Remedial Investigation Work Plan

3701 River Road Site
BCP Site No. C915419
Tonawanda, New York

November 2026

Prepared for:

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List of Acronyms

AA	Alternatives Analysis
AST	Aboveground Storage Tank
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Plan
COC	Chain-of-Custody
COPC	Constituents of Potential Concern
CP	Citizen Participation
CSCO	Commercial Soil Cleanup Objective
cVOC	Chlorinated Volatile Organic Compound
DO	Dissolved Oxygen
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
ESA	Environmental Site Assessment
FADL	Field Activity Daily Log
fbgs	Feet below ground surface
FOP	Field Operating Procedures
FWIA	Fish and Wildlife Impact Assessment
GCM	Grossly Contaminated Media
GPS	Global Positioning System
GWQS/GV	Groundwater Quality Standards/Guidance Values
HSA	Hollow Stem Auger
HASP	Health and Safety Plan
HDPE	High density polyethylene
IDW	Investigative Derived Waste
ISCO	Industrial Soil Cleanup Objective
LNAPL	Light Non-Aqueous Phase Liquid
mg/kg	Milligrams per kilogram
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OHSM	Office Health and Safety Manager
ORP	Oxidation Reduction Potential
OVM	Organic Vapor Monitor
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PFAS	Per- and Polyfluoroalkyl Substances
PGWSCO	Protection of Groundwater Soil Cleanup Objective
PID	Photoionization Detector
PPE	Personal Protective Equipment

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ppm	Parts per million
pVOC	Petroleum Volatile Organic Compound
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
REC	Recognized Environmental Condition
RI	Remedial Investigation
RRSCO	Restricted-Residential Soil Cleanup Objective
SAP	Sampling and Analysis Plan
SCG	Standards, Criteria, and Guidance
SCO	Soil Cleanup Objective
SIM	Selective Ion Monitoring
SRM	Standard Reference Materials
SS	Site Supervisor
SSHO	Site Safety and Health Officer
SVOC	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
USCO	Unrestricted Soil Cleanup Objective
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

Certification Statement

I, Thomas H. Forbes, certify that I am currently a NYS registered Professional Engineer and that this Remedial Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) the DER Green Remediation policy (DER-31).



Thomas H. Forbes	11-13-26	
	Date	Signature/Stamp

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

1. Introduction

This document presents the proposed scope of work and implementation procedures for completion of a Remedial Investigation (RI) at the 3701 River Road Site (Site), located at 3701 River Road in the Town of Tonawanda, New York (see Figure 1 and Figure 2). The Applicant, 3701 River Road, LLC, acting as a Participant, has elected to pursue cleanup and redevelopment of the Site under the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP). 3701 River Road, LLC is submitting a BCP Application concurrently with this work plan.

Currently, there is no redevelopment plan in place. However, given the nature of the property and surrounding area, the Applicant is considering construction of a commercial capacity.

The RI will be completed by Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of the Applicant. The work will be completed in accordance with NYSDEC DER-10 and DER-31 guidelines.

1.1 Site Background

The Site is east of River Road in a predominantly commercial and industrial area of the Town of Tonawanda, Erie County, New York. The Site is bordered by River Road and mixed-use waterfront properties to the west; and industrial properties to the north, south, and east. The 3.19-acre Site consists of one (1) parcel as summarized below (see Figure 2):

Parcel Address	SBL No.	Acreage
3701 River Road	64.12-1-15.113	3.19

The Site is currently developed with one main commercial building, located on the western part of the Site, that is used as storage for Woodlands Earth and Stone (Woodlands), a landscape supply company. The eastern portion of the Site is currently used by Woodlands for outside storage of landscaping materials and includes a scale house. Entrances to the Site are from River Road (west) and a private driveway to the north.

Prior to purchase by the Applicant, the Site was previously used as a portion of a greater oil refinery with on-site operations including a fuel storage terminal with a fueling rack, petroleum tanks[1], and associated product piping. Historic aerial photographs indicate the presence of one former bulk oil storage tank, east of the main existing building, that was historically used as a fueling rack from at least 1951 through at least 1985. Historic aerial photographs also depict railroad tracks running east-west across the southern portion of the Site. Per historic title records and Requestor provided information former owner/operators at the Site include NOCO Energy Corp., Ashland Oil, Inc., Exxon Corporation and multiple subsidiaries, colonial Beacon Oil Company, Shell Oil Company/Corporation/Eastern Petroleum Products, Wonalancet Company, and Beacon Company.

The previous Phase II investigation at the Site identified petroleum-impacted soil and groundwater with grossly contaminated media (GCM) observed at sixteen (16) investigation locations across the Site (see

[1] As further discussed in this work plan, one orphan UST, encountered during the previous Phase II work, remains on-site and will be addressed as part of remedial activities planned for the Site.

Figure 3). In addition, buried product piping, and one petroleum orphan UST were encountered during the Phase II work. Details of the previous investigation are presented in Section 2.7 below.

Based on petroleum-impacts including GCM, an orphan underground storage tank (UST), and product piping observed in the field, the NYSDEC was notified during the work and Spill No. 2404522 was opened on August 14, 2024; this spill incident remains active to-date.

Upon completion of the Phase II investigation, a forensics analysis of on-Site soil/fill was completed to determine the chemical fingerprinting of petroleum contamination associated with the Site. To complete this analysis, three (3) samples, identified as TP-4 PIANO, TP-5 PIANO, and TP-10 PIANO, were collected from impacted material at corresponding locations collected during the Phase II (i.e., TP-4, TP-5, and TP-10). After chemical analysis and reconnaissance of historical documents of the Site environs TP-4 PIANO was determined to be enriched with a mixture of aviation fuel and heating oil, TP-5 PIANO was determined to be enriched with a mixture of heating oil and relatively lower level of coke-like aspect. The combination of chemical analysis, review of subsurface conditions, and review of historical Site related documents showed that: “the aviation fuel enriched in TP-4 PIANO soil sample, and heating oils enriched in TP-4 PIANO and TP-5 PIANO were released at least 40 years ago from historical tank(s) or pipeline network associated to heating oil handling on-Site”. Based on this information, the contamination pre-dates the Applicant’s involvement and ownership of the Site.

1.2 Project Objectives

For sites entering the BCP at the point of investigation, NYSDEC requires completion of the RI detailed in this Work Plan. The primary objectives of this RI are to:

1. Delineate the areal and vertical extent of contaminants in all media at or emanating from the Site;

2. Determine the surface and subsurface characteristics of the site, including topography, geology and hydrogeology, including depth to groundwater;

3. Identify the sources of contamination, the migration pathways, and actual or potential receptors of contaminants on or through air, soil, bedrock, sediment, groundwater, surface water, utilities, and structures at a contaminated site, without regard to property boundaries;

4. Collect and evaluate all data necessary for a fish and wildlife resource impact analysis (FWRIA), pursuant to section 3.10, to determine all actual and potential adverse impact to fish and wildlife resources;

5. Collect and evaluate all data necessary to evaluate the actual and potential threats to public health and the environment. This would include evaluating all current and future potential public health exposure pathways, in accordance with Appendix 3B, as well as potential impacts to biota; and

6. Collect the data necessary to evaluate any release to an environmental medium and develop remedial alternative(s) to address the release.

Two data confidence levels will be employed in the RI: screening level data and definitive level data. In general, screening level confidence will apply to field measurements, including photoionization detector (PID) measurements, groundwater elevation measurements, and field analysis (i.e., pH, temperature, dissolved

oxygen (DO), oxidation reduction potential (ORP), specific conductivity, and turbidity). Definitive level confidence will apply to samples for chemical analysis.

The applicability of these levels of data is further specified in the Quality Assurance Project Plan (QAPP) in Section 4. Sampling and analytical acceptance and performance criteria such as precision, accuracy, representativeness, comparability, completeness, and sensitivity, are also defined in the QAPP.

1.3 Project Organization and Responsibilities

The Applicant, 3701 River Road, LLC, has been accepted into the BCP as a "Participant" concurrently with submittal of this RIWP, per ECL§27-1405. Roux Environmental Engineering and Geology, D.P.C. will complete the RI on behalf of 3701 River Road, LLC. Roux will also be responsible for verifying and certifying that the brownfield activities are completed in conformance with the Brownfield Cleanup Agreement (BCA), the approved RIWP, any subsequent work plans, and NYSDEC DER-10/DER-31 requirements.

Résumés for the known members of Roux's project team are included in Appendix A. Roux personnel and subcontractors for this project have not been determined at this time. Once pricing is secured, subcontract agreements are in place, and a field schedule determined, résumés for the selected project team will be provided to the NYSDEC, if requested. The table below presents the planned project team.

pany	Role	Name	Contact Information
NYSDEC	Project Manager	Jason Kryszak	(716) 851-7012 jason.kryszak@dec.ny.gov
NYSDOH	Project Manager	Ivana Zivkovic	(518) 485-7174 ivana.zivkovic@health.ny.gov
3701 River Road, LLC	Applicant Contact	Tim Boyle	(716) 362-5072 tboyle@newcowny.com
Roux	Project Manager	Bryan Mayback	(716) 856-0599 bmayback@rouxinc.com
Roux	Project Principal	Michael Lesakowski	(716) 856-0599 mlesakowski@rouxinc.com
Roux	Principal Engineer	Thomas Forbes, P.E	(716) 856-0599 tforbes@rouxinc.com
Roux	Field Team	TBD	TBD
TBD	Analytical Testing	TBD	TBD
TBD	Drilling Services	TBD	TBD
TBD	Excavation Services	TBD	TBD
Data Validation Services	DUSR	Judy Harry	(518) 251-4429 harry@frontiernet.net

2. Site Description

2.1 General

The Site is currently developed with one main commercial building that is used for storage. The eastern portion of the Site is currently used as a landscape supply company with a scale house and entrances to the Site from River Road (west) and a private driveway to the north.

Currently, there is no redevelopment plan in place. However, given the nature of the property and surrounding area, the Applicant is considering construction of a commercial capacity.

The vicinity of the Site includes various commercial/industrial properties and warehouses; therefore, planned redevelopment would be consistent with the surrounding area. The redevelopment would also be consistent with zoning in the surrounding area, which is predominantly zoned as G-1 (General Industrial) with mixed use waterfront (MU-W) properties to the west, across River Road. The redevelopment will not consist of single-family residential housing or renewable energy.

Further, the Site is located in a New York State (NYS) Climate Act Disadvantaged Community (Census Tract 36029008400) area and the NYS Department of State (DOS) Brownfield Opportunity Area – Tonawanda Opportunity Area, indicating the need for redevelopment and remediation of contaminated sites.

Sensitive receptors include mixed-use properties to the west, which include recreational properties. Several residential properties are located approximately 250-feet to the south/southeast on James Avenue. Wetlands (including the Niagara River to the west) and threatened/endangered species are also located within 0.25-mile to 0.5-mile from the Site, which are considered sensitive ecological receptors, and are discussed in more detail in Section 2.8. Land use/zoning is shown on Figure 4 and ecological resources are shown on Figure 5.

2.2 Site Topography and Drainage

The Site is generally flat lying. The Site is primarily covered with asphalt, concrete, and gravel. Precipitation is likely to flow toward storm drains on River Road via overland flow. Regional groundwater likely flows west toward Niagara River. Groundwater flow will be further evaluated as part of RI activities. Local groundwater flow, however, may be influenced by subsurface features, such as utilities, former development, and localized subsurface fill conditions.

2.3 Geology and Hydrogeology

2.3.1 Overburden

The Site is located within the Lake Erie-Niagara River major drainage basin, which is typified by little topographic relief that gently slopes westward towards Lake Erie and the Niagara River, except in the immediate vicinity of major drainage ways. According to the United States Department of Agriculture (USDA) Web soil survey, the Site soils are characterized as Urban Land (Ud) with a small area of the southern portion of the Site consisting of Schoharie silt loam (SaA). Typical surface covering for urban land include asphalt, concrete, buildings, or other impervious structures, commonly found in an urban environment. Schoharie silt loam consists of predominantly silt loam typically red clayey glaciolacustrine deposits derived from calcareous shale at 0 to 3 percent slopes.

Based on results of the previous investigation conducted, underlying the asphalt, concrete and gravel surfaces, soils generally consisted of native silty sand underlain by sandy lean clay to depths of at least 20 feet below ground surface (fbgs). Of the 25 investigation locations completed during the current assessment, fill materials were noted at five investigation locations (i.e., TP-1, TP-2, TP-3, TP-12, and TP-17), including the former railroad bed that spans across the southern portion of the Site (see Figure 3).

2.3.2 Bedrock

Based on the bedrock geologic map of Erie County, the Site is situated over the Camillus Shale Formation of the Upper Silurian Series. The Camillus Shale Formation is comprised of gray shale containing large amounts of gypsum. The unit has an approximate thickness of 400 to 700 feet.

Bedrock was not encountered during previous investigations and geotechnical drilling to bedrock has not been completed on-Site to date.

2.3.3 Hydrogeology

The Site is located within the Lake Erie-Niagara River major drainage basin, which has little topographic relief that gently slopes westward towards Lake Erie and the Niagara River, except in the immediate vicinity of major drainageways. Groundwater was encountered at depths ranging between 16 fbgs and 20 fbgs during the previous drilling investigation. Regional groundwater likely flows west toward the Niagara River. However, local groundwater flow may be influenced by subsurface features, such as excavations, utilities, and localized fill-conditions. Localized on-site groundwater flow will be confirmed during the RI.

2.4 Climate

The Town of Tonawanda has a cold continental climate, with moisture from Lake Erie causing increased precipitation. Average annual precipitation is reported as 39.6 inches and average snowfall is 84 inches. The average temperature is 48.3 degrees Fahrenheit. The ground and lakes typically remain frozen from December to March. Winds are generally from the southwest (USClimateData.com).

2.5 Population and Land Use

The Site is located in a highly developed area with commercial and industrial zoning in the Town of Tonawanda (see Figure 4). The Town of Tonawanda, encompassing 18.74 square miles, has a population of 72,636. The Site is located within Census Tract 84 (US Census Bureau).

According to the Town of Tonawanda the current zoning for the Site is defined as G-1 (General Industrial). The surrounding land-use is mixed use, including commercial and industrial.

2.6 Utilities and Groundwater Use

The Site has access to major public and private utilities, including potable water (Town of Tonawanda), sanitary and storm sewers (Town of Tonawanda), electric (National Grid), and natural gas (National Fuel Gas).

Groundwater at the Site is assigned Class “GA” by 6NYCRR Part 701.15. Currently, there are no deed restrictions on the use of groundwater at the Site; however, there are no groundwater supply wells on the

property. There is one industrial water well owned by Unifax 1 LLC located approximately 1.25-mile northeast of the Site (upgradient). Municipal potable water service is provided to the areas surrounding the Site.

2.7 Previous Investigations

A summary of the investigation that has been completed at the Site is presented below and included in Appendix B. Soil and groundwater analytical results are provided on Table 1 and Table 2, respectively. Data from the previous investigation has not been validated by an independent third-party and will be identified as "historical" data in the RI. Previous investigation locations and areas of concern are shown on Figure 3.

2.7.1 Phase II Environmental Investigation – October 2024

At the request of the current owner/Requestor, Roux Environmental Engineering and Geology, D.P.C. (Roux) completed a Phase II Environmental Investigation in August 2024 (report dated October 30, 2024) to assess environmental conditions on-site. As part of the work, Roux completed 20 test pits (TP-1 through TP-20) across the Site using an excavator to a depth of up to 10 fbgs. Following test pit activities, five (5) soil borings (SB-1 through SB-5) were completed at the Site by Roux's subcontractor, Trec Environmental Inc. (Trec), using a direct-push drill rig to a target depth of 20 fbgs, except for SB-4, which was completed to 12 fbgs. Four (4) soil borings were converted into temporary one-inch diameter monitoring wells. Pertinent findings are summarized on Figure 3 and described as follows:

Underlying the asphalt, concrete and gravel surfaces, soils generally consisted of native silty sand underlain by sandy lean clay to depths of at least 20 fbgs. Fill materials were noted at five investigation locations at TP-1, TP-2, TP-3, TP-12, and TP-17. Based on the history of the Site, the potential for additional areas with fill materials exists.

Groundwater was noted during drilling at depths ranging between 16 fbgs and 20 fbgs.

Elevated PID readings and petroleum-like odors were identified on the central and western portions of the Site. In addition, during completion of TP-13, an orphan UST, filled with a presumed petroleum-water mixture and totaling approximately 20,000-gallons, was identified east of the existing building. Buried product piping, associated with historical fueling operations, was also observed. Evidence of a former rail line was noted across the south portion of the Site. Based on field observations indicating the presence of subsurface petroleum impacts and the presence of an orphan UST and piping, as required by law, the NYSDEC was notified and Spill No. 2404522 was assigned to the Site. Remediation is required on-site to address environmental impacts, the UST, and product piping.

2.7.2 Chemical Fingerprinting Forensic Analysis – April 2025

A forensics analysis of on-Site soil/fill was completed to determine the chemical fingerprinting of petroleum contamination identified in on-Site soil/fill. To complete this analysis, three (3) samples, identified as TP-4 PIANO, TP-5 PIANO, and TP-10 PIANO, were collected from impacted material at corresponding locations collected during the Phase II (i.e., TP-4, TP-5, and TP-10). After chemical analysis and reconnaissance of historical documents of the Site environs TP-4 PIANO was determined to be enriched with a mixture of aviation fuel and heating oil, TP-5 PIANO was determined to be enriched with a mixture of heating oil and relatively lower level of coke-like aspect. The combination of chemical analysis, review of subsurface conditions, and review of historical Site related documents showed that: "the aviation fuel enriched in TP-4

PIANO soil sample, and heating oils enriched in TP-4 PIANO and TP-5 PIANO were released at least 40 years ago from historical tank(s) or pipeline network associated to heating oil handling on" Site.

