-6	Aroclor 1248	36	U	36	19	
11097-69-1	Aroclor 1254	36	U	36	21	
11096-82-5	Aroclor 1260	36	U	36	19	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
Decachlorobiphenyl	57	22-150	9/24/13 11:20	
Tetrachloro-m-xylene	33	10-126	9/24/13 11:20	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
		Date Extracted:	9/20/13
		Date Analyzed:	9/24/13 09:36
Sample Name:	Method Blank	**Units:**	µg/Kg
Lab Code:	RQ1311372-01	**Basis:**	Dry

Polychlorinated Biphenyls (PCBs) by GC

Analytical Method:	8082A	**Analysis Lot:**	360033
Prep Method:	EPA 3541	**Extraction Lot:**	192209
Data File Name:	I:\ACQUDATA\GCEXT4\DATA\092413\NM768.D\	**Instrument Name:**	R-GC-56
		Dilution Factor:	1

CAS No.	Analyte Name	Result	Q	MRL	MDL	Note
12674-11-2	Aroclor 1016	33	U	33	17	
11104-28-2	Aroclor 1221	67	U	67	34	
11141-16-5	Aroclor 1232	33	U	33	17	
53469-21-9	Aroclor 1242	33	U	33	17	
12672-29-6	Aroclor 1248	33	U	33	17	
11097-69-1	Aroclor 1254	33	U	33	19	
11096-82-5	Aroclor 1260	33	U	33	17	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Q
Decachlorobiphenyl	76	22-150	9/24/13 09:36	
Tetrachloro-m-xylene	46	10-126	9/24/13 09:36	

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/24/13
Sample Matrix:	Soil		

Lab Control Sample Summary
Polychlorinated Biphenyls (PCBs) by GC

Analytical Method:	8082A	**Units:**	µg/Kg
Prep Method:	EPA 3541	**Basis:**	Dry
		Extraction Lot:	192209

	Lab Control Sample RQ1311372-02			Duplicate Lab Control Sample RQ1311372-03					
Analyte Name	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
Aroclor 1260	135	167	81	132	167	79	58 - 129	2	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Environmental

METALS

COVER PAGE - INORGANIC ANALYSIS DATA PACKAGE

Contract: R1306782

SDG No.: TB-15A (24"

Lab Code:

Case No.:

SAS No.:

SOW No.: SW846 CLP-M

Sample ID.	Lab Sample No.
TB-15A (24')	R1306782-001
TB-15A (24')D	R1306782-001D
TB-15A (24')S	R1306782-001S

Were ICP interelement corrections applied?	Yes/No	YES
Were ICP background corrections applied?	Yes/No	YES
If yes-were raw data generated before application of background corrections?	Yes/No	NO

Comments: See Attatched Case Narrative

Signature:

Name: Michael Perry

Date: 10/10/13

Title: Laboratory Director

METALS

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INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

TB-15A (24')

Contract: R1306782

Lab Code: Case No.: SAS No.: SDG NO.: TB-15A (24")

Matrix (soil/water): SOIL

Lab Sample ID: R1306782-001

Level (low/med): LOW

Date Received: 9/16/2013

% Solids: 91.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7440-22-4	Silver	1.0	U		P
7429-90-5	Aluminum	5580			P
7440-38-2	Arsenic	6.7			P
7440-39-3	Barium	34.5			P
7440-41-7	Beryllium	0.521	U		P
7440-70-2	Calcium	42200		*	P
7440-43-9	Cadmium	0.521	U		P
7440-48-4	Cobalt	5.2	U		P
7440-47-3	Chromium	22.0		*	P
7440-50-8	Copper	15.3			P
7439-89-6	Iron	15900			P
7440-09-7	Potassium	619			P
7439-95-4	Magnesium	4820		*	P
7439-96-5	Manganese	697		*	P
7439-97-6	Mercury	0.035	U		CV
7440-23-5	Sodium	146			P
7440-02-0	Nickel	10.9		N	P
7439-92-1	Lead	9.2			P
7440-36-0	Antimony	6.3	U		P
7782-49-2	Selenium	1.0	U		P
7440-28-0	Thallium	2.1	U		P
7440-62-2	Vanadium	9.8			P
7440-66-6	Zinc	51.6		N	P