2.8 Ecological Concerns

There are no State or Federal wetlands or floodplains located on Site or adjacent to the Site; however, there are several Federally/State regulated wetlands within 0.25-mile to 0.5-mile of the Site, including the Niagara River to the west (see Figure 5) as follows:

- Several federally regulated wetlands per the National Wetland Inventory (NWI) are located within 0.5-mile of the Site as follows:
    - Federally regulated Freshwater Ponds under 1-acre in size are located to the northwest and southwest of the Site (Classification Codes PUBF, PUBFx, and PUBHx).
    - A Federally regulated Freshwater Emergent Wetland measuring 1.74-acres is located northwest of the Site (Classification Code PEM1B).
    - Federally regulated Freshwater Forested/Shrub Wetlands measuring 3.10-acres (Classification Code PSS1E), 11.48-acres (Classification Codes PSS1/EM1B), and 34.79-acres (Classification Codes PFO1/SS1Bd) are located northeast of the Site.
- The Blacknose Shiner is located within the Niagara River; however, the NYSDEC Environmental Resource Mapper indicates this species is "not listed by NYS".
- The Niagara River is located approximately 0.25-mile west of the Site and has several classifications including a Federally regulated Riverine (Classification Code R2UBH), a NYSDEC Class A-Spcl River/Steam classified as Impaired, a Significant Waterfowl Winter Concentration Area, and a mussel screening stream (FIN: ONT-158).
- A NYSDEC regulated wetland measuring 41.3-acres (Wetland I.D. BW-6, Wetland Class 2) is located northeast of the Site.

The Site has historically been utilized for commercial and industrial purposes. Although unspecified endangered or threatened species are shown on-Site, the Site is developed with limited to no natural habitat available. NYS regulated wetlands were identified upgradient of the Site and Federally regulated wetlands surround the area. The Site is currently covered by asphalt, concrete, gravel, or grass cover reducing the risk for erosion and off-site transport. Additionally, the planned remediation will consist of excavating and removing impacted materials with construction of an engineered cover system, further reducing potentially impacted subgrade materials as well as further reducing the potential for erosion and off-Site transport.

A Fish and Wildlife Resource Impact Analysis (FWRIA) Decision Key (included in DER-10 Appendix 3C) is provided as Appendix C, which indicates the Site does not require a FWRIA in accordance with DER-10 Section 3.10.1; however, while not anticipated, should a condition be identified during the RI that may potentially impact ecological resources, a FWRIA will be included in the RI Report (RIR).

2.9 Primary Constituents of Concern

Based on findings to date, the constituents of potential concern (COPCs) are presented by media below:

- **Soil:** Petroleum-related Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAHs), and GCM
- **Groundwater:** Petroleum-related VOCs
- **Soil Vapor:** Petroleum-related VOCs

3. Remedial Investigation Scope of Work

This RI is focused on defining the nature and extent of contamination on-site and potential for off-site migration, identifying the sources of contamination, defining chemical constituent migration pathways, qualitatively assessing human health and ecological risks, and obtaining data of sufficient quantity and quality to perform an Alternatives Analysis (AA). The current goal of this BCP cleanup is to achieve a Track 1 Unrestricted cleanup; however, this is subject to change based on the results of the RI.

Field team personnel will collect environmental samples in accordance with the rationale and protocols described in the Quality Assurance Project Plan (QAPP) in Section 4. United States Environmental Protection Agency (USEPA) and NYSDEC-approved sample collection and handling techniques will be used as outlined in DER-10 Chapter 2 and included in Field Operating Procedures provided in Appendix D. Soil, groundwater, and soil vapor samples taken for chemical analysis will be analyzed in accordance with USEPA SW-846 methodology with an equivalent Category B deliverable package to meet the definitive-level data requirements. Analytical results will be evaluated by a third-party data validation expert in accordance with provisions described in the QAPP. Data submittals will be provided to the NYSDEC in accordance with the most current electronic data deliverables (EDD) protocols.

In addition to collection of environmental samples, a geophysical survey will be completed to determine whether additional product piping and/or additional orphan USTs remain on-site.

During intrusive RI activities, the Community Air Monitoring Plan (CAMP) will be implemented. The CAMP is consistent with the requirements for community air monitoring at remediation sites as established by the NYSDOH and NYSDEC. Accordingly, it follows procedures and practices outlined under NYSDEC's DER-10 (May 2010) Appendix 1A (NYSDOH's Generic Community Air Monitoring Plan) and Appendix 1B (Fugitive Dust and Particulate Monitoring).

The investigation approach is described below. The proposed RI sample locations are presented in Figure 6 and the planned sampling and analytical program is identified on Table 3. Soil data will be compared to applicable 6 NYCRR Part 375 SCOs and groundwater data will be compared to GWQS/GV.

3.1 Preparation Activities

3.1.1 Utility Clearance

Prior to any intrusive activities, Dig Safely New York (Call 811) will be contacted by the site contractor a minimum of three business days in advance of the work and informed of the intent to perform intrusive work at the Site. If underground utilities are present on the property and are anticipated to interfere with intrusive activities, the Applicant and the NYSDEC will be contacted to discuss mitigating measures.

3.1.2 GPR Assessment

A geophysical assessment will be completed on-site using non-intrusive ground penetrating radar (GPR) equipment to locate buried utilities and to assess whether additional product piping and/or USTs remain on-site; the work will be completed across the Site in accessible exterior areas. A color figure showing differences in conductivity values thereby representing subsurface structures (anomalies) will be generated upon completion of the survey. A copy of the report will be provided to the Department. Roux notes that based on

the GPR findings, investigation locations, further discussed below, may need to be modified or additional investigation locations added, in consultation with the Department.

3.2 RI Soil/Fill Investigation

A soil/fill investigation will be completed at the Site to assess the extent of known contamination and to determine whether additional areas of environmental impact are present. The soil/fill investigation will include the collection of surface soil samples and completion of test pits and soil borings to allow for characterization of subsurface soil, identification of GCM, and sample collection. The proposed RI soil sample locations are presented in Figure 6, and the sampling and analytical program is presented on Table 3.

3.2.1 Surface Soil/Fill Investigation

Six (6) surface soil samples (SS-1 through SS-6) will be collected from the upper 0 to 2 inches of vegetative cover. Approximate locations are shown on Figure 6 and samples will be analyzed in accordance with the sampling plan on Table 3.

Surface soil/fill samples will be collected using stainless steel tools and decontaminated between sampling locations using potable tap water and a phosphate-free detergent (e.g., Alconox). The soil will be examined by qualified Roux personnel for characterization by visual observation in accordance with ASTM Method D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Field personnel will create a field log and collect photograph documentation from the investigation locations. Soil will be inspected for impacts via visual and olfactory observations, inspected for the presence of GCM, and field screened for total volatile organics using a PID equipped with a 10.6 eV lamp as a procedure for ensuring the health and safety of personnel and to identify potentially impacted soil/fill samples for laboratory analysis.

As summarized on Table 3, each surface soil sample will be analyzed for target compound list (TCL) volatile organic compounds plus tentatively identified compounds (TICs), TCL semi-volatile organic compounds (SVOCs, including 1,4-dioxane) plus TICs, and Target Analyte List (TAL) metals (including total cyanide), polychlorinated biphenyls (PCBs), pesticides, and PFAS. Samples collected for PFAS analysis will be analyzed via USEPA Method 1633A.

Should sustained PID readings above 10 parts per million (ppm) be noted during field screening of surface soil samples, laboratory analysis will be expanded to include TCL VOC analysis.

En-core samplers will be used to collect VOC soil samples. The remaining samples will be placed into pre-cleaned laboratory-provided sample bottles. All samples will be placed on ice and cooled to 4°C (±2°C) in the field and transported under chain-of-custody command to a New York State Department of Health (NYSDOH) ELAP-certified analytical laboratory.

Sampling techniques are detailed in Appendix D – Field Operating Procedures (FOPs).

3.2.2 Subsurface Soil/Fill Investigation

Fifteen (15) additional subsurface soil/fill investigation locations will be advanced across the Site during the RI for further characterization purposes, consisting of seven (7) soil borings (MW-1 through MW-7) and eight (8) test pits (TP-21 through TP-28).

Test pits will be completed using an excavator capable of retrieving soil samples from the ground surface to a depth of approximately 15 feet, or until equipment refusal, whichever is shallower. Soil borings will be advanced with a rotary or direct-push drill rig. Each boring will be advanced at least 5 feet into the upper most water bearing zone, or until equipment refusal, whichever is shallower. All non-dedicated tools and equipment will be decontaminated between investigation locations using potable tap water and a phosphate-free detergent (e.g., Alconox).

The soil/fill retrieved from the test pit and soil boring locations will be examined by qualified Roux personnel for characterization by visual observation in accordance with ASTM Method D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Field personnel will create a field log and collect photograph documentation from the investigation locations. Test pit logs and soil boring logs will be completed for future reporting purposes and are included in Appendix E – Project Documentation Forms. Regarding soil borings which will be converted into groundwater monitoring wells, an additional Monitoring Well Completion Detail will be completed to provide final construction details of each well. Well Completion Details are provided in Appendix E – Project Documentation Forms. Soil will be inspected for impacts via visual and olfactory observations, inspected for the presence of GCM, and field screened for total volatile organics using a PID equipped with a 10.6 eV lamp as a procedure for ensuring the health and safety of personnel and to identify potentially impacted soil/fill samples for laboratory analysis.

Test pit and boring spoils will be placed on the ground next to each investigation location. Soil/fill removed from the test pit and soil boring investigation locations shall be returned back to their location in the general order that it was excavated/removed. If GCM is identified, test pit spoils will be placed on and covered with polyethylene sheeting to prevent cross-contamination with surface soil.

During test pit activities, open excavations will be monitored by on-Site Roux personnel to restrict Site occupants (landscaping company employees) or members of the general public from approaching the areas. If needed (i.e., a test pits must remain open), high visibility barriers such as caution tape, cones, or barrels will be placed around any open excavation area until the excavation is backfilled, as summarized above. Excavations will not remain open overnight.

3.2.2.1 Subsurface Soil/Fill Sample Collection and Analysis

Soil samples will be collected at varying depths throughout the Site to assess fill and native soil conditions, further delineate the extent of contamination, and determine if other impacts requiring remediation are present at the Site. Soil samples will be biased to the suspected location of greatest contamination. Sample locations will be based on professional judgement, visual/olfactory observations, and PID readings. Additional sample intervals may be identified in the field due to elevated PID scan results and/or evidence of visual or olfactory impacts.

Table 3 summarizes the proposed sample collection and analytical program. The sample interval identified as the most impacted (i.e., greatest PID scan result and/or visual-olfactory evidence of impact) will be selected for laboratory analysis. If either the impacts are ubiquitous from grade to final depth or no impacts are identified, the soil/fill directly above water table will be selected for analysis. If the impacts are ubiquitous from grade to final depth, no impacts are identified, and water is not encountered at a particular sample location or within a particular layer, the sample interval will be selected based on the professional discretion of the field personnel and in consultation with the NYSDEC. If differentiable impacts are noted during the investigation, additional sample location(s) will be collected.

As summarized on Table 3, each subsurface soil samples will be analyzed for TCL VOCs plus TICs, TCL SVOCs (including 1,4-dioxane) plus TICs, and TAL metals (including total cyanide). Select sample locations will be analyzed for full suite, including PCBs, pesticides, and PFAS. Samples collected for PFAS analysis will be analyzed via USEPA Method 1633A. Soil boring samples collected from monitoring well locations will be collected from within the screened interval of the monitoring well and analyzed for full suite analysis, as shown on Table 3.

En-core samplers will be used to collect VOC soil samples. The remaining samples will be placed into pre-cleaned laboratory-provided sample bottles. All samples will be placed on ice and cooled to 4°C (±2°C) in the field and transported under chain-of-custody command to a New York State Department of Health (NYSDOH) ELAP-certified analytical laboratory.

Sampling techniques are detailed in Appendix D – Field Operating Procedures (FOPs).

3.3 Groundwater Investigation

Seven (7) groundwater monitoring wells, identified as MW-1 through MW-7, will be advanced to allow for assessment of groundwater quality and flow. Proposed groundwater monitoring well locations are shown on Figure 6. Monitoring well installation and groundwater sample collection details are discussed in the following sections.

3.3.1 Monitoring Well Installation

Each monitoring well boring will be advanced to a target minimum depth of five feet below the first encountered water (estimated depths ranging from 15 to 20 fbgs based on groundwater levels noted during previous investigation activities). Final depth and placement of wells may be modified based on the site soil type identified and hydrogeology, and consideration of potential contaminants (e.g., confining clay layer, if encountered) with approval of the NYSDEC Project Manager. All non-dedicated drilling tools and equipment will be decontaminated between boring locations using potable tap water and a phosphate-free detergent (e.g., Alconox).

Each well will be constructed with two (2)-inch diameter Schedule (SCH) 40 PVC with a minimum five (5)-foot flush joint SCH 40 PVC 0.010-inch machine-slotted well screen. Each well screen and attached riser will be placed at the bottom of the borehole and a silica sand filter pack (size #0) will be installed from the base of the well to a minimum of two (2)-feet above the top of the screen. A seal (e.g., bentonite chip) will then be installed to mitigate the potential for downhole contamination. The newly installed monitoring wells will be completed with keyed-alike locks, a lockable J-plug, and protective casing/road box.

3.3.2 Well Development

After installation, but not within 24 hours, newly installed monitoring wells will be developed in accordance with Roux's FOP for Monitoring Well Development (see Appendix D) and NYSDEC protocols. Monitoring wells will be developed via surge and purge methodology (alternating between agitation of the water column and water removal) using dedicated, disposable high-density polyethylene (HDPE) or polyvinyl chloride (PVC) bailers. Non-dedicated equipment will be decontaminated prior to and after use, in accordance with Roux's FOP for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Field parameters including pH, temperature, specific conductance, turbidity, DO, and ORP will be measured periodically (i.e., every well volume or as necessary) during development. Development will continue until

field parameters become stable, turbidity measurements fall below 50 Nephelometric Turbidity Units (NTU) or become stable above 50 NTU regardless of volume purged, and a minimum of ten well volumes have been evacuated from the well. Stability will be defined as summarized below:

- Dissolved Oxygen: ±10%
- Turbidity: ±10%
- Specific Conductance: ±3%
- ORP: ±10 mV
- pH: ±0.1 units

If LNAPL/DNAPL is encountered within a particular well, development waters from that location will be containerized and characterized. Drums will be labeled with regard to contents, origin, and date of generation using a paint stick marker on two sides and the top of each drum. The drums will be staged on-Site pending characterization analyses and remedial measures assessment.

3.3.3 Groundwater Sample Collection

Groundwater sampling will be completed at least one week following well development to allow natural groundwater conditions to become reestablished. During the duration of the RI, two (2) groundwater sampling events will be completed in accordance with DER-10 3.7.2(c)8 the ensure proper characterization of groundwater. The second sampling event should occur approximately 3-6 months after the first sampling event. Prior to sample collection, static water levels will be measured and recorded from the on-Site monitoring wells in accordance with Roux's FOP for Groundwater Level Measurement to facilitate the preparation of a Site-wide isopotential map. Following water level measurement, field personnel will purge and sample monitoring wells in accordance with Roux's FOPs for Groundwater Purging and Sample Collection and NYSDEC protocols using a submersible pump with dedicated pump tubing following low-flow/minimal drawdown purge and sample collection procedures. In the event of pump failure or if the saturated unit does not permit the proper implementation of low-flow sampling, a dedicated HDPE or PVC bailer will be used to purge and sample the well(s). When utilizing low-flow methodology, groundwater will be evacuated from each well at a low-flow rate (typically less than 0.1 liters per minute) while maintaining a generally consistent water level. Non-dedicated equipment will be decontaminated prior to and after use, in accordance with Roux's FOP for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Field measurements for pH, temperature, specific conductance, turbidity, DO, ORP, and water level, as well as visual and olfactory field observations, will be periodically recorded and monitored for stabilization. Purging will be considered complete when field parameters stabilize (as discussed in Section 3.4.2) and when turbidity measurements fall below 50 NTU or become stable above 50 NTU regardless of volume purged or to dryness. Once purging is complete, groundwater samples will be collected and analyzed as discussed below.

If LNAPL/DNAPL is encountered within a particular well, purge waters from that location will be containerized and characterized. Drums will be labeled with regard to contents, origin, and date of generation using a paint stick marker on two sides and the top of each drum. The drums will be staged on-Site pending characterization analyses and remedial measures assessment.

If less than 0.1 feet of LNAPL is detected during well development surge and purge activities, Roux will remove this thin layer using a disposable bailer or absorbent sock; purge three (3) well volumes using a

disposable bailer; and, if LNAPL has been removed, collect a groundwater sample using a disposable bailer as describe below.

If DNAPL is detected during well development surge and purge activities, Roux will purge three (3) well volumes using a disposable bailer; allow the DNAPL to settle; and collect a groundwater sample using a disposable bailer as described below from the upper portion of the water column to prevent the presence of DNAPL.

If NAPL is present in the monitoring well and cannot be removed or avoided, a groundwater sample will not be collected as the sample containing free product will yield unrepresentative, highly biased dissolved-phase analytical results for the on-Site groundwater. The groundwater will be assumed to be impacted during the RI and will be re-investigated upon removal of GCM during remedial actions and/or interim remedial measures (IRMs).

Groundwater samples will be completed as soon as practical after purging at any time after the well has recovered sufficiently to sample, or within 24 hours after evacuation, if the well recharges slowly. Groundwater sampling methods will conform with the protocol acceptable for the collection of PFAS in accordance with the NYSDEC'S April 2023 Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) and Roux's FOP for Groundwater Sampling (see Appendix D). Clean nitrile gloves be worn while handling sample containers, during the groundwater sampling, and sealing/placement of samples into the laboratory supplied cooler. Non-dedicated equipment will be decontaminated prior to and after use, in accordance with Roux's FOP for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Sample collection methods that will be implemented during the RI include:

- **Submersible Pump with Dedicated Pump Tubing**

  Monitoring wells will be purged and sampled using a non-dedicated plastic submersible pump and dedicated HDPE or PVC tubing following low-flow (minimal drawdown) purge and sample collection procedures, as described above. Non-dedicated pumps will require decontamination prior to use at each well location and the collection of an equipment blank.

- **Disposable Bailer**

  If low flow is not feasible (e.g., due to depth to groundwater), wells of any depth (up to 100 fbgs) may be purged and sampled using a disposable HDPE or PVC bailer via direct grab. In general, a bottom filling dedicated HDPE or PVC bailer is attached to a length of dedicated rope and lowered into the well smoothly and slowly as not to agitate the groundwater or damage the well.

Prior to, and immediately following collection of groundwater samples, field measurements for pH, temperature, specific conductance, turbidity, DO, ORP, and water level, as well as visual and olfactory field observations, will be recorded. All collected groundwater samples will be placed in pre-cleaned, pre-preserved, pre-labeled laboratory provided sample bottles, cooled to 4°C (±2°C) in the field, and transported under chain-of-custody command to a NYSDOH-approved laboratory for analysis.

3.3.4 Groundwater Sample Analysis

Table 3 summarizes the proposed groundwater sampling program. Groundwater samples will be analyzed for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (including total cyanide), PCBs, pesticides, PFAS, and 1,4-dioxane. Groundwater samples will be collected and analyzed in accordance with USEPA SW

846 methodology with equivalent NYSDEC Category B deliverables to allow for independent third-party data usability assessment. Samples for dissolved metals analysis will be filtered at the laboratory. Samples collected for 1,4-dioxane will be analyzed via USEPA Method 8270 Selective Ion Monitoring (SIM) mode and samples collected for PFAS analysis will be analyzed via USEPA Method 1633A.

3.4 Subslab Soil Vapor Investigation

A soil vapor intrusion (SVI) assessment will be completed to evaluate the potential for vapor intrusion into the two existing buildings. The SVI will include the collection of two (2) paired subslab and indoor air samples from the lowest accessible area of the main building (SSV-1/IA-1 and SSV-2/IA-2) and one additional paired subslab and indoor air sample (SSV-3/IA-3) from the lowest accessible level of the scale house. One (1) outdoor ambient location, identified as OA-1, will be collected during the work. Approximate sample locations are shown on Figure 6. Sub-slab vapor sampling will be completed in conformance with the NYSDOH Soil Vapor Intrusion Guidance (October 2006 and subsequent revisions) and Roux's Ambient Air and Sub-slab Vapor Sampling FOP (see Appendix D). Indoor air samples will be collected at a typical breathing height. SSV, IA, and OA samples will be collected and sent to a NYSDOH-approved laboratory for analysis of USEPA TCL VOCs plus TICs in accordance with USEPA Method TO-15/TO-15 SIM.

3.4.1 SVI Pre-Sample Assessment

Prior to initiation of SSV sampling, a pre-sampling inspection will be performed prior to each sampling event to identify and minimize conditions that may interfere with the proposed testing. The inspection will evaluate the type of structure, floor layout, airflows, and physical conditions of the building. This information, along with information on sources of potential indoor air contamination, will be identified on a building inventory form (see Appendix E – Project Documentation Forms).

3.4.2 SVI Sample Collection

At each SSV sampling location, Roux personnel will drill a hole through the concrete slab using a hand-held hammer drill. Temporary sub-slab vapor probes and tubing will be utilized for the sample collection. Holes in the concrete slab will be filled and sealed after completion of the sampling event. Sub-slab vapor samples will be collected in the following general manner:

- After installation of the probes, complete a tracer gas test to verify the integrity of the soil vapor probe seal;
- Upon completion of a successful tracer gas test, three volumes (i.e., the volume of the sample probe and tube) will be purged prior to collecting the samples to ensure samples collected are representative;
- The sub-slab vapor probes will be sealed to the surface with permagum grout, melted beeswax, putty, or other non-VOC containing and non-shrinking products for temporary installation;
- Flow rates for both purging and collecting will not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling;
- Sub-slab vapor sample canisters will be equipped with an 8-hour regulator to allow the sample to be collected over an approximate 8-hour period; and,

- Samples will be collected in a laboratory provided container which meets the requirements of the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzed by EPA Method TO-15) and is certified clean by the laboratory.

Each canister, with an initial pressure of approximately 30 pounds per square inch (psi), will be fitted with a sampling valve that uses a critical orifice and mass flow controller to regulate the air flow into the canister for the selected sampling period. The mass flow controller will maintain a relative constant air flow rate throughout the sampling period. Summa canister valves will remain closed until the sample holes are complete and all of the canisters are in their respective positions. The valves will then be opened for the designated collection period.

3.4.3 SVI Sample Analysis

Samples will be collected in laboratory supplied Summa® canisters and once filled will be transported under chain-of-custody command to a NYSDOH-approved laboratory for analysis of USEPA TCL VOCs plus TICs in accordance with USEPA Method TO-15/TO-15 SIM. Samples will be analyzed in accordance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006, and subsequent revisions). Typically, a minimum reporting limit of 1 microgram per cubic meter (1 ug/m^3) or less is sufficient for most analytes. Field documentation of soil vapor investigation sampling activities will be recorded. Preliminary results will be provided to the Department for review.

3.5 Soil Vapor Sampling

In addition to the SVI sampling discussed above, exterior soil vapor (SV) sampling will also be completed to evaluate the potential for soil vapor intrusion into areas where future buildings may be constructed and to complete a qualitative exposure assessment for the Site. Sampling equipment will be advanced to a target depth of 5-6 fbgs to approximate foundation depth of future buildings (depending on depth to groundwater observed during soil boring and test pit investigations). Soil vapor sample locations, identified as SV-1 through SV-4, are shown on Figure 6. One (1) ambient outdoor air sample will also be collected concurrent with the soil vapor samples (see Section 3.4, above). Soil vapor sampling probes will be installed in conformance with the NYSDOH Soil Vapor Intrusion Guidance.

Each soil vapor sampling probe will be installed using specialized stainless steel soil probes. Sampling equipment includes stainless steel sampling screens, ¼-inch inside diameter inert sample tubing and dedicated Summa canisters. Soil boreholes will be advanced to a depth up to 5-6 fbgs. The steel rod will be equipped with an anchor point at the driving end of the rod. The anchor point will be connected to the sampling screen and tubing on the inside of the steel rod. Once the steel rod is advanced to the target depth, the steel rod will be retracted, leaving the anchor point, sampling screen, and sampling tubing within the borehole annulus. Glass beads (or equivalent) will be poured around the sampling screen in a manner to cover the entire length of the sampling screen. Bentonite or bentonite/soil mixture will be placed above the glass beads to the ground surface to create a seal to prohibit infiltration of ambient air into the sampling area.

Once the sample probes are installed, the probe and tubing will be purged (three volumes) using a syringe and helium tracer gas will be used during the purging phase (in the same manner as recommended for soil vapor intrusion probes) to ensure that the probes are well sealed. Samples will be collected over an approximate 8-hour period. All soil vapor samples will be collected and analyzed for VOCs plus TICs by EPA Method TO-15.

Each canister will be fitted with a sampling valve that uses a critical orifice and mass flow controller to regulate the air flow into the canister for the selected sampling period. The mass flow controller will maintain a relative constant air flow rate throughout the sampling period. Summa canister valves will remain closed until the sample holes are complete and all of the canisters are in their respective positions. The valves will then be opened for the designated collection period.

3.6 Waste Characterization Sampling

Five (5) waste characterization samples will be collected at the time of the investigation and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, TCLP SVOCs, TCLP metals, PCBs, ignitability, corrosivity, and reactivity to assess landfill disposal requirements and options.

3.7 Field Specific Quality Assurance/Quality Control Sampling

In addition to the soil/fill, groundwater, and soil vapor samples described above, field-specific quality assurance/quality control (QA/QC) samples will be collected and analyzed to ensure the reliability of the generated data as described in the QAPP (see Section 4) and to support the required third-party data usability assessment effort. Site-specific QA/QC samples will include matrix spikes, matrix spike duplicates, blind duplicates, equipment blanks, field blanks, and trip blanks.

3.8 Decontamination and Investigation-Derived Waste Management

Every attempt will be made to utilize dedicated sampling equipment during the RI; however, if non-dedicated equipment is required and/or used, the equipment will be decontaminated, at a minimum, with a non-phosphate detergent (i.e., Alconox®) and potable water mixture, rinsed with distilled water, and air-dried before each use in accordance with Roux's FOPs presented in Appendix D. Decontaminated sampling equipment will be kept in a clean environment prior to sample collection. Heavy equipment, such as an excavator (if used) and drilling tools, will be decontaminated by the subcontractor, as necessary.

RI generated drilling spoils, groundwater, decontamination rinse water, or other Investigative-Derived Waste (IDW) not exhibiting gross contamination (i.e., visible product, odor, sheen, etc.) will be either returned to the investigation location from which it was removed (soil/fill) or in the case of groundwater and rinse water, containerized in sealed New York State Department of Transportation (NYSDOT) approved drums until associated analytical results are received to determine if the IDW is appropriate for discharge to the ground surface if it can infiltrate the ground in the vicinity from which it was generated, or will require additional sampling and/or offsite disposal.

IDW materials exhibiting gross contamination will be segregated and/or containerized for subsequent characterization and disposal. All generated IDW drums will be labeled alpha-numerically with regard to contents, origin, and date of generation using a paint stick marker on two sides and the top of each drum. Characterization analytical results of containerized IDW material will be used to determine if spoils can be returned to the ground surface, utilized on-Site, or require treatment and/or off-Site disposal. Drums will be securely staged on-site pending characterization analyses and remedial measures assessment. Field personnel will coordinate the on-site handling and temporary storage of IDW drums, including transportation, characterization sampling, and offsite disposal arrangements, as necessary.

Discarded personal protective equipment (PPE) (i.e., latex gloves, Tyvek, paper towels, etc.) and disposable sampling equipment (i.e., bailers or stainless steel spoons) will be placed in sealed plastic garbage bags and disposed of as municipal solid waste.

3.9 Site Mapping & Survey

A Site map will be developed during the field investigation. Sample points and relevant Site features will be located on the map. Roux will employ a handheld global positioning system (GPS) unit to identify all sample locations including test pits, surface soil samples, near surface soil samples, monitoring wells, and soil vapor samples relative to State planar grid coordinates. Monitoring well elevations will be surveyed by Roux. An isopotential map showing the general direction of groundwater flow will be prepared based on water level measurements relative to an arbitrary vertical datum. Site maps will be provided with the RI report.

3.10 Documentation

3.10.1 Daily Field Logs

RI field activities will be documented on field activity daily logs (FADLs). FADLs will provide a record of activities conducted at the Site. Entries will be signed and dated at the end of each day of fieldwork (or as produced) by the Field Team Leader. Field notes will include, at a minimum, the: date and time of all entries, names of personnel on site, weather conditions (temperature, precipitation, etc.), location of activity, description of activity, and CAMP data including exceedances of CAMP action levels and subsequent corrective actions(s), if applicable (note that NYSDEC and NYSDOH will be notified within 24-hours of any CAMP action level exceedances observed during RI activities). Daily field logs will be provided to the NYSDEC Project Manager by the end of the following day throughout the duration of the RI. Sampling activities will be logged and photographed as necessary to document the activities at the Site. Progress photographs will be collected to document investigation activities. Field personnel will, at a minimum, complete the following standard field forms (see Appendix E):

- Tailgate Safety Meeting Form
- Chain of Custody Form (per selected laboratory)
- Equipment Calibration Log
- Field Activity Daily Log (FADL)
- Test Pit Excavation Log
- Field Borehole/Monitoring Well Log
- Groundwater Field Form
- Air Canister Field Records
- Indoor Air Quality Questionnaire and Building Inventory
- Photographic Log
- Problem Identification Report (if necessary)
- Corrective Measures Report (if necessary)

4. Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPP) has been prepared in support of the RI activities. The QAPP dictates implementation of the investigation tasks delineated in this Work Plan. A Sampling and Analysis Plan (SAP) identifying methods for sample collection, decontamination, handling, and shipping, is provided in Section 4.7.

The QAPP will assure the accuracy and precision of data collection during the Site characterization and data interpretation periods. The QAPP identifies procedures for sample collection to mitigate the potential for cross-contamination, as well as analytical requirements necessary to allow for independent data validation. The QAPP has been prepared in accordance with USEPA's Requirements for Quality Assurance Project Plans for Environmental Data Operations, the EPA Region II CERCLA Quality Assurance Manual, and NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation (May 2010).

4.1 Scope of the QAPP

This QAPP was prepared to provide quality assurance (QA) and quality control (QC) guidelines to be implemented during the RI activities. This document may be modified for subsequent phases of investigative work, as necessary. The QAPP provides:

- A means to communicate exactly what is to be done, by whom, and when it is to be done, with the person(s) executing the various activities.
- A culmination of the planning process that ensures that the program includes provisions for obtaining quality data (e.g., suitable methods of field operations).
- A historical record that documents the investigation in terms of the methods used, calibration standards used, frequencies, and auditing.
- A document that can be used by the Project Manager (PM) and QA Officer to assess if the planned activities are being implemented and to assess the importance of each activity for accomplishing the goal of quality data.
- A plan to document and track project data and results.
- Detailed descriptions of the data documentation materials and procedures, project files, and tabular and graphical reports.

The QAPP is primarily concerned with the QA and QC aspects of the procedures involved in the collection, preservation, packaging, and transportation of samples; field testing; record keeping; data management; chain-of-custody procedures; laboratory analyses; and other necessary matters to ensure that the investigation activities, once completed, will yield data whose integrity can be defended.

QA refers to the conduct of all planned and systematic actions necessary to perform satisfactorily all task-specific activities and to provide information and data confidence as a result of such activities. The QA for task-specific activities includes the development of procedures, auditing, monitoring, and surveillance of the performance.

QC refers to the activity performed to determine if the work activities conform to the requirements. This includes activities such as inspections of the work activities in the field (e.g., verification that the items and

materials installed conform to applicable codes and design specifications). QA is an overview monitoring of the performance of QC activities through audits rather than first time inspections.

4.2 QAPP Organization and Responsibility

The principal organizations involved in verifying achievement of data collection goals for the Site include: 3701 River Road, LLC (Participant), Roux (Participants' Consultant), the drilling subcontractor(s), GPR survey contractor(s), the independent environmental laboratory, and the independent third-party data validator. Roles, responsibilities, and required qualifications of these organizations are discussed in the following subsections. Résumés are included in Appendix A.

4.2.1 Participant

3701 River Road, LLC will be responsible for complying with the QA requirements as specified herein and for monitoring and controlling the quality of the Brownfield cleanup construction either directly or through their designated environmental consultant and/or legal counsel. The designated project manager is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements.

4.2.2 Environmental Consultant

Roux is the engineering and scientific consultant on this project and is responsible for the implementation of the RIWP, including, but not limited to, field operations, laboratory testing, data management, data analysis, and reporting. Any member of Roux's staff may fill more than one of the identified project positions (e.g., site supervisor and site safety and health officer). The various quality assurances, field, laboratory, and management responsibilities of key project personnel are defined below.

- *Project Principal (PP)*: *Michael Lesakowski*

  The PP has the responsibility for ensuring conformance with the BCP program requirements. The PP will report directly to the Applicants and the NYSDEC/NYSDOH Project Managers and is responsible for project oversight. The PP will:

  - Define project objectives and develop a detailed work plan schedule.
  - Acquire and apply technical and corporate resources as needed to assure performance within budget and schedule constraints.
  - Review the work performed on the project to assure its quality, responsiveness, and timeliness.
  - Certify deliverables before their submission to NYSDEC.

- *Project Manager (PM)*: *Bryan Mayback*

  The PM has the responsibility for ensuring that the project meets the Work Plan objectives. The PM will report directly to the Applicants' Project Coordinator and the NYSDEC/NYSDOH Project Managers and is responsible for technical and project oversight. The PM will:

  - Define project objectives and develop a detailed work plan schedule.
  - Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.

- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Review the work performed on each task to assure its quality, responsiveness, and timeliness.
- Review and analyze overall task performance with respect to planned requirements and authorizations.
- Review all deliverables before their submission to NYSDEC.
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Ultimately be responsible for the preparation and quality of interim and final reports.
- Represent the project team at meetings.

- *Site Supervisor / Site Health and Safety Officer:* *TBD*

  The Site Supervisor (SS) has the responsibility for implementation of specific project tasks identified at the Site and is responsible for the supervision of project field personnel, subconsultants, and subcontractors. The SS reports directly to the PM. The SS will:

  - Define daily work activities.
  - Orient field staff concerning the project's special considerations.
  - Monitor and direct subcontractor personnel.
  - Review the work performed on each task to ensure its quality, responsiveness, and timeliness.
  - Assure that field activities, including sample collection and handling, are carried out in accordance with this QAPP.

  The Site Safety and Health Officer (SSHO) is responsible for implementing the procedures and required components of the Site Health and Safety Plan (HASP), determining levels of protection needed during field tasks, controlling site entry/exit, briefing the field team and subcontractors on site-specific health and safety issues, and all other responsibilities as identified in the HASP.

4.3 Quality Assurance (QA) Responsibilities

The QA Officer will have direct access to corporate executive staff as necessary, to resolve any QA dispute, and is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations and Roux policies, and NYSDEC requirements. The QA Officer has sufficient authority to stop work on the investigation as deemed necessary in the event of serious QA issues.

- *Project QA Officer:* *Lori Riker*

  Specific function and duties include:

  - Performing QA audits on various phases of the field operations.
  - Reviewing and approving QA plans and procedures.
  - Providing QA technical assistance to project staff.
  - Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the PM for technical operations.

- Responsible for assuring third party data review of all sample results from the analytical laboratory.

4.4 Field Responsibilities

Roux field staff for this project are drawn from a pool of qualified personnel. The PM will use staff to gather and analyze data and to prepare various task reports and support materials. The designated technical team members will be experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

4.5 Quality Assurance Objectives for Measurement Data

The overall objectives and criteria for assuring quality for this effort are discussed below. This QAPP addresses how the acquisition and handling of samples and the review and reporting of data will be documented. The objectives of this QAPP are to address the following:

- The procedures to be used to collect, preserve, package, and transport samples.
- Field data collection.
- Record keeping.
- Data management.
- Chain-of-custody procedures.
- Assess the precision, accuracy, completeness, representativeness, decision rules, comparability, and level of QC effort conformance for sample analysis and data management by the laboratory under EPA analytical methods.

4.6 Level of QC Effort for Sample Parameters

Field blank, equipment blank, trip blank, field duplicate, laboratory duplicate, laboratory control, standard reference materials (SRM), and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. QC samples are discussed below.

- Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field-sampling program. Field (equipment) blank samples are analyzed to check for procedural chemical constituents at the facility that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage.
- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures.
- Duplicate samples are analyzed to check for sampling and analytical reproducibility.
- Matrix spike (MS) and matrix spike duplicate (MSD) samples provide information about the effect of the sample matrix on the digestion and measurement methodology. Depending on site-specific circumstances, one MS and one MSD should be collected for every 20 or fewer investigative samples to be analyzed for organic and inorganic chemicals of a given matrix.