Color Before: BROWN

Clarity Before:

Texture: MEDIUM

Color After: YELLOW

Clarity After: CLEAR

Artifacts:

Comments:

METALS

-3-

BLANKS

Contract: R1306782

Lab Code: Case No.: SAS No.: SDG NO.: TB-15A (24")

Preparation Blank Matrix (soil/water): SOIL

Preparation Blank Concentration Units (ug/L or mg/kg): MG/KG

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L)						Preparation Blank	C	M
			1	C	2	C	3	C			
Silver	10.000	U	10.000	U	10.000	U	10.000	U	1.000	U	P
Aluminum	100.000	U	100.000	U	100.000	U	100.000	U	10.000	U	P
Arsenic	10.000	U	10.000	U	10.000	U	10.000	U	1.000	U	P
Barium	20.000	U	20.000	U	20.000	U	20.000	U	2.000	U	P
Beryllium	5.000	U	5.000	U	5.000	U	5.000	U	0.500	U	P
Cadmium	5.000	U	5.000	U	5.000	U	5.000	U	0.500	U	P
Cobalt	50.000	U	50.000	U	50.000	U	50.000	U	5.000	U	P
Chromium	10.000	U	10.000	U	10.000	U	10.000	U	1.000	U	P
Copper	20.000	U	20.000	U	20.000	U	20.000	U	2.000	U	P
Potassium	2000.000	U	2000.000	U	2000.000	U	2000.000	U	200.000	U	P
Magnesium	1000.000	U	1000.000	U	1000.000	U	1000.000	U	100.000	U	P
Manganese	10.000	U	10.000	U	10.000	U	10.000	U	1.000	U	P
Mercury	0.200	U	0.200	U	0.200	U	0.200	U	0.033	U	CV
Sodium	1000.000	U	1000.000	U	1000.000	U	1000.000	U	100.000	U	P
Nickel	40.000	U	40.000	U	40.000	U	40.000	U	4.000	U	P
Lead	50.000	U	50.000	U	50.000	U	50.000	U	5.000	U	P
Antimony	60.000	U	60.000	U	60.000	U	60.000	U	6.000	U	P
Selenium	10.000	U	10.000	U	10.000	U	10.000	U	1.000	U	P
Thallium	10.000	U	10.000	U	10.000	U	10.000	U	1.000	U	P
Vanadium	50.000	U	50.000	U	50.000	U	50.000	U	5.000	U	P
Zinc	20.000	U	20.000	U	20.000	U	20.000	U	2.000	U	P

Comments:

METALS

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BLANKS

Contract: R1306782

Lab Code: ________ Case No.: ________ SAS No.: ________ SDG NO.: TB-15A (24")

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L)						Preparation Blank	C	M
			1	C	2	C	3	C			
Silver			10.000	U							P
Aluminum			100.000	U							P
Arsenic			10.000	U							P
Barium			20.000	U							P
Beryllium			5.000	U							P
Cadmium			5.000	U							P
Cobalt			50.000	U							P
Chromium			10.000	U							P
Copper			20.000	U							P
Potassium			2000.000	U							P
Magnesium			1000.000	U							P
Manganese			10.000	U	10.000	U					P
Mercury			0.200	U							CV
Sodium			1000.000	U							P
Nickel			40.000	U							P
Lead			50.000	U							P
Antimony			60.000	U							P
Selenium			10.000	U							P
Thallium			10.000	U	10.000	U					P
Vanadium			50.000	U							P
Zinc			20.000	U							P

Comments:

METALS

-3-

BLANKS

Contract: R1306782

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG NO.: TB-15A (24")

Preparation Blank Matrix (soil/water): SOIL

Preparation Blank Concentration Units (ug/L or mg/kg): MG/KG

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L)							Preparation Blank	C		M
			1	C	2	C	3	C					
Calcium	1000.000	U	1000.000	U	1000.000	U	1000.000	U		100.000	U		P
Iron	100.000	U	100.000	U	100.000	U	100.000	U		10.000	U		P

Comments:

METALS

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BLANKS

Contract: R1306782

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG NO.: TB-15A (24")

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Preparation Blank	C	M
Calcium			1000.000	U	1000.000	U					P
Iron			100.000	U	100.000	U					P

Comments:

METALS

-5A-

SPIKE SAMPLE RECOVERY

SAMPLE NO.

TB-15A (24')S

Contract: R1306782

Lab Code: Case No.: SAS No.: SDG NO.: TB-15A (24")

Matrix (soil/water): SOIL Level (low/med): LOW

% Solids for Sample: 91.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Silver	75 - 125	5.19		1.04	U	5.4	96		P
Aluminum		4850.00		5580.00		214.0	-341		P
Arsenic	75 - 125	10.10		6.70		4.3	79		P
Barium	75 - 125	227.00		34.50		214.0	90		P
Beryllium	75 - 125	5.19		0.52	U	5.4	96		P
Calcium		66400.00		42200.00		214.0	11308		P
Cadmium	75 - 125	4.32		0.52	U	5.4	80		P
Cobalt	75 - 125	51.00		5.21	U	53.6	95		P
Chromium	75 - 125	42.10		22.00		21.5	93		P
Copper	75 - 125	39.70		15.30		26.8	91		P
Iron		14700.00		15900.00		107.0	-1121		P
Potassium	75 - 125	2620.00		619.00		2150.0	93		P
Magnesium		15800.00		4820.00		214.0	5131		P
Manganese		1090.00		318.00		53.6	1440		P
Sodium	75 - 125	2300.00		146.00		2150.0	100		P
Nickel	75 - 125	49.70		10.90		53.6	72	N	P
Lead	75 - 125	59.10		9.24		53.60	93		P
Antimony	75 - 125	45.90		6.25	U	53.6	86		P
Selenium	75 - 125	96.40		1.04	U	108.0	89		P
Thallium	75 - 125	206.00		0.95	U	214.0	96		P
Vanadium	75 - 125	58.70		9.83		53.6	91		P
Zinc	75 - 125	87.90		51.60		53.6	68	N	P

Comments:

METALS
-5B-

POST DIGEST SPIKE SAMPLE RECOVERY

SAMPLE NO.
TB-15A (24')A

Contract: R1306782

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG NO.: TB-15A (24")

Matrix (soil/water): SOIL Level (low/med): LOW

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Silver		41.10		10.00	U	50.0	82		P
Aluminum		54300.00		53500.00		2000.0	40		P
Arsenic		101.00		64.30		40.0	92		P
Barium		2200.00		331.00		2000.0	93		P
Beryllium		49.20		5.00	U	50.0	98		P
Calcium		22400.00		20200.00		2000.0	110		P
Cadmium		42.20		5.00	U	50.0	84		P
Cobalt		494.00		50.00	U	500.0	99		P
Chromium		394.00		211.00		200.0	92		P
Copper		383.00		147.00		250.0	94		P
Iron		8560.00		7610.00		1000.0	95		P
Potassium		25100.00		5940.00		20000.0	96		P
Magnesium		46400.00		46200.00		2000.0	10		P
Manganese		3810.00		3340.00		500.0	94		P
Sodium		20800.00		1400.00		20000.0	97		P
Nickel		494.00		105.00		500.0	78		P
Lead		545.00		88.60		500.0	91		P
Antimony		488.00		60.00	U	500.0	98		P
Selenium		927.00		10.00	U	1010.0	92		P
Thallium		1950.00		10.00	U	2000.0	98		P
Vanadium		564.00		94.30		500.0	94		P
Zinc		915.00		495.00		500.0	84		P

Comments:

METALS
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DUPLICATES

SAMPLE NO.