The general level of QC effort will be one field (blind) duplicate, one MS, and one MSD for every 20 or fewer investigative samples of a given matrix. An equipment blank will be collected for the full suite of contaminants analyzed when non dedicated equipment is used for every 20 or fewer aqueous samples. One field blank sample will be collected consisting of distilled, deionized water for every 20 or fewer aqueous PFAS samples. One trip blank consisting of distilled, deionized water will be included along with each sample delivery group of aqueous VOC samples.

4.7 Sampling and Analysis Plan

Methods and protocol to be used to collect environmental samples (i.e., soil and groundwater) for this investigation are described in the Roux FOPs. Applicable FOPs are summarized on Table 4 and presented electronically in Appendix D.

The number and types of environmental samples to be collected are summarized in Table 3. Sample parameter lists, holding times and sample container requirements are summarized in Table 5. The sampling program and related site activities are discussed below. To the extent allowed by existing physical conditions at the facility, sample collection efforts will adhere to the specific methods presented herein. If alternative sampling locations or procedures are implemented in response to facility specific constraints, each will be selected on the basis of meeting data objectives. Such alternatives will be approved by NYSDEC before implementation and subsequently documented for inclusion in the project file.

4.7.1 Custody Procedures

Sample custody is controlled and maintained through the chain-of-custody (COC) procedures. Chain of custody is the means by which the possession and handling of samples will be tracked from the source (field) to their final disposition (laboratory). A sample is considered to be in a person's custody if it is in the person's possession or it is in the person's view after being in his or her possession or it was in that person's possession and that person has locked it in a vehicle or room. Sample containers will be cleaned and preserved at the laboratory before shipment to the Site. The following sections and the FOP for Sampling, Labeling, Storage, and Shipment (see Appendix D), describe procedures for maintaining sample custody from the time samples are collected to the time they are received by the analytical laboratory.

4.7.2 Sample Storage

Samples are stored in secure limited-access areas. Walk-in coolers or refrigerators are maintained at 4°C, ± 2°C, or as required by the applicable regulatory program. The temperatures of all refrigerated storage areas are monitored and recorded a minimum of once per day. Deviations of temperature from the applicable range require corrective action, including moving samples to another storage location if necessary.

4.7.3 Sample Custody

Sample custody is defined by this document as when any of the following occur:

- It is in someone's actual possession.
- It is in someone's view after being in his or her physical possession.
- It was in someone's possession and then locked, sealed, or secured in a manner that prevents unsuspected tampering.

- It is placed in a designated and secured area.

Samples are removed from storage areas by the sample custodian or analysts and transported to secure laboratory areas for analysis. Access to the laboratory and sample storage areas is restricted to laboratory personnel and escorted visitors only; all areas of the laboratory are therefore considered secure. If required by the applicable regulatory program, internal chain-of-custody is documented in a log by the person moving the samples between laboratory and storage areas.

Laboratory documentation used to establish COC and sample identification may include the following:

- Field COC forms or other paperwork that arrives with the sample.
- The laboratory COC.
- Sample labels or tags are attached to each sample container.
- Sample custody seals.
- Sample preparation logs (i.e., extraction and digestion information) recorded in hardbound laboratory books that are filled out in legible handwriting, signed, and dated by the chemist.
- Sample analysis logs (e.g., metals, GC/MS, etc.) information recorded in hardbound laboratory books that are filled out in legible handwriting, signed, and dated by the chemist.
- Sample storage log (same as the laboratory COC).
- Sample disposition log, which documents sample disposal by a contracted waste disposal company.

4.7.4 Sample Tracking

All samples are maintained in the appropriate coolers prior to and after analysis. The analysts remove and return their samples as needed. Samples that require internal COC are relinquished to the analysts by the sample custodians. The analyst and sample custodian must sign the original COC relinquishing custody of the samples from the sample custodian to the analyst. When the samples are returned, the analyst will sign the original COC returning sample custody to the sample custodian. Sample extracts are relinquished to the instrumentation analysts by the preparatory analysts. Each preparation department tracks internal COC through their logbooks/spreadsheets.

Any change in the sample during the time of custody will be noted on the COC (e.g., sample breakage or depletion).

4.7.5 Split Sampling

The NYSDEC may split any soil or groundwater samples at the NYSDEC's expense, during this RI. Roux personnel will cooperate with the NYSDEC to facilitate split sampling, as requested.

4.8 Calibration Procedures and Frequency

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

4.8.1 Field Instrument Calibration

Quantitative field data to be obtained during groundwater sampling include pH, temperature, specific conductance, turbidity, DO, ORP, and depth to groundwater. Quantitative water level measurements will be obtained with an electronic sounder or steel tape, which require no calibration. Quantitative field data to be obtained during soil sampling include screening for the presence of volatile organic constituents using a PID.

FOPs located in Appendix D describe the field instruments used to monitor for these parameters and the calibration methods, standards, and frequency requirements for each instrument. Calibration results will be recorded on the appropriate field forms and in the FADLs.

4.9 Analytical Procedures

Samples collected during this investigation field sampling activities will be analyzed by a NYSDOH-approved laboratory.

4.9.1 Field Analytical Procedures

Field procedures for collecting and preserving groundwater and soil samples are described in FOPs located in Appendix D. A summary of the FOPs is presented in Table 4.

4.10 Data Usability Evaluation

Data usability evaluation procedures shall be performed for both field and laboratory operations as described below.

4.10.1 Procedures Used to Evaluate Field Data Usability

Procedures to validate field data for this project will be facilitated by adherence to the FOPs identified in Appendix D. The performance of all field activities, calibration checks on all field instruments at the beginning of each day of use, manual checks of field calculations, checking for transcription errors and review of field log books is the responsibility of the Site Supervisor.

4.10.2 Procedures Used to Evaluate Laboratory Data Usability

Data evaluation will be performed by the third-party data validator using the most current methods and quality control criteria from the USEPA's Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review, and Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review. The data review guidance will be used only to the extent that it is applicable to the SW-846 methods; SW-846 methodologies will be followed primarily and given preference over CLP when differences occur. Also, results of blanks, surrogate spikes, MS/MSDs, and laboratory control samples will be reviewed/evaluated by the data validator. All sample analytical data for each sample matrix shall be evaluated. The third-party data validation expert will also evaluate the overall completeness of the data package. Completeness checks will be administered on all data to determine whether deliverables specified in this QAPP are present. The reviewer will determine whether all required items are present and request copies of missing deliverables.

5. Investigation Support Documents

5.1 Health and Safety Protocols

Roux has prepared a Site-Specific Health and Safety Plan (HASP) for use by our employees in accordance with 40 CFR 300.150 of the NCP and 29 CFR 1910.120. The HASP, provided in Appendix F, includes the following site-specific information:

- Emergency contact information for on- and off-site personnel.
- Health and safety roles & responsibilities.
- A hazard assessment.
- Training requirements.
- A site control program including definitions of exclusion, contaminant reduction, and other work zones.
- Monitoring procedures for site operations.
- Safety procedures.
- Personal protective clothing and equipment requirements for various field operations.
- Disposal and decontamination procedures.
- Assessment of environmental conditions and stressors.
- Tailgate health and safety meeting requirements.
- Emergency response plan.

Health and safety activities will be monitored throughout the field investigation. A member of the field team will be designated to serve as the on-site Health and Safety Officer throughout the field program. This person will report directly to the PM and the Office Health and Safety Manager (OHSM) and Office Operations Manager (OM). The HASP will be subject to revision as necessary, based on new information that is discovered during the RI activities.

5.2 Community Air Monitoring

Real-time community air monitoring will be performed during the RI activities at the Site. A Community Air Monitoring Plan (CAMP) is included in Appendix G. Particulate and VOC monitoring will be performed along the downwind perimeter of the work area during RI test pit excavations, RI soil boring advancement, and soil/fill handling activities in accordance with this plan. The CAMP is consistent with the requirements for community air monitoring at remediation sites as established by the NYSDOH and NYSDEC. Accordingly, it follows procedures and practices outlined under NYSDEC's DER-10 (May 2010) Appendix 1A (NYSDOH's Generic Community Air Monitoring Plan) and Appendix 1B (Fugitive Dust and Particulate Monitoring). Should the Site be occupied during RI activities, the following special requirements for the CAMP will be implemented should work occur within 20-feet of potentially exposed individuals or structures.

NYSDEC and NYSDOH will be notified within 24 hours of any CAMP action level exceedances observed during RI activities. CAMP exceedances and corrective measures will be also reported in daily field logs.

Based on documented GCM present at the Site, odor suppressants should be available on-Site during RI activities and utilized as needed.

5.2.1 Special Requirements for Work Within 20-Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 part-per-million, monitoring should occur within the occupied structure(s). Depending upon the nature of contamination, chemical-specific colorimetric tubes of sufficient sensitivity may be necessary for comparing the exposure point concentrations with appropriate pre-determined response levels (response actions should also be pre-determined). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 micrograms per cubic meter, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 micrograms per cubic meter or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

A copy of the Special Requirements for Work Within 20-Feet of Potentially Exposed Individuals or Structures is proved in Appendix G.

5.3 Citizen Participation Activities

NYSDEC will coordinate and lead community relations throughout the course of the project. Roux will support NYSDEC's community relations activities, as necessary. A Citizen Participation (CP) Plan will be prepared by Roux and submitted to NYSDEC under separate cover. The CP Plan will follow NYSDEC's CP Plan template for BCP sites entering the BCP at the point of site investigation.

6. Reporting and Scheduling

Upon completion of the RI fieldwork, a comprehensive RIR will be completed summarizing the RI tasks completed as described below.

6.1 Remedial Investigation Reporting

The RI section of the RIR report will include the following information and documentation, consistent with the NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and DER-31 Green Remediation.

- Introduction and background;
- A description of the Site and the investigation areas;
- A description of the field procedures and methods used during the RI;
- The collection of geospatial data and presentation of investigation drawings detailing the investigation locations, potential areas of concern, presence of buildings, utility poles, and subgrade utilities.
- A discussion of the nature and rationale for any significant variances from the scope of work described in this Work Plan;
- The data obtained during the RI and previous investigations, considered by Roux to be of usable quality, including geochemical data, field measurements, validated analytical results, etc.;
- A discussion of contaminant fate and transport including a description of Site hydrogeology and an evaluation of the lateral and vertical movement of groundwater;
- Results of a FWRIA to be conducted as a component of the RI (if needed);
- Conclusions regarding the extent and character of environmental impact in the media being investigated;
- The conclusions of the on-site and off-site qualitative human health and environmental exposure assessment completed in accordance with DER-10; and
- Supporting materials for RI data. These will include test pit logs, boring logs, monitoring well construction diagrams, laboratory analytical reports, and similar information.

In addition, Roux will require third-party analytical data review by a qualified, independent data validation expert for the RI and historic investigation data. Specifically, a Data Usability Summary Report (DUSR) will be prepared, with appropriate data qualifiers added to the results. The DUSR will follow NYSDEC format per the NYSDEC's September 1997 DUSR guidelines and May 2010 DER-10 guidance. The DUSR and any necessary qualifications to the data will be appended to the RI report.

6.2 Remedial Work Plan (RWP)

The Remedial Work Plan (RWP) will be developed to include the alternatives analysis (AA) and detail planned remedial activities. The AA is developed to provide a forum for evaluating and selecting a recommended remedial approach, in accordance with DER-10. A list of remedial action objectives will be developed based on findings of the RI and the requirement for the selected remedial measures to be protective of human

health and the environment under the proposed future use scenario. Proposed SCOs for the Site for the contaminants will also be presented based on the proposed future use of the Site. After that, volumes and areas of media requiring remediation will be calculated. General response actions will then be delineated to address each of the Site problem areas. These response actions will form the foundation for the development and screening of applicable remedial alternatives against the following criteria as described in 6NYCRR 375-1.8(f) and DER-10-4.2:

- Overall Protection of Human Health and the Environment
- Compliance with Standards, Criteria, & Guidance (SCGs)
- Long-term Effectiveness & Permanence
- Reduction of Toxicity, Mobility, or Volume
- Short-term Effectiveness
- Implementability
- Cost Effectiveness
- Land Use

In addition, the criteria of community acceptance will be considered based on public comments on the RWP and proposed remedial action. Following the screening of alternatives, a comparative analysis will be performed against the above criteria. The comparative analysis will allow for better understanding of the relative advantages and disadvantages of each of the alternatives and will facilitate identification of a recommended remedial approach. Procedures for completing the recommended remedial approach will be included in the RWP.

7. Project Schedule

A tentative project schedule for the major tasks to be performed in support of the RIWP is presented as Figure 7.

8. References

1. New York State Department of Environmental Conservation. *DER-10; Technical Guidance for Site Investigation and Remediation.* May 2010.

2. *6 NYCRR Part 375 Environmental Remediation Programs*. December 31, 2025.

3. New York State Department of Environmental Conservation Division of Water Technical and Operation Guidance (TOGS). *1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations*. June 1998.

4. NYS Department of Health. *The Guidance for Evaluating Soil Vapor Intrusion in the State of New York.* October 2006, and subsequent updates.

5. United States Department of Agriculture (USDA), Soil Conservation Service. *Soil Survey of Erie County, New York*. December 1986.

6. New York State Department of Environmental Conservation. *Sampling, Analysis, and Assessment of Per- And Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs.* April 2023.

7. New York State Department of Environmental Conservation. *DER-23; Citizen Participation Handbook for Remedial Programs*. January 2010.

8. United States Environmental Protection Agency Region II. *CERCLA Quality Assurance Manual, Revision I*. October 1989.

9. United States Environmental Protection Agency. *Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5)*. October 1998.

10. Roux Environmental Engineering & Geology, D.P.C. *Phase II Environmental Investigation*. October 30, 2024.

TABLES

1. Summary of Phase II Soil/Fill Analytical Results
2. Summary of Phase II Groundwater Analytical Results
3. Sampling and Analysis Plan
4. Summary of Field Operating Procedures
5. Sample Container, Volume, Preservative & Holding Time Requirements

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TABLE 1

SUMMARY OF PHASE II SOIL/FILL ANALYTICAL RESULTS
REMEDIAL INVESTIGATION WORK PLAN
3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

PARAMETER [1]	CP-51 SCLs[2]	Unrestricted Use SCOs[2]	Restricted Residential Use SCOs[2]	Commercial Use SCOs[2]	Industrial Use SCOs[2]	SAMPLE LOCATION (DEPTH)							
						TP-1 4-6 ft	TP-4 3-4 ft	TP-10 8-9 ft	TP-11 6-8 ft	TP-12 6-8 ft	TP-14 4-5 ft	SB-3 4-5 ft	SB-4 4-5 ft
Sample Date						08/13/2024			08/14/2024			08/15/2024	
Volatile Organic Compounds (VOCs) - mg/kg [3]													
Methylene chloride	--	0.05	100	500	500	0.008 vs	ND	ND	0.006 vs	0.013 vs	**0.083 vs**	ND	ND
Toluene	0.7	0.7	100	500	1000	ND	**0.13 J**	ND	ND	ND	ND	ND	ND
Ethylbenzene	1	1	76	390	390	ND	0.79	**34 J**	ND	ND	ND	0.75 J	**1.2 J**
Total Xylenes	0.26	0.26	100	500	1000	ND	**4.2**	**160**	ND	ND	ND	**0.63 J**	ND
Acetone	--	0.03	100	500	1000	ND	ND	ND	**0.052 vs**	**0.043 vs**	0.028 Jvs	ND	ND
n-Butylbenzene	12	18	100	500	1000	ND	1.6	1.7	ND	ND	ND	1.2	0.94 J
sec-Butylbenzene	11	25	100	500	500	ND	0.2 J	0.64 J	ND	ND	ND	0.39 J	ND
Isopropylbenzene	2.3	--	--	--	--	ND	0.13 J	**3.9**	ND	ND	ND	0.46 J	0.75 J
p-Isopropyltoluene	10	--	--	--	--	ND	ND	0.93 J	ND	ND	ND	0.76	1.3 J
n-Propylbenzene	3.9	5	100	500	1000	ND	0.69	**15**	0.00062 Jvs	ND	ND	0.68	0.83 J
1,3,5-Trimethylbenzene	8.4	3.1	100	500	1000	ND	**3.2**	**32**	ND	ND	ND	1.8	2.1 J
1,2,4-Trimethylbenzene	3.6	5.9	100	500	1000	ND	**14**	**120**	ND	ND	ND	2	**6.3**
Cyclohexane	--	--	--	--	--	ND	ND	0.82 J	ND	ND	ND	1.5	37
Methyl cyclohexane	--	--	--	--	--	ND	ND	5.4	ND	ND	ND	10	180
Total TICS	--	--	--	--	--	ND	35.8	194.4	0.176	0.1286	ND	50.9	594
Polyaromatic Hydrocarbons (PAHs) - mg/kg [3]													
Anthracene	100	100	100	500	1000	5 J	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	1	1	1.4	37	37	**8.7 J**	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1	1	1	3.7	3.7	**6.5 J**	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1	1	1.4	37	37	**7.4 J**	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	100	0.64	4.9	47	78	**3.6 J**	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	0.8	0.8	4.9	47	78	**3.9 J**	ND	ND	ND	ND	ND	ND	ND
Chrysene	1	1	4.9	47	78	**7.6 J**	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	85	100	500	1000	21	0.021 J	ND	ND	ND	0.029 J	ND	ND
Fluorene	30	30	100	500	1000	2.7 J	0.033 J	ND	ND	ND	ND	0.037 J	ND
Indeno(1,2,3-cd)pyrene	0.5	0.5	1.4	37	37	**3.2 J**	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12	12	100	500	1000	2.5 J	0.19 J	0.074 J	ND	ND	ND	0.25	ND
Phenanthrene	100	1.1	4.9	47	78	**21**	0.027 J	ND	ND	ND	ND	0.055 J	ND
Pyrene	100	64	100	500	1000	16 J	0.098 J	ND	ND	ND	0.025 J	ND	ND
Lead - mg/kg													
Total Lead	--	63	400	1000	3900	--	12.1 J	11.6 J	--	--	--	--	--
Tetraethyl lead	--	--	--	--	--	--	ND	ND	--	--	--	--	--

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC CP-51 Soil Cleanup Levels
3. Sample results were reported by the laboratory in ug/kg and converted to mg/kg for comparisons to SCLs

Definitions:

ND = Parameter not detected above laboratory detection limit.
vs = Reported analyte concentrations are below 200 ug/kg and may be biased low due to the sample not being collected according to 5035A-L low-level specifications.
J = Estimated value; result is less than the sample quantitation limit but greater than zero.

Bold	= Results Exceeds its CP-51 SCL.
Bold	= Results Exceeds its Unrestricted Use SCO.
Bold	= Results Exceeds its Restricted Residential Use SCO.
Bold	= Results Exceeds its Commercial Use SCO.
Bold	= Results Exceeds its Industrial Use SCO.

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TABLE 2

SUMMARY OF PHASE II GROUNDWATER ANALYTICAL RESULTS
REMEDIAL INVESTIGATION WORK PLAN
3701 RIVER ROAD SITE
TONAWANDA, NY

PARAMETER[1]	GWQS[2]	Sample Location			
		SB-1W	SB-2W	SB-3W	SB-5W
		08/21/24			
Volatile Organic Compounds (VOCs) - ug/L					
1,2,4-Trimethylbenzene	**5**	3.9 J	ND	ND	**49**
1,3,5-Trimethylbenzene	**5**	ND	ND	ND	**13**
Acetone	**50**	**53**	ND	42 J	ND
Benzene	**1**	**4.6 J**	ND	ND	ND
Cyclohexane	**--**	2.6 J	ND	8	ND
Ethylbenzene	**5**	**8.3**	ND	ND	**25**
Methylcyclohexane	**--**	3.7 J	ND	8.8	1.8 J
p/m-Xylene	**5**	ND	ND	ND	**80**
o-Xylene	**5**	ND	ND	ND	**22**
Xylene (total)	**5**	ND	ND	ND	**100**

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Division of Water Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations - Class GA (TOGS 1.1.1)

Definitions:

ND = Parameter not detected above laboratory detection limit.

"--" = Sample not analyzed for parameter or no SCO available for the parameter.

J = Estimated Value - Below calibration range.

BOLD = Result exceeds GWQS.

TABLE 3
SAMPLING AND ANALYSIS PLAN
REMEDIAL INVESTIGATION WORK PLAN
3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

Matrix	Investigation Location	Sample Type	TCL VOCs + TICs (EPA Method 8260)	TCL SVOCs[1] + TICs (EPA Method 8270)	TAL Metals (EPA Method 6010/7471)[2] + total Cyanide (EPA Method 9010C)	PCBs (EPA Method 8082)	Pesticide (EPA Method 8081)	PFAS[3] (EPA Method 1633A)
Soil/Fill	SS-1	Surface Soil/Fill	1	1	1	1	1	1
	SS-2		1	1	1	1	1	1
	SS-3		1	1	1	1	1	1
	SS-4		1	1	1	1	1	1
	SS-5		1	1	1	1	1	1
	SS-6		1	1	1	1	1	1
	TP-21	Subsurface Soil/Fill	1	1	1			
	TP-22		1	1	1			
	TP-23		1	1	1	1	1	1
	TP-24		1	1	1			
	TP-25		1	1	1			
	TP-26		1	1	1	1	1	1
	TP-27		1	1	1	1	1	1
	TP-28		1	1	1			
	MW-1	Soil Borings (Native)	1	1	1	1	1	1
	MW-2		1	1	1	1	1	1
	MW-3		1	1	1	1	1	1
	MW-4		1	1	1	1	1	1
	MW-5		1	1	1	1	1	1
	MW-6		1	1	1	1	1	1
	MW-7		1	1	1	1	1	1
	WC-1 through WC-5	Waste Characterization	See Note 7					
QA/QC	Soil	MS	1	1	1	1	1	1
		MSD	1	1	1	1	1	1
		Blind Dup	1	1	1	1	1	1
TOTAL SOIL SAMPLES + QA/QC:			**24**	**24**	**24**	**19**	**19**	**19**
Groundwater	MW-1	Groundwater	2	2	2	2	2	2
	MW-2		2	2	2	2	2	2
	MW-3		2	2	2	2	2	2
	MW-4		2	2	2	2	2	2
	MW-5		2	2	2	2	2	2
	MW-6		2	2	2	2	2	2
	MW-7		2	2	2	2	2	2
QA/QC	Groundwater	MS	2	2	2	2	2	2
		MSD	2	2	2	2	2	2
		Blind Duplicate	2	2	2	2	2	2
		Equipment Blank[4]	2					2
		Field Blank[5]						2
		Trip Blank[6]	2					
TOTAL GROUNDWATER SAMPLES:			**24**	**20**	**20**	**20**	**20**	**24**
Soil Gas (TO-15/SIM Method)	SSV-1		1					
	IA-1		1					
	SSV-2		1					
	IA-2		1					
	SSV-3		1					
	IA-3		1					
	SV-1		1					
	SV-2		1					
	SV-3		1					
	SV-4		1					
	OA-1		1					
TOTAL SOIL VAPOR SAMPLES:			**11**	**--**	**--**	**--**	**--**	**--**

Notes:

1. 1,4-Dioxane will be analyzed in soil and groundwater samples. Groundwater samples to be analyzed using EPA Method 8270 SIM per NYSDEC guidelines.
2. In the event groundwater turbidity is >50 NTUs during sampling, groundwater analysis will include total and dissolved TAL Metals and mercury.
3. PFAS = Analysis via EPA Method 1633 for soils and groundwater.
4. One equipment blank will be collected when non-dedicated equipment is used for every 20 or fewer aqueous VOC/PFAS samples.
5. One field blank consisting of PFAS-free dionized water provided by the laboratory will be collected for every 20 or fewer aqueous PFAS samples.
6. One trip blank consisting of distilled, deionized water provided by the laboratory will be included with each sample delivery group of aqueous VOC samples.
7. As a conservative estimate, 5 waste characterization samples will be collected in accordance with NYSDEC requirements. Per landfill requirements, samples will be collected for Toxic Characteristic Leaching Procedure (TCLP) VOCs, TCLP SVOCs, TCLP metals, and Total PCBs (if needed).

Acronyms:

TCL = Target Compound List
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
TAL = Target Analyte List
PCBs = Polychlorinated Biphenyls
TBD = to be determined.
PFAS = Per- and polyfluoroalkyl Substances
QA/QC = quality control/quality assurance sample
MS = matrix spike
MSD = matrix spike duplicate

TABLE 4
SUMMARY OF FIELD OPERATING PROCEDURES
REMEDIAL INVESTIGATON WORK PLAN
3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

FOP Number	Description
001.1	Abandonment of Borehole Procedures
002.0	Abandonment of Monitoring Wells Procedure
004.7	Soil Vapor Sample Collection Procedure
007.0	Calibration and Maintenance of Portable Dissolved Oxygen Meter
008.0	Calibration and Maintenance of Portable Field pH/Eh Meter
009.0	Calibration and Maintenance of Portable Field Turbidity Meter
011.1	Calibration and Maintenance of Portable Photoionization Detector
012.0	Calibration and Maintenance of Portable Specific Conductance Meter
013.1	Composite Sample Collection Procedure for Non-Volatile Organic Analysis
015.0	Documentation Requirements for Drilling and Well Installation
017.0	Drill Site Selection Procedure
018.0	Drilling and Excavation Equipment Decontamination Procedures
021.0	Establishing Horizontal and Vertical Control
022.0	Groundwater Level Measurement
023.1	Groundwater Purging Procedures Prior to Sample Collection
024.1	Groundwater Sample Collection Procedures
024.3	PFAS Groundwater/Surface Water Sample Collection Procedures
025.0	Hand Augering Procedure
026.1	Hollow Stem Auger (HSA) Drilling Procedures
031.2	Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedure
032.2	Management of Investigation-Derived Waste (IDW)
033.0	Monitoring Well Construction for Hollow Stem Auger Boreholes
036.0	Monitoring Well Development Procedures
039.1	NAPL Detection and Sample Collection Procedure
040.1	Non-Disposable and Non-Dedicated Sampling Equipment Decontamination
041.0	Overburden Casing Installation Procedure
046.1	Sample Labeling, Storage and Shipment Procedures
047.0	Screening of Soil Samples for Organic Vapors During Drilling Activities
054.2	Soil Description Procedures Using The Visual-Manual Method
057.0	Soil Sample Collection for VOC Analysis - EnCore Sampling
058.0	Split-Spoon Sampling Procedures
063.4	Surface and Subsurface Soil Sampling Procedures
065.1	Test Pit Excavation and Logging Procedures
070.0	Well/Piezometer Construction Materials and Design
073.2	Real-Time Air Monitoring During Intrusive Activities
074.0	Underground Storage Tank Excavation & Removal Procedures
076.0	"Before Going Into the Field" Procedure
084.0	Calibration and Maintenance of Portable Particulate Meter
085.0	Field Quality Control Procedures
088.0	Underground Piping Decommissioning Procedures
090.0	Outdoor Ambient Air VOC Sample Collection Procedure

Notes:

1. FOPs are identified by the sequential FOP number and revision number. For example, FOP number 097.3 indicates FOP 97, revision 3.

TABLE 5
SAMPLE CONTAINER, VOLUME, PRESERVATIVE & HOLDING TIME REQUIREMENTS
REMEDIAL INVESTIGATION WORK PLAN
3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

Matrix	Parameter [1]	Method [1,2]	Container Type	Minimum Volume	Preservation (Cool to 2-4 °C for all samples)	Holding Time from Sample Date
Soil	TCL + CP-51 VOCs	8260	EnCore/WMG	3 - 5 gram	Cool to 2-4 °C, Zero Headspace	48 - hours / 14 days
	TCL SVOCs	8270	WMG	4 oz.	Cool to 2-4 °C	14 days extrac./40 days
	TAL Metals	6010/7471	WMG	4 oz.	Cool to 2-4 °C	6 months/Hg 28 days
	Pesticides	8081	WMG	4 oz.	Cool to 2-4 °C	14 days extrac./40 days
	PCBs	8082	WMG	4 oz.	Cool to 2-4 °C	14 days extrac./40 days
	PFAS	1633	HDPE	4 - 8 oz.	Cool to 2-4 °C	90 days
Groundwater	TCL + CP-51 VOCs	8260	glass vial	3 - 40 ml	HCl to pH<2, Zero Headspace, Cool to 2-4 °C	14 days
	TCL SVOCs	8270	amber glass	1000 ml	Cool to 2-4 °C	7 days extrac/40 days
	1,4-Dioxane	8270 SIM	amber glass	2 - 500 ml	Cool to 2-4 °C	7 days extrac/40 days
	TAL Metals, Total	6010/7470	HDPE	250 ml	HNO_3 to pH<2, Cool to 2-4 °C	6 months/Hg 28 days
	TAL Metals, Dissolved	6010/7470	HDPE	250 ml	HNO_3 to pH<2, Cool to 2-4 °C, filter through 0.45-µm filter	6 months/Hg 28 days
	Hardness, Total	SM 2340	HDPE	250 ml	HNO_3 to pH<2, Cool to 2-4 °C	6 months
	Pesticides	8081	amber glass	1000 ml	Cool to 2-4 °C	14 days extrac./40 days
	PCBs	8082	amber glass	1000 ml	Cool to 2-4 °C	7 days extrac/40 days
	PFAS	1633	HDPE	2 - 500 ml	Cool to 2-4 °C	28 days
Air/Soil Vapor	TCL VOCs	TO-15	Summa Cannister	6 liters	None	Analyze within 14 days of sample date of collection

References:

1. Test Methods for Evaluating Solid Wastes, USEPA SW-846, Update III, 1991.

Notes:

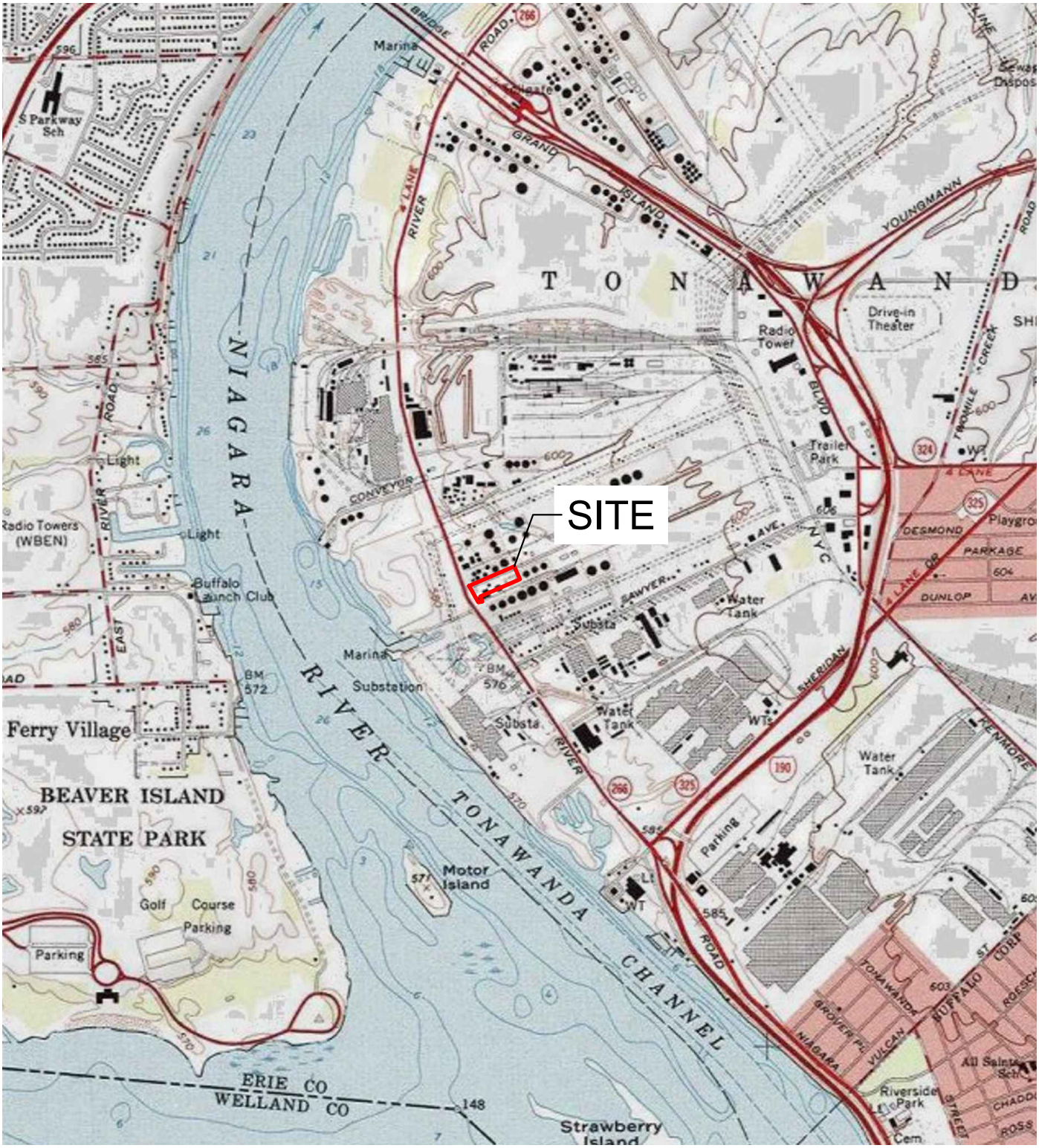
1. EPA-approved methods published in Reference 1 above may be used. The list of analytes, laboratory method and the method detection limit for each parameter are included in Tables 1 and 2 of the QAPP.
2. Mercury sampling in soil/groundwater via EPA methods 7471/7470 respectively.

Acronyms:

VOCs = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
TCL = Target Compound List
TAL = Target Analyte List
WMG = Wide Mouth Glass
PFAS = Per- and Polyfluoroalkyl Substances
WMG = Wide Mouth Glass
HDPE = High-Density Polyethylene

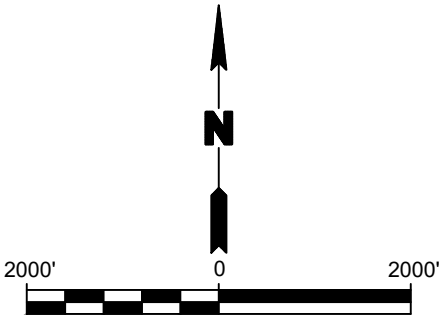
FIGURES

1. Site Location and Vicinity Map
2. Site Plan (Aerial)
3. Historic Investigation Locations and Areas of Concern
4. Zoning Map
5. Ecological Resources
6. Planned Remedial Investigation Locations
7. Preliminary Project Schedule



MAP PER USGS BUFFALO NW QUADRANGLE, 2023.





Title: **SITE LOCATION AND VICINITY MAP**

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

REMEDIAL INVESTIGATION WORK PLAN

Prepared for:

3701 RIVER ROAD, LLC

ROUX	Compiled by: CMS	Date: MARCH 2026	FIGURE
	Prepared by: CMS	Scale: AS SHOWN	1
	Project Mgr: BWM	Project: 4369.0005B000	
	File: FIGURE 1; SITE LOCATION AND VICINITY MAP.DWG		

F:\CAD\O-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\FIGURE 1; SITE LOCATION AND VICINITY MAP.DWG

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\FIGURE 2; SITE PLAN (AERIAL).DWG



LEGEND:

BCP SITE BOUNDARY

PARCEL BOUNDARY

N

100' 0 100'

MAP PER GOOGLE EARTH, JUNE 2024.