TB-15A (24')D

Contract: R1306782

Lab Code: Case No.: SAS No.: SDG NO.: TB-15A (24")

Matrix (soil/water): SOIL Level (low/med): LOW

% Solids for Sample: 91.4 % Solids for Duplicate: 91.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Silver		1.04	U	1.06	U			P
Aluminum		5580.00		5050.00		10		P
Arsenic		6.70		6.49		3		P
Barium		34.50		36.10		5		P
Beryllium		0.52	U	0.53	U			P
Calcium		42200.00		67100.00		46	*	P
Cadmium		0.52	U	0.53	U			P
Cobalt		5.21	U	5.31	U			P
Chromium		22.00		14.60		40	*	P
Copper		15.30		14.20		7		P
Iron		15900.00		14600.00		9		P
Potassium	212.0	619.00		697.00		12		P
Magnesium		4820.00		13600.00		95	*	P
Manganese		318.00		899.00		95	*	P
Sodium	106.0	146.00		176.00		19		P
Nickel	4.3	10.90		10.10		8		P
Lead	5.3	9.24		7.98		15		P
Antimony		6.25	U	6.37	U			P
Selenium		1.04	U	1.06	U			P
Thallium		0.95	U	2.12	U			P
Vanadium	5.3	9.83		9.33		5		P
Zinc		51.60		47.40		8		P

Comments:

METALS

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LABORATORY CONTROL SAMPLE

Contract: R1306782

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG NO.: TB-15A (24")

Solid LCS Source: ERA

Aqueous LCS Source:

Analyte	Aqueous (ug/L			Solid (mg/K					
	True	Found	%R	True	Found	C	Limits		%R
Silver				34	33.81		22.8	46.1	98
Aluminum				8400	7667.01		3950	12800	91
Arsenic				95	88.52		77.8	111	94
Barium				167	169.88		140	193	102
Beryllium				58	55.88		47.8	67.4	97
Calcium				6140	5572.04		5110	7180	91
Cadmium				61	59.22		50.3	70.7	98
Cobalt				102	104.19		84.9	119	102
Chromium				70	72.36		57.6	83.2	103
Copper				80	84.11		66.7	92.4	106
Iron				12500	11279.54		6330	18700	90
Potassium				2490	2392.73		1740	3230	96
Magnesium				2580	2486.51		1960	3190	96
Manganese				283	291.29		233	332	103
Mercury				3.730	3.83		2.56	4.89	103
Sodium				215	214.46		144	286	100
Nickel				58	58.99		47.7	67.5	102
Lead				92	91.79		75.5	108	100
Antimony				93	129.79		6	186	139
Selenium				86	81.45		69.2	104	94
Thallium				120	122.50		93.9	145	102
Vanadium				57	55.79		41.9	72	98
Zinc				140	137.49		115	165	98

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/11/13 1130
Sample Matrix:	Soil	**Date Received:**	9/16/13
Sample Name:	TB-15A (24')		
Lab Code:	R1306782-001	**Basis:**	As Received

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	MRL	Dilution Factor	Date Extracted	Date Analyzed	Note
Solids, Total	160.3 Modified	**91.4**		Percent	1.0	1	NA	9/23/13 13:22	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/11/13 1130
Sample Matrix:	Soil	**Date Received:**	9/16/13
Sample Name:	TB-15A (24')		
Lab Code:	R1306782-001	**Basis:**	Dry
		Percent Solids:	91.4

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	MRL	Dilution Factor	Date Extracted	Date Analyzed	Note
Cyanide, Total	9012B	0.094	U	mg/Kg	0.094	1	9/24/13	9/24/13 17:08	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client: Day Environmental, Incorporated
Project: Olean/48845-13
Sample Matrix: Soil