Title:

SITE PLAN (AERIAL)

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

REMEDIAL INVESTIGATION WORK PLAN

Prepared for:

3701 RIVER ROAD, LLC

ROUX

Compiled by: CMS	Date: MARCH 2026	FIGURE
Prepared by: CMS	Scale: AS SHOWN	2
Project Mgr: BWM	Project: 4369.0005B000	
File: FIGURE 2; SITE PLAN (AERIAL).DWG		

ADDITIONAL INVESTIGATION LOCATIONS OF ENVIRONMENTAL CONCERN

LOCATION	HIGHEST PID READING	VISUAL/OLFACTORY OBSERVATION
TP-2	420 PPM	PETROLEUM-LIKE ODOR
TP-3	450 PPM	PETROLEUM-LIKE ODOR
TP-5	1,000 PPM	PETROLEUM-LIKE ODOR
TP-9	0.5 PPM	PETROLEUM-LIKE ODOR
TP-19	100 PPM	PETROLEUM-LIKE ODOR
TP-20	50 PPM	PETROLEUM-LIKE ODOR

SB-5W — *8/21/2024*
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 3 PPM

PARAMETER	ug/L
1,3,5-TRIMETHYLBENZENE	49
1,2,4-TRIMETHYLBENZENE	13
ETHYLBENZENE	25
p/m-XYLENE	80
o-XYLENE	22
TOTAL XYLENES	100

TP-11 (6-8 FT) — *8/14/2024*
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 300 PPM

PARAMETER	MG/KG
ACETONE	0.052

SB-3 (4-5 FT) — *8/15/2024*
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 1,000 PPM

PARAMETER	MG/KG
TOTAL XYLENES	0.63

TP-12 (6-8 FT) — *8/14/2024*
FILL MATERIALS NOTED
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 15 PPM

PARAMETER	MG/KG
ACETONE	0.043

SB-1W — *8/21/2024*
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 800 PPM

PARAMETER	ug/L
ACETONE	53
BENZENE	4.6
ETHYLBENZENE	8.3

TP-4 (3-4 FT) — *8/13/2024*
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 1,000 PPM

PARAMETER	MG/KG
TOLUENE	0.13
TOTAL XYLENES	4.2
1,3,5-TRIMETHYLBENZENE	3.2
1,2,4-TRIMETHYLBENZENE	14

TP-14 (4-5 FT) — *8/15/2024*
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 5 PPM

PARAMETER	MG/KG
METHYLENE CHLORIDE	0.083

TP-10 (8-9 FT) — *8/13/2024*
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 1,890 PPM

PARAMETER	MG/KG
ETHYLBENZENE	34
TOTAL XYLENES	160
ISOPROPYLBENZENE	3.9
n-PROPYLBENZENE	15
1,3,5-TRIMETHYLBENZENE	32
1,2,4-TRIMETHYLBENZENE	120

SB-4 (4-5 FT) — *8/15/2024*
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 1,000 PPM

PARAMETER	MG/KG
ETHYLBENZENE	1.2
1,2,4-TRIMETHYLBENZENE	6.3

TP-1 (4-6 FT) — *8/13/2024*
FILL MATERIALS NOTED
PETROLEUM-LIKE ODOR
HIGHEST PID READING = 3 PPM

PARAMETER	MG/KG
BENZO(A)ANTHRACENE	8.7
BENZO(A)PYRENE	6.5
BENZO(B)FLUORANTHENE	7.4
BENZO(G,H,I)PERYLENE	3.6
BENZO(K)FLUORANTHENE	3.9
CHRYSENE	7.6
INDENO(1,2,3-CD)PYRENE	3.2
PHENANTHRENE	21

DRIVEWAY
EXISTING ORPHAN UST (APPROX. 20,000-GAL.)
FORMER PUMP ISLAND
FORMER GAS LOADING DOCK AND RACK
FORMER RAILBED ENCOUNTERED; FILL MATERIALS NOTED.
FORMER HEATING OIL STORAGE TANK.
EXISTING METAL SUSPECT PETROLEUM PRODUCT LINES ENCOUNTERED AT 3.5 FBGS; FILL MATERIALS NOTED.
FILL MATERIALS NOTED.
APPROXIMATE LOCATION OF SUSPECT PRODUCT PIPE LINE(S)
EXISTING METAL SUSPECT PETROLEUM PRODUCT LINES ENCOUNTERED AT 5 FBGS
MAIN BUILDING
RIVER ROAD
JAMES AVE.
GELLEY ST.

TP-1 TP-2 TP-3 TP-4 TP-5 TP-6 TP-7 TP-8 TP-9 TP-10 TP-11 TP-12 TP-13 TP-14 TP-15 TP-16 TP-17 TP-18 TP-19 TP-20
SB-1 SB-1/1W SB-2/2W SB-3/3W SB-4 SB-5 SB-5/5W

MAP PER GOOGLE EARTH, APRIL 2006.

LEGEND:

- BCP SITE BOUNDARY
- PARCEL BOUNDARY
- SB-1 — SOIL BORING
- TP-1 — TEST PIT
- SB-1 /1W — TEMPORARY WELL LOCATION
- GROSSLY CONTAMINATED SOILS ENCOUNTERED (PETROLEUM-LIKE ODORS AND ELEVATED PID READINGS)
- FORMER RAIL
- EXCEEDS UNRESTRICTED USE SCOs[1] AND/OR CPLs[2]
- EXCEEDS RESTRICTED-RESIDENTIAL USE SCOs[1]
- EXCEEDS COMMERCIAL USE SCOs[1]
- EXCEEDS INDUSTRIAL USE SCOs[1]
- EXCEEDS GWQS[3]

NOTES:
1. SOIL RESULTS COMPARED TO 6 NYCRR PART 375 SOIL CLEANUP OBJECTIVES (SCOs).
2. SOIL RESULTS COMPARED TO CP-51 SOIL CLEANUP LEVLES (CPLs).
3. GROUNDWATER RESULTS COMPARED TO DIVISION OF WATER TECHNICAL AND OPERATIONAL GUIDANCE SERIES (1.1.1.) AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES AND GROUNDWATER EFFLUENT LIMITATIONS.
4. FILL MATERIALS NOTED AT TP-1, TP-2, TP-3, TP-12, AND TP-17.

N

100' 0 100'

Title:
HISTORIC INVESTIGATION LOCATIONS AND RESLUTS
3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

REMEDIAL INVESTIGATION WORK PLAN

Prepared for:
3701 RIVER ROAD, LLC

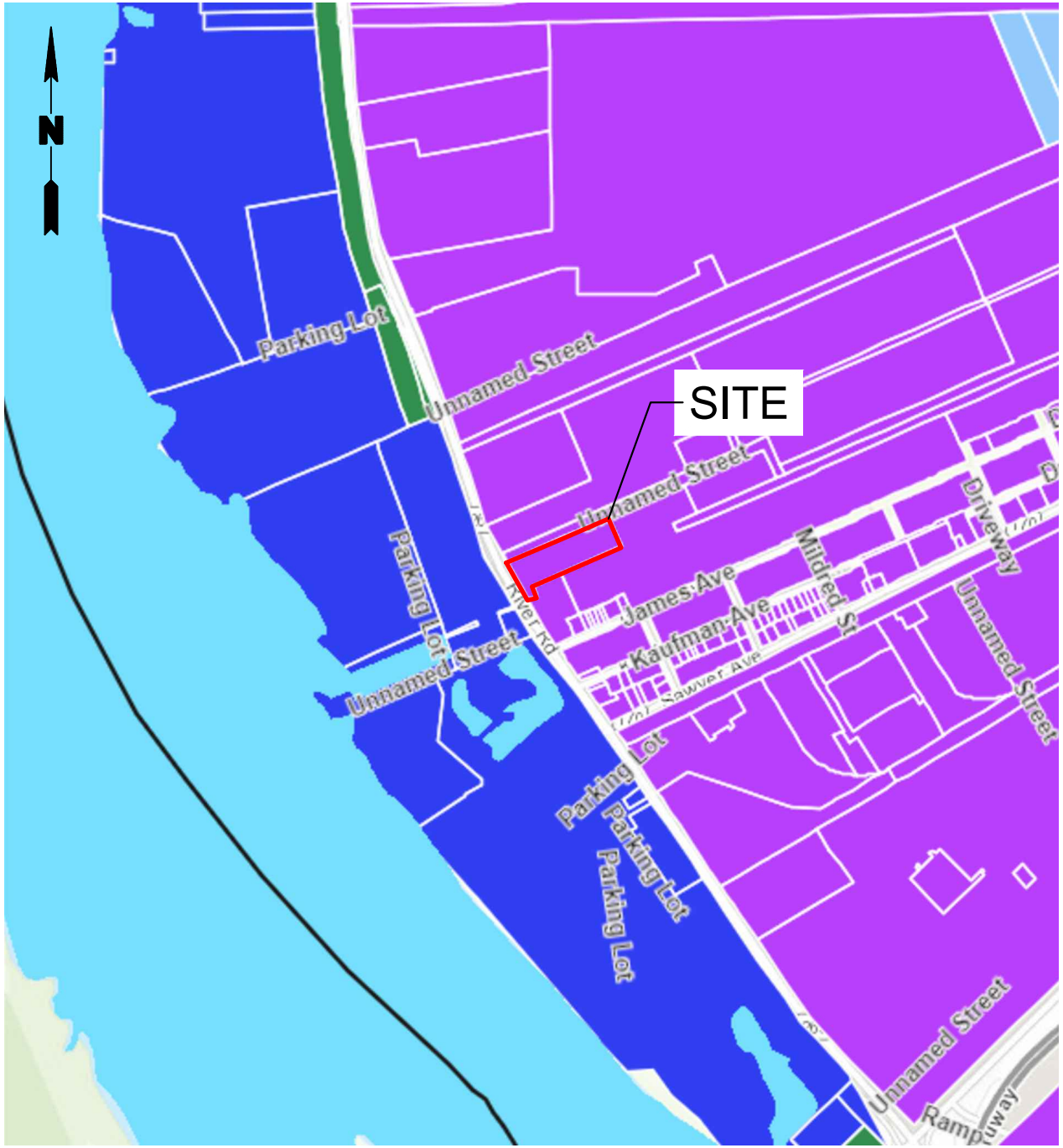
ROUX

Compiled by: CMS	Date: FEBRUARY 2026
Prepared by: CMS	Scale: AS SHOWN
Project Mgr: BWM	Project: 4369.0005B000
File: FIGURE 3; HISTORIC INVESTIGATION LOCATIONS AND RESULTS_REV2.DWG	

FIGURE 3

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\FIGURE 3; HISTORIC INVESTIGATION LOCATIONS AND RESULTS_REV2.DWG

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\FIGURE 4; ZONING MAP.DWG



LEGEND:

BCP SITE BOUNDARY

Waterway

Current Zoning

- Single-Family Residential (R-1)
- Two-Family Residential (R-2)
- Mixed Residential (MR)
- Mixed Use Neighborhood (MU-N)
- Mixed Use General Commercial (MU-GC)
- Mixed Use Industrial (MU-I)
- General Industrial (GI)
- Community Facility (CF)
- Open Space (OS)
- Mixed Use Waterfront (MU-W)

1000' 0 1000'

MAP PER TOWN OF TONAWANDA GIS.

Title:

ZONING MAP

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

REMEDIAL INVESTIGATION WORK PLAN

Prepared for:

3701 RIVER ROAD, LLC

ROUX

Compiled by: CMS	Date: MARCH 2026	FIGURE
Prepared by: CMS	Scale: AS SHOWN	4
Project Mgr: BWM	Project: 4369.0005B000	
File: FIGURE 4; ZONING MAP.DWG		



MAP PER NYSDEC ENVIRONMENTAL RESOURCE MAPPER, FEBRUARY 2026.

LEGEND:

- BCP SITE BOUNDARY
- 0.25-MILE RADIUS FROM SITE BOUNDARY
- 0.5-MILE RADIUS FROM SITE BOUNDARY
- NATIONAL WETLAND INVENTORY (NWI) FRESHWATER FORESTED/SHRUB WETLAND
- NWI FRESHWATER EMERGENT WETLAND
- NYSDEC REGULATED WETLAND (CLASS 2)
- NWI FRESHWATER POND
- NYSDEC SIGNIFICANT WATERFOWL WINTER CONCENTRATION AREA, NWI RIVERINE, NYSDEC MUSSEL SCREENING STREAM
- NYSDEC AREA OF ANIMALS LISTED AS ENDANGERED OR THREATENED
- NYSDEC AREA OF BLACK NOSE SHINER

1000' 0 1000'

Title: **ECOLOGICAL RESOURCE MAPPER**

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

REMEDIAL INVESTIGATION WORK PLAN

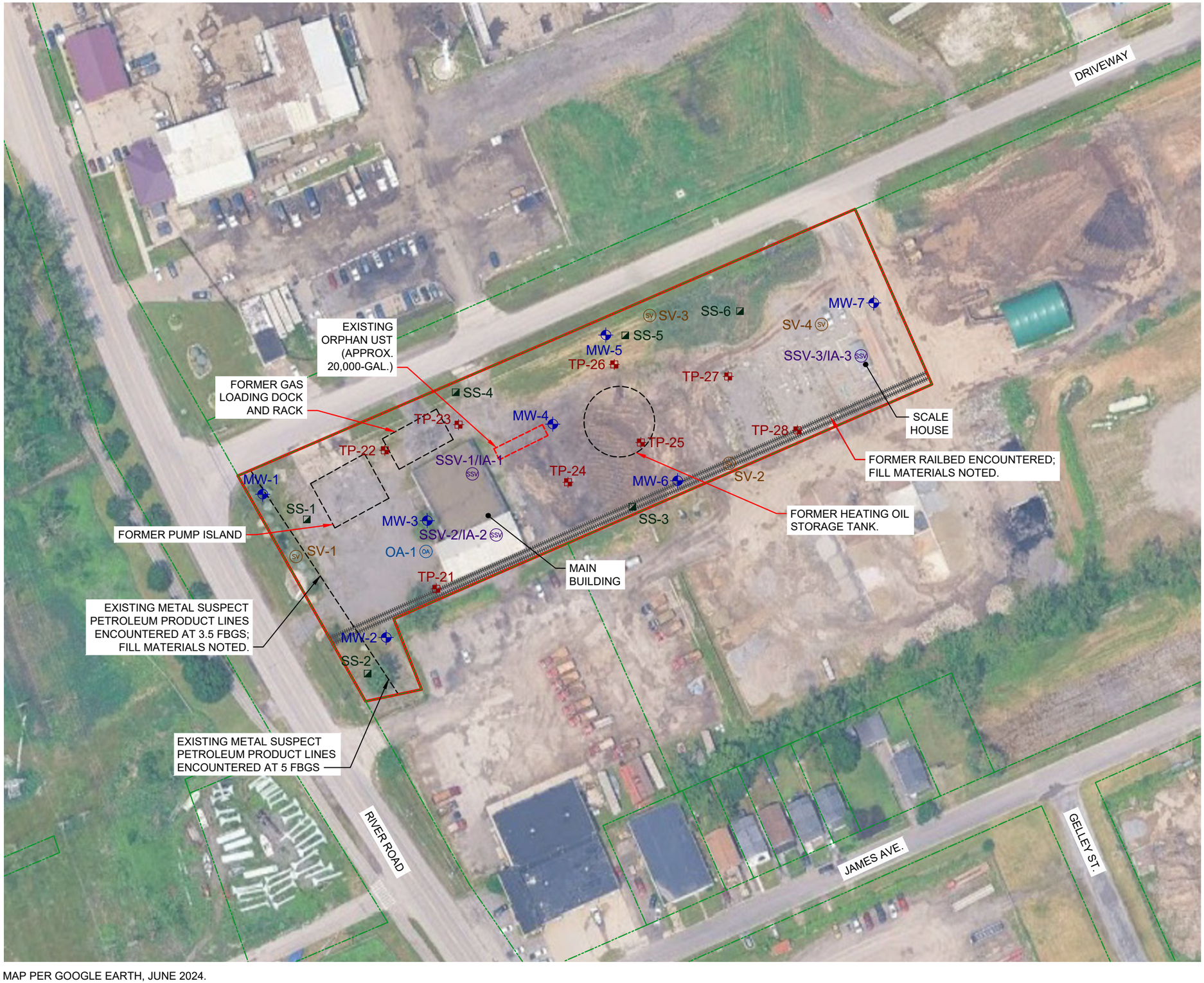
Prepared for:

3701 RIVER ROAD, LLC

ROUX

Compiled by: CMS	Date: MARCH 2026	FIGURE
Prepared by: CMS	Scale: AS SHOWN	5
Project Mgr: BWM	Project: 4369.0005B000	
File: FIGURE 5; ECOLOGICAL RESOURCES.DWG		

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\FIGURE 5; ECOLOGICAL RESOURCES.DWG



MAP PER GOOGLE EARTH, JUNE 2024.

LEGEND:

- BCP SITE BOUNDARY
- PARCEL BOUNDARY
- TP-21 — RI TEST PIT
- MW-1 — RI MONITORING WELL
- SS-1 — RI SURFACE SOIL SAMPLE
- SV-1 — RI SOIL VAPOR SAMPLE
- SSV-1/IA-1 — RI SUBSLAB SOIL VAPOR/INDOOR AIR SAMPLE
- OA-1 — RI OUTDOOR AIR SAMPLE

NOTES:
1. FILL MATERIALS NOTED AT TP-1, TP-2, TP-3, TP-12, AND TP-17 DURING THE PREVIOUS PHASE II INVESTIGATION.

N

100' 0 100'

Title:

PLANNED REMEDIAL INVESTIGATION LOCATIONS
3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

REMEDIAL INVESTIGATION WORK PLAN

Prepared for:

3701 RIVER ROAD, LLC

ROUX

Compiled by: CMS	Date: MARCH 2026	FIGURE
Prepared by: CMS	Scale: AS SHOWN	6
Project Mgr: BWM	Project: 4369.0005B000	
File: FIGURE 6; PLANNED REMEDIAL INVESTIGATION LOCATIONS_REV4.DWG		

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\FIGURE 6; PLANNED REMEDIAL INVESTIGATION LOCATIONS_REV4.DWG

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\FIGURE 7; PRELIMINARY PROJECT SCHEDULE_REV3 (2027 COC).DWG

PROJECT TASKS:



Title:

PRELIMINARY PROJECT SCHEDULE

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

REMEDIAL INVESTIGATION WORK PLAN

Prepared for:

3701 RIVER ROAD, LLC

ROUX

Compiled by: CMS	Date: NOVEMBER 2026	FIGURE
Prepared by: CMS	Scale: NA	7
Project Mgr: BWM	Project: 4369.0005B000	
File: FIGURE 7; PRELIMINARY PROJECT SCHEDULE_REV3 (2027 COC).DWG		

APPENDICES

APPENDIX A

Resumes

STAFF RESUME

Michael A. Lesakowski

Vice President | Principal Scientist

OFFICE
Buffalo, NY 14218

YEARS OF EXPERIENCE
Roux: 18 Years
Other Firm: 10 Years

EDUCATION
BS, Biology, State University of New York at Fredonia, 1994
MS, Environmental Engineering Science, University of Buffalo, 2008

WHY CHOSEN FOR NYSDEC CONTRACT

- Professional with +25 years of experience with environmental due diligence, investigation and remediation
- Experienced with New York Brownfield Cleanup Program, NY Inactive Hazardous Waste Disposal (State Superfund) Program, NY Petroleum Spills Program
- Experienced with Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10), 6NYCRR Part 375 Environmental Remediation Programs, 6NYCRR Part 360 Solid Waste Regulations and Part 371 Hazardous Waste Regulations.

EXPERIENCE SUMMARY

Over twenty-five years professional experience in environmental engineering, science, and consulting at numerous contaminated sites throughout the northeast United States as Vice President (Roux Environmental Engineering and Geology, DPC), President, Principal Scientist, Sr. Project Manager and Project Manager (TurnKey Environmental Restoration, LLC), Executive Vice President, Project Manager and Environmental Scientist (LCS, Inc.) and Environmental Scientist (GZA GeoEnvironmental of NY).

TECHNICAL SPECIALTIES

Expert in all aspects of the New York Brownfield Cleanup Program, including technical assessment and analysis of the site investigation/remedy selection process, and site remediation. Mr. Lesakowski has investigated and remediated over 100 NY brownfield projects, including ten renewable energy redevelopment projects on remediated brownfield sites. He has managed assessments, investigations and remediation projects on properties with a multitude of historic uses (e.g., petroleum storage refineries and terminals, gas stations, automobile dealerships, rail yards, foundries, dry cleaners, steel manufacturing, metallurgical plants, metal plating operations, junk yards), media types (surface and subsurface soil, groundwater, sediments, soil vapor, indoor air, building materials) and contaminants (e.g., volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], polychlorinated biphenyls [PCBs], heavy metals, per- and polyfluoroalkyl substances [PFAS]). Mr. Lesakowski has managed remediation projects, ranging from simple underground storage tank (UST) removals to large-scale soil excavations, in situ soil stabilization, and complex groundwater remediation programs, such as biological and/or chemical in situ groundwater treatment and permeable reactive barriers for VOCs and PFAS.

REPRESENTATIVE PROJECTS

Principal Scientist: Olean Redevelopment Parcels 1, 2 and 3 Sites (2011 to present: Roux): Manager and Principal Investigator/Remediator for a Remedial Investigation/Alternatives Analysis and Remedial Action at a former petroleum refining and major storage facility in Olean, New York. The comprehensive investigation, which was completed over three separate sites (Olean Redevelopment Parcels 1,2 and 3) totaling approximate 60-acres, included a hydrogeologic assessment, including soil borings, test pits and monitoring well installation, development, and sampling. Remedial Action included:

- Excavation of arsenic-contaminated soil/fill and Grossly Contaminated Media (GCM);
- In-Situ Stabilization of lead contaminated soil/fill;
- Removal, cleaning and recycling of approximately 145,000 linear feet of subsurface metallic product piping;
- Characterization and removal of over 100 hazardous and non-hazardous, 55-gallon drums of various petroleum wastes;
- Installation and operation of 5 SVE systems to address GCM. The SVE systems included the installation of over 70 SVE wells. Emissions from the SVE system were controlled using biofilters, which allowed the naturally occurring microbes to bioremediate the air stream;
- LNAPL recovery was completed utilizing hydrocarbon absorbent socks;
- A site cover system was constructed to allow for commercial use of the Sites

Project Manager: Seneca Market I, LLC Site, Watkins Glen, New York (2007 to present: Roux): Manager of Site Investigation and Remediation at a former drycleaner, bus garage and asphalt plant under NYSDEC guidance with significant chlorinated volatile organic compounds impact. The investigation included a hydrogeologic assessment, including soil borings, test pits and monitoring well installation, development, and sampling. The remediation approach involved: underground storage tank removal; In-ground hydraulic lift removal; hazardous soil excavation and disposal proximate a commercial building; enhanced biodegradation of groundwater; groundwater treatment with granular activated carbon; design and installation of an active sub-slab depressurization system; and an engineered soil cover system.

STAFF RESUME

Bryan Mayback

Technical Director

OFFICE
Buffalo, NY

YEARS OF EXPERIENCE
Roux: 10+ Years
Other Firm: 10+ Years

EDUCATION
BS, Earth Sciences, Environmental Concentration, State University of New York College at Buffalo, 2002
AAS, Environmental Technology, Trocaire College, 1999

TRAINING
OSHA 40 Hour HAZWOPER
OSHA 8-Hour HAZWOPER Supervisor Training
OSHA 10-hour Construction Safety Training
ASTM Conference Environmental Site Assessments for Property Transfer

WHY CHOSEN FOR NYSDEC CONTRACT

- Environmental Professional with 20+ years of experience in environmental due diligence, investigation, and remediation.
- Experience with hazardous/regulated waste, petroleum and solvent spills, and emerging contaminants, while actively working on NYSDEC regulated sites.
- Experienced Project Manager of complex due diligence projects, including properties in Lackawanna, NY formerly occupied by Bethlehem Steel, and devising appropriate Investigation and Remediation Work Plans under regulatory programs (Spills and BCP).
- Proven successful track record in working with the NYSDEC to move various spill projects to closure and New York Brownfield Cleanup Program sites to Certificate of Completion.

EXPERIENCE SUMMARY

Over 20 years of experience in various aspects of the environmental field: Technical Director/Project Manager at Roux (07/2014-present, note that TurnKey Environmental Restoration, LLC merged with Roux in 07/2023); Vice President/President at RJS Environmental (06/2009-07/2014); Senior Environmental Scientist at Groundwater and Environmental Services, Inc./GES (09/2007-06/2009); Senior Environmental Scientist/Technical Writer at Lender Consulting Services, Inc./LCS (08/2002-09/2007).

TECHNICAL SPECIALTIES

Mr. Mayback has assisted in Health and Safety Plan (HASP) Development and has performed various field services such as investigation and remedial oversight, Soil Vapor Intrusion Assessments, groundwater management, and groundwater monitoring activities including well gauging, purging (bailers and low flow) and sampling. In addition to the management of large-scale investigation projects, Mr. Mayback has also managed large-scale remediation projects that involved soil/fill excavations, tank pulls and inground lift removals, groundwater injection activities, groundwater management, sensitive receptor surveys, hydrogeologic studies, impact delineation studies, and pilot testing relative to remedial alternatives. Additional experience includes bedrock investigations, light non-aqueous phase liquid (NAPL) recovery via vacuum extraction, and oversight/interpretation of reports associated with Geophysical Assessments, including Magnetometer and Ground Penetrating Radar (GPR). Mr. Mayback has also provided environmental consulting services for large financial institutions, insurance companies, and major petroleum companies such as ExxonMobil and Sunoco.

REPRESENTATIVE PROJECTS

Project Manager; Silo City Phase I BCP Site, Buffalo, NY (2019 – Present: Roux): Manager during environmental due diligence activities (pre-Brownfield Cleanup Program) and all BCP tasks involving a six-acre property that had a variety of historic uses, most notably a grain malting/milling facility and a rail yard. The redevelopment plans involved renovating existing industrial buildings located along the Buffalo River into an affordable housing complex with commercial and community spaces, and construction of a parking lot. Investigation activities supported successful entry of the Silo City Phase I Site into the BCP. Supplemental investigation activities completed under the BCP (i.e., Remedial Investigation), revealed the presence of soil/fill impacted by polycyclic aromatic hydrocarbons (PAHs) and metals, concrete impacted by polychlorinated biphenyls (PCBs), and groundwater impacted by volatile organic compounds (VOCs). Provided management and support for approved Remedial Actions including excavation and disposal of over 10,000 tons of soil/fill, groundwater injection activities to address elevated VOC concentrations in groundwater, removal of PCB-impacted concrete, and installation of a site-wide cover system.

A mixed Track 4 Cleanup was achieved consisting of restricted-residential on the affordable housing part of the Site, and commercial in the newly constructed parking lot area; both portions of the Site are subject to a Site Management Plan that was approved by the NYSDEC and NYSDOH.

Project Manager; Jet Fuel Release Spill Response, Cheektowaga, New York (2017: Roux): Manager tasked with addressing a release of approximately 2,000-gallons of jet fuel from a fueling vehicle that overturned during an accident on a roadway proximate to a major airport. Impacted soil/fill was transferred off-site for treatment and such was deemed non-hazardous based on waste characterization laboratory analytical results. Off-site characterization/investigation activities were required to assess whether jet fuel migrated to an off-site via drainage systems; this involved an evaluation of chemical differences between differing petroleum types and analytical data from the spill site in comparison to the analytical data from off-site properties. Through this analysis, it was determined that the jet fuel did not migrate off-site, and Site Characterization and spill response/remediation activities achieved spill reclassification by the NYSDEC to no further action status.

Project Manager; Thrifty NYSDEC Spill Site, Lockport, New York (2016 – 2022: Roux): Manager during the entire large-scale spill project at this petroleum retail facility and automotive repair operation that began with spill response due to the presence of subsurface petroleum impacts. Provided management during remedial activities involving soil/fill excavations, construction of an on-site temporary biotreatment facility, removal of fuel assets, removal of orphan USTs, groundwater treatment, installation/operation of a groundwater pump and treat system, and installation of sumps to allow for vacuum extraction activities, and connection to the pump and treat system. Manager/main writer for various reports documenting the extensive investigation and remedial work discussed, which resulted in the NYSDEC reclassification of the spill incident to no further action status.

STAFF RESUME

Chad M. Schuster

Project Scientist

OFFICE
Buffalo, NY

YEARS OF EXPERIENCE
Roux: 8 Years
Other Firm: 5 Years

EDUCATION
BS, Architectural Technology, State University of New York at Alfred, 2008
MS, Great Lakes Ecosystem Science, State University of New York at Buffalo State, 2017

WHY CHOSEN FOR NYSDEC CONTRACT

- 8 years of experience with environmental remediation.
- Experienced with hazardous waste, petroleum spills, and emerging contaminants, while actively working on NYSDEC regulated Brownfield Cleanup Program sites.

EXPERIENCE SUMMARY

Eight years of experience within the environmental remediation and investigation field. Has led multiple large-scale Brownfield Cleanup Program (BCP) projects within NYSDEC Region 9 including, but not limited to, BCP applications, remedial investigations, soil/fill removal, remedial injections, and soil vapor intrusion (SVI) mitigation. Additional experience includes 5 years at FRA Engineering/TY Lin in civil/architectural design.

TECHNICAL SPECIALTIES

Phase I Environmental Site Assessments including field investigations and reporting. Phase II Site Investigations including field team leader during investigation activities and reporting. Field team leader during BCP Remedial Investigations, Interim Remedial Measures, and Remedial Cleanup activities. Prepare reports including, but not limited to, Phase I ESAs, Phase II Investigations, Remedial Investigations and Alternatives Analyses, Site Management Plans, Final Engineering Reports, Work Plans, Periodic Review Reports, and Feasibility Studies. Point of contact with NYSDEC project managers and third-party contractors including site contractors, analytical laboratories, landfill operators, and data validation services. Prepare CAD drawings for all aspects of remedial design and reporting summarized above.

REPRESENTATIVE PROJECTS

Staff Scientist II/Project Scientist; Silo City Phase I Project (C915361); Buffalo, NY (2019-Present: Roux): Oversaw all aspects of remedial investigation and cleanup during redevelopment of an underutilized historic area in the City of Buffalo, New York into commercial and residential use. Job duties included initial investigation; oversight during remedial cleanup including soil/fill removal, groundwater injection to remediate petroleum impacts, soil and groundwater sampling; SVI sampling and mitigation; reporting; and on-going Site management.

Staff Scientist II/Project Scientist; 2101 Kenmore Avenue Site (C915391); Tonawanda, NY (2021-Present: Roux): Oversaw all aspects of remedial investigation and cleanup during redevelopment of an underutilized area in Tonawanda, New York into commercial and residential use. Job duties included initial investigation; oversight during remedial cleanup including soil/fill removal, underground storage tank (UST) removal, soil and groundwater sampling; SVI sampling and mitigation; reporting; and on-going Site management.

Staff Scientist II/Project Scientist; Main and East Balcom Street Site (C915306); Buffalo, NY (2019-Present: Roux): Oversaw all aspects of remedial cleanup during redevelopment of an underutilized area in the City of Buffalo, New York into commercial and residential use. Job duties included oversight during remedial cleanup including soil/fill removal, soil and groundwater sampling; reporting; and on-going Site management.

Engineer/Scientist; Oregon Road Site (C905045); Buffalo, NY (2019-2021: Roux): Oversaw all aspects of remedial cleanup during redevelopment of an underutilized area in the City of Olean, New York. Job duties included oversight during remedial cleanup including soil/fill removal, soil and groundwater sampling; groundwater injection to remediate PFAS impacts; and reporting.

TRAINING

- OSHA 40 Hour HAZWOPER with Annual 8-Hour Refresher
- First Aid, Cardiopulmonary Resuscitation (CPR)/Automated External Defibrillator (AED)
- NYSDEC 4-hour Erosion and Sediment Control certificate

APPENDIX B

Previous Investigation

October 30, 2024

Mr. Tim Boyle
NOCO Black Dirt Prop LLC
2101 St. Rita's Lane
Williamsville, NY 14221

Re: Phase II Environmental Investigation
3701 River Road
Tonawanda, New York

Dear Tim:

Roux Environmental Engineering and Geology, D.P.C. (Roux) has prepared this report to present the results of a Phase II Environmental Investigation at 3701 River Road, Tonawanda, Erie County, New York (Site). A Site Location and Vicinity Map is provided as Figure 1.

BACKGROUND AND PURPOSE

The 3.2-acre Site is currently developed with one vacant commercial building. The eastern portion of the Site is currently used as a landscape supply company. The Site is located in an industrial area that uses the public water system for its potable drinking water supply.

Prior to current operations, the Site was used as a portion of a greater oil refinery. Historic aerial photographs indicate the presence of one bulk oil storage tank, east of the existing building historically used as a fueling rack, from at least 1951 through at least 1985. City directories identify the following historic owners/occupants of the Site at 3701 River Road:

- At least 1968 to at least 1970– Humble Oil Refining
- At least 1976 – Ashland Chemical, Ashland Oil, Exxon CO USA Orders/Sales, Sherwood Stoll Corp.

Roux is aware of a previous remedial excavation, reportedly completed north of the existing building, that was backfilled with clean material.

The current property owner, NOCO Black Dirt Prop LLC, has reportedly owned the Site since 2010.

Due to the history of the Site, the current property owner elected to complete this Phase II Environmental Investigation to assess site-wide subsurface soil and groundwater conditions as part of their due diligence. The Phase II work completed by Roux is further discussed below.

PHASE II INVESTIGATION ACTIVITIES

On August 13, 2024, through August 15, 2024, Roux completed 20 test pits (TP-1 through TP-20) across the Site using an excavator to a depth of up to ten feet below ground surface (fbgs). Following test pit activities, five soil borings (SB-1 through SB-5) were completed at the Site by Roux's subcontractor, Trec Environmental Inc. (Trec), using a direct-push drill rig to a target depth of 20 fbgs[1], except for SB-4, which was completed to 12 fbgs. As further detailed below, four soil borings were converted into

[1] In accordance with Roux's Health and Safety protocol, each soil boring was hand cleared to a depth of approximately five fbgs; hand clearing was achieved either by using an air knife and other hand tools, or soft digging techniques with the excavator.

2558 Hamburg Turnpike, Suite 300, Buffalo, New York 14218 ■ + 716 856 0599 ■ www.rouxinc.com
California ■ Illinois ■ Massachusetts ■ New Jersey ■ New York ■ Texas ■ Virginia

temporary one-inch diameter monitoring wells. Investigation locations are shown on Figure 2. Test pits and soil borings were completed across the Site

The removed soils were observed for field characterization of the subsurface lithology and collection of soil samples. The soils from each soil boring were screened for total volatile organics using a MiniRae 3000 photoionization detector (PID); visual characteristics were classified; and olfactory observations, if any, were noted.

Soil borings (SB-1, SB-2, SB-3, and SB-5) were converted into temporary one-inch diameter monitoring wells (SB-1W, SB-2W, SB-3W, and SB-5W) using one-inch diameter Schedule 40 PVC well screen and riser. Groundwater grab samples were collected utilizing a dedicated and disposable 0.5" polyethylene bailers after purging a minimum of three well volumes from each well. The temporary wells were manually decommissioned (pulled) following groundwater sampling activities. The resulting open annuluses were backfilled with Site soils.

Eight soil samples were analyzed by Eurofins Buffalo (Eurofins) for Target Compound List (TCL) plus NYSDEC Commissioner Policy 51 (CP-51) volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and/or Resource Conservation and Recovery Act (RCRA) metals. In addition, to further characterize on-Site soil/fill for disposal/treatment, two samples were analyzed for total lead and tetraethyl lead. Four groundwater samples were analyzed for TCL plus CP-51 VOCs.

Samples were collected in laboratory provided sample bottles and placed on ice prior to transport.

FIELD OBSERVATIONS AND NYSDEC REPORTING OBLIGATION

Underlying the asphalt, concrete and gravel surfaces, soils generally consisted of native silty sand underlain by sandy lean clay to depths of at least 20 fbgs. Of the 25 investigation locations completed during the current assessment, localized areas of fill materials were noted at five investigation locations at TP-1, TP-2, TP-3, TP-12, and TP-17.

Groundwater was noted during drilling at depths ranging between 16 fbgs and 20 fbgs.

No visual or olfactory concerns were identified during the work on the eastern portion of the Site.

Elevated PID readings and petroleum-like odors were identified on the central and western portions of the Site. In addition, during completion of TP-13, an orphan UST, filled with a presumed petroleum-water mixture and totaling approximately 20,000-gallons, was identified east of the existing building. Based on these field observations, as required by law, the NYSDEC was notified and Spill No. 2404522 was assigned to the Site.

Additional information relative to Roux's PID screening results and visual/olfactory observations is provided in the table below.

Investigation ID	Property Location	Highest PID reading in parts per million (ppm) and depth	Visual/Olfactory Observations
SB-1/1W	Western Portion of Site	800 ppm at 7 fbgs	Petroleum-like odors.
SB-2/2W	Western Portion of Site	37 ppm at 12 fbgs	Petroleum-like odors.
SB-3/3W	Within Building footprint	1,000 ppm at 5 fbgs.	Petroleum-like odors.
SB-4	Within Building footprint	1,000 ppm at 4 fbgs.	Petroleum-like odors.
SB-5/5W	East of existing building	3 ppm at 1 fbgs.	Petroleum-like odors.
TP-1	Western portion of Site	3 ppm at 4 fbgs.	Slight petroleum-like odors.
TP-2	Western portion of Site	420 ppm at 3.5 fbgs.	Petroleum-like odors.
TP-3	Western portion of Site	450 ppm at 4 fbgs.	Petroleum-like odors.