Sample Name: TB-17 (3')
Lab Code: R1306782-002

Service Request: R1306782
Date Collected: 9/13/13 1130
Date Received: 9/16/13

Basis: As Received

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	MRL	Dilution Factor	Date Extracted	Date Analyzed	Note
Solids, Total	160.3 Modified	**84.8**		Percent	1.0	1	NA	9/23/13 13:22	

Printed 10/10/13 11:14
\\Inflow2\Starlims\LimsReps\AnalyticalReport.rpt

Form 1A

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	9/12/13 1015
Sample Matrix:	Soil	**Date Received:**	9/16/13
Sample Name:	TB-12 (30')		
Lab Code:	R1306782-003	**Basis:**	As Received

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	MRL	Dilution Factor	Date Extracted	Date Analyzed	Note
Solids, Total	160.3 Modified	**90.1**		Percent	1.0	1	NA	9/23/13 13:22	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank		
Lab Code:	R1306782-MB	**Basis:**	As Received

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	MRL	Dilution Factor	Date Extracted	Date Analyzed	Note
Solids, Total	160.3 Modified	1.0	U	Percent	1.0	1	NA	9/23/13 13:22	

ALS Group USA, Corp. dba ALS Environmental

Analytical Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank		
Lab Code:	R1306782-MB	**Basis:**	Dry

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	MRL	Dilution Factor	Date Extracted	Date Analyzed	Note
Cyanide, Total	9012B	0.10	U	mg/Kg	0.10	1	9/24/13	9/24/13 16:47	

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/24/13
Sample Matrix:	Soil		

Lab Control Sample Summary
General Chemistry Parameters

Units: mg/Kg
Basis: Dry

		Lab Control Sample R1306782-LCS1			
Analyte Name	**Method**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**
Cyanide, Total	9012B	1.01	1.00	101	85 - 115

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client:	Day Environmental, Incorporated	**Service Request:**	R1306782
Project:	Olean/48845-13	**Date Analyzed:**	9/24/13
Sample Matrix:	Soil		

Lab Control Sample Summary
General Chemistry Parameters

Units: mg/Kg
Basis: Dry

		Lab Control Sample R1306782-LCS2			
Analyte Name	**Method**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**
Cyanide, Total	9012B	4.04	4.00	101	85 - 115

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

APPENDIX D

Anticipated RI/RAA Schedule

Proposed Schedule
Remedial Investigation/Remedial Alternatives Analysis (RI/RAA)
211 Franklin Street
Olean, NY

TASK	Duration (weeks)
Submit BCP Application and Draft RI/RAA Work Plan	0
NYSDEC Notification of a Complete Application	2
Agency/Public Reviews and Finalization of RI/RAA Work Plan, Submit Citizens Participation Plan, FACT Sheet	12
Approval of RI/RAA Work Plan	0
Site Investigation	
- Basement/Vault Assessment	4
- Geophysical Survey	
- Soil Vapor Screening	
- Utility Assessment	
- Soil Borings & Monitoring Well Installation/Development	6
- Analytical Laboratory Testing and DUSR Preparation: Soil Samples	6
- Initial Groundwater Sampling Event	1
- Physical Testing of Monitoring Wells, Survey, etc.	2
- Analytical Laboratory Testing and DUSR Preparation: Initial GW Monitoring Event	6
- Second Groundwater Sampling Event	1
- Analytical Laboratory Testing and DUSR Prepation: Second GW Monitoring Event	6
- Underground Storage Tank (UST) Removal (IRM)	1
- UST Confirmatory Testing, DUSR Preparation and Reporting	6
RI/RAA Report	
- Prepare Draft RI/RAA Report	8
- Agency Reviews	12
- Finalize RI/RAA Report	
- Remedy Selection	
- Proposed Decision Document