TP-4	Western portion of Site	1,000 ppm at 3 fbgs.	Petroleum-like odors.
TP-5	Western portion of Site	1,000 ppm at 3 fbgs.	Petroleum-like odors.
TP-6	North of existing building	0 ppm	No concerns noted.
TP-7	East of existing building	0 ppm	No concerns noted.
TP-8	East of existing building	0 ppm	No concerns noted.
TP-9	East of existing building	0.5 ppm at 1 fbgs.	Slight petroleum-like odors.
TP-10	East of existing building	1,890 ppm at 8 fbgs.	Petroleum-like odors.
TP-11	East of existing building	300 ppm at 6 fbgs.	Petroleum-like odors.
TP-12	East of existing building	15 ppm at 6 fbgs.	Petroleum-like odors.
TP-13	East of existing building	450 ppm at 4 fbgs.	Petroleum-like odors.
TP-14	East of existing building	5 ppm at 1 fbgs.	Petroleum-like odors.
TP-15	Eastern portion of Site	0 ppm	No concerns noted.
TP-16	Eastern portion of Site	0 ppm	No concerns noted.
TP-17	Eastern portion of Site	0 ppm	Old railbed, no visual/olfactory concerns noted.
TP-18	Eastern portion of Site	0 ppm	No concerns noted.
TP-19	Western portion of Site	100 ppm at 5 fbgs.	Petroleum-like odors.
TP-20	Western portion of Site	50 ppm at 4 fbgs.	Petroleum-like odors.

Additional information relative to lithology and field observations is provided in Attachment 1, photographs taken during the work are included in Attachment 2.

LABORATORY ANALYTICAL RESULTS

Laboratory analytical results were provided by Eurofins Buffalo in reports dated August 23, 2024, August 28, 2024, and September 10, 2024. This laboratory analytical reports are provided in Attachment 3.

Soil Analytical Results

Table 1 presents a summary of the analytical results from the soil samples that were analyzed. For comparative purposes, Table 1 includes NYSDEC Commissioner Policy 51 (CP-51) Soil Cleanup Levels (SCLs) and 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs), Restricted Residential SCOs (RRSCOs), Commercial SCOs (CSCOs), and Industrial SCOs (ISCOs). [CP-51 SCLs are most applicable for petroleum; however, for additional comparison criteria and discussion, Part 375 SCOs are also included.]

No VOC exceedances were identified at TP-1, TP-12, or TP-14.

Petroleum VOCs were detected at concentrations exceeding their respective CP-51 SCLs in four of the eight soil samples collected from the Site at TP-4 (western portion of Site), TP-10 (eastern), SB-3 (building footprint), and SB-4 (building footprint). Regarding Part 375 SCOs, these VOCs exceeded their respective USCOs but not their respective RRSCOs with exception to two compounds, total xylenes and 1,2,4-trimethylbenzene, at TP-10, which exceed their RRSCOs but not their CSCOs. The highest VOC concentrations were identified at TP-10 completed east of the existing building.

PAHs were either at concentrations below laboratory detection limits or their respective CP-51 SCLs/USCOs with exception to TP-1 (west of the existing building) where individual PAHs exceeding their respective CP-51 SCLs, USCOs, RRSCOs, CSCOs and/or ISCOs.

Regarding the two soil samples from TP-4 and TP-10 that were expanded to include total lead and tetraethyl lead, total lead was significantly below its USCO and tetraethyl lead was not detected at a concentration above its laboratory detection limit.

Groundwater
Groundwater sample results are summarized on Table 2 with comparison to Class GA Groundwater Quality Standards (GWQS) per NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1.

As summarized on Table 2, no VOC exceedances of GWQS were identified at SB-2W (west of the existing building) or at SB-3W (within the building footprint). Individual VOCs exceeded their respective GWQS at SB-1W (northwest of the existing building) and SB-5W (east of the existing building). The highest VOC concentrations in groundwater were identified at SB-5W.

CONCLUSIONS

Historic on-Site operations have resulted in petroleum-impacted soil and groundwater at the Site. Based on the results of this investigation, remediation work appears warranted to reclassify Spill No. 2404522 to a "no further action" status. A copy of this report should be provided to the NYSDEC for their review and comment.

Please contact us if you have any questions or require additional information.

Sincerely,
Roux Environmental Engineering and Geology, D.P.C.

Michael A. Lesakowski
Vice President , Principal Scientist,
Co-Operations Manager

Bryan W. Mayback
Technical Director

Attachments
Table 1 – Soil Analytical Results
Table 2 – Groundwater Analytical Results
Figure 1 – Site & Vicinity Map
Figure 2 – Investigation Locations
Attachment 1 – Test Pit and Soil Boring Logs with Well Completion Details
Attachment 2 – Photo Log
Attachment 3 – Laboratory Analytical Report

TABLES

TABLE 1

SUMMARY OF SOIL ANALYTICAL RESULTS

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

PARAMETER [1]	CP-51 SCLs[2]	Unrestricted Use SCOs[2]	Restricted Residential Use SCOs[2]	Commercial Use SCOs[2]	Industrial Use SCOs[2]	SAMPLE LOCATION (DEPTH)							
						TP-1 4-6 ft	TP-4 3-4 ft	TP-10 8-9 ft	TP-11 6-8 ft	TP-12 6-8 ft	TP-14 4-5 ft	SB-3 4-5 ft	SB-4 4-5 ft
Sample Date						08/13/2024			08/14/2024			08/15/2024	
Volatile Organic Compounds (VOCs) - mg/kg [3]													
Methylene chloride	--	0.05	100	500	500	8 vs	ND	ND	0.006 vs	0.013 vs	0.083 vs	ND	ND
Toluene	0.7	0.7	100	500	500	ND	**0.13 J**	ND	ND	ND	ND	ND	ND
Ethylbenzene	1	1	41	390	390	ND	0.79	**34 J**	ND	ND	ND	0.75 J	**1.2 J**
Total Xylenes	0.26	0.26	100	500	1000	ND	**4.2**	**160**	ND	ND	ND	**0.63 J**	ND
Acetone	--	0.05	100	500	--	ND	ND	ND	**0.052 vs**	0.043 vs	0.028 Jvs	ND	ND
n-Butylbenzene	12	12	100	500	--	ND	1.6	1.7	ND	ND	ND	1.2	0.94 J
sec-Butylbenzene	11	11	100	500	500	ND	0.2 J	0.64 J	ND	ND	ND	0.39 J	ND
Isopropylbenzene	2.3	--	--	--	--	ND	0.13 J	**3.9**	ND	ND	ND	0.46 J	0.75 J
p-Isopropyltoluene	10	--	--	--	--	ND	ND	0.93 J	ND	ND	ND	0.76	1.3 J
n-Propylbenzene	3.9	3.9	100	500	500	ND	0.69	**15**	0.00062 Jvs	ND	ND	0.68	0.83 J
1,3,5-Trimethylbenzene	8.4	8.4	52	190	190	ND	3.2	**32**	ND	ND	ND	1.8	2.1 J
1,2,4-Trimethylbenzene	3.6	3.6	52	190	190	ND	**14**	**120**	ND	ND	ND	2	**6.3**
Cyclohexane	--	--	--	--	--	ND	ND	0.82 J	ND	ND	ND	1.5	37
Methyl cyclohexane	--	--	--	--	--	ND	ND	5.4	ND	ND	ND	10	180
Total TICS	--	--	--	--	--	ND	35.8	194.4	0.176	0.1286	ND	50.9	594
Polyaromatic Hydrocarbons (PAHs) - mg/kg [3]													
Anthracene	100	100	100	500	1000	5 J	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	1	1	1	5.6	11	**8.7 J**	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1	1	1	1	1.1	**8.6 J**	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1	1	1	5.6	11	**7.4 J**	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	100	100	100	500	1000	3.8 J	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	0.8	0.8	3.9	56	110	**3.9 J**	ND	ND	ND	ND	ND	ND	ND
Chrysene	1	1	3.9	56	110	**7.8 J**	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	100	100	500	1000	21	0.021 J	ND	ND	ND	0.029 J	ND	ND
Fluorene	30	30	100	500	1000	2.7 J	0.033 J	ND	ND	ND	ND	0.037 J	ND
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.5	5.6	11	**3.2 J**	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12	12	100	500	1000	2.6 J	0.19 J	0.074 J	ND	ND	ND	0.25	ND
Phenanthrene	100	100	100	500	1000	18	0.027 J	ND	ND	ND	ND	0.055 J	ND
Pyrene	100	100	100	500	1000	21 J	0.098 J	ND	ND	ND	0.025 J	ND	ND
Lead - mg/kg													
Total Lead	--	63	400	1000	3900	--	12.1 J	11.6 J	--	--	--	--	--
Tetraethyl lead	--	--	--	--	--	--	ND	ND	--	--	--	--	--

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC CP-51 Soil Cleanup Levels
3. Sample results were reported by the laboratory in ug/kg and converted to mg/kg for comparisons to SCLs

Definitions:

ND = Parameter not detected above laboratory detection limit.
vs = Reported analyte concentrations are below 200 ug/kg and may be biased low due to the sample not being collected according to 5035A-L low-level specifications.
J = Estimated value; result is less than the sample quantitation limit but greater than zero.

Bold	= Results Exceeds its CP-51 SCL or its Unrestricted Use SCO.
Bold	= Results Exceeds its Restricted Residential Use SCO.
Bold	= Results Exceeds its Commercial Use SCO.
Bold	= Results Exceeds its Industrial Use SCO.

TABLE 2

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
PHASE II ENVIRONMENTAL INVESTIGATION
3701 RIVER ROAD
TONAWANDA, NY

PARAMETER[1]	GWQS[2]	Sample Location			
		SB-1W	SB-2W	SB-3W	SB-5W
		08/21/24			
Volatile Organic Compounds (VOCs) - ug/L					
1,2,4-Trimethylbenzene	**5**	3.9 J	ND	ND	**49**
1,3,5-Trimethylbenzene	**5**	ND	ND	ND	**13**
Acetone	**50**	**53**	ND	42 J	ND
Benzene	**1**	**4.6 J**	ND	ND	ND
Cyclohexane	**--**	2.6 J	ND	8	ND
Ethylbenzene	**5**	**8.3**	ND	ND	**25**
Methylcyclohexane	**--**	3.7 J	ND	8.8	1.8 J
p/m-Xylene	**5**	ND	ND	ND	**80**
o-Xylene	**5**	ND	ND	ND	**22**
Xylene (total)	**5**	ND	ND	ND	**100**

Notes:
1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Division of Water Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations - Class GA (TOGS 1.1.1)

Definitions:
ND = Parameter not detected above laboratory detection limit.
"--" = Sample not analyzed for parameter or no SCO available for the parameter.
J = Estimated Value - Below calibration range.
BOLD = Result exceeds GWQS.

FIGURES



QUADRANGLE LOCATION

BASE MAP USGS QUADRANGLE 2019:
BUFFALO NW, NY.

3,000' 0 3,000'

Title: **SITE LOCATION AND VICINITY MAP**

PHASE II SITE INVESTIGATION

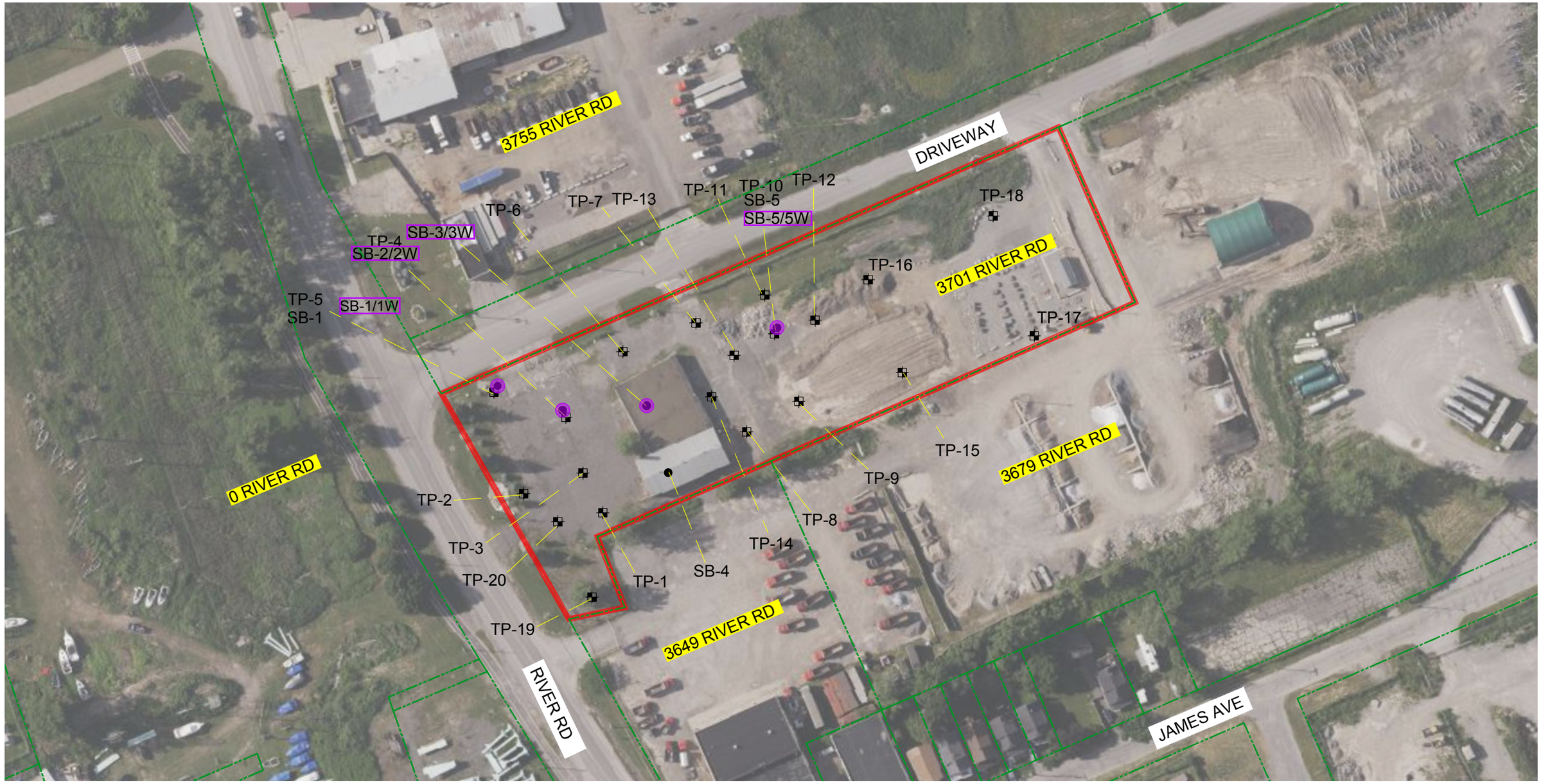
3701 RIVER ROAD
TOWN OF TONAWANDA, NEW YORK

Prepared for:
NEWMAN PROPERTIES LLC

ROUX

Compiled by:	Date: AUGUST 2024	FIGURE
Prepared by: RFL	Scale: AS SHOWN	1
Project Mgr: BWM	Project:	
File: FIGURE 1; SITE LOC VIC_3701.DWG		

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\FIGURE 1; SITE LOC VIC_3701.DWG



LEGEND:

	PROPERTY BOUNDARY
	PARCEL BOUNDARIES
SB-1 ●	SOIL BORING
TP-1 ✚	TEST PIT
SB-1/1W ●	TEMPORARY WELL LOCATION

NOTE:
1. AERIAL IMAGE FROM MICROSOFT BING MAPS USING AUTODESK AUTOCAD GEOLOCATION INTERFACE AUGUST 2024.
2. PARCEL BOUNDARIES FROM ERIE COUNTY GIS – AUGUST 2024.

N

100' 0 100'

Title:
SITE EXPLORATION PLAN

PHASE II SITE INVESTIGATION

3701 RIVER ROAD
TOWN OF TONAWANDA, NEW YORK

Prepared for:
NEWMAN PROPERTIES LLC

ROUX

Compiled by: NAS	Date: AUGUST 2024	FIGURE
Prepared by: RFL	Scale: AS SHOWN	2
Project Mgr: BWM	Project:	
File: FIGURE 2; SITE PLAN_3701.DWG		

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\PHASE II\FIGURE 2; SITE PLAN_3701.DWG

ATTACHMENT 1 – Soil Boring Logs

TP-1

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 6 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	MIXD		Reworked Sandy Lean Clay with mulch			0	
	ASPH		Asphalt Millings			0	
	MLS		Silty Sand- Grey, moist, mostly silty sand, no odors			0	
5	MIXD		Sandy Lean Clay with Fill- Reddish Brown, moist, mostly sandy lean clay, some fill (metal, wood, concrete, brick), slight odors			3	
	CONC		Concrete Bottom of test pit at 6 feet				

ROUX STANDARD LOG_ - 8/23/24 14:59 - F:\GINT\PROJECTS\3701 RIVER ROAD\3701 RIVER ROAD TEST PIT AND SOIL BORING LOGS.GPJ

TP-2

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS

Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 5 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	MIXD		Slag				
1	SPG		Fine Sand and Gravel- Black, moist, mostly fine sand, some subrounded gravel, petroleum-like odors			290	
						390	
2			Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors				
3	CL						
			Suspect petroleum pipes encountered			420	
4							
5			Bottom of test pit at 5 feet				

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TP-3

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS

Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 8 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	MIXD		Slag			115	
	SPG		Fine Sand and Gravel- Black, moist, mostly fine sand, some subrounded gravel, petroleum-like odors			400	
5	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			450 400 188 100	
			Bottom of test pit at 8 feet				

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TP-4

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 6 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	CONC		Concrete				
	SPG		Fine Sand and Gravel- Black, moist, mostly fine sand, some subrounded gravel, petroleum-like odors			400	
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			600	
						1000	
						1000	
5						390	
			Bottom of test pit at 6 feet				

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TP-5

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, petroleum-like odors				
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			300	
						800	
						1000	
						1000	
5						1000	
						400	
						585	
						600	
						350	
10			Bottom of test pit at 10 feet				

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TP-6

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000	
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS	
Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, no odors			0	
						0	
						0	
						0	
5						0	
						0	
						0	
						0	
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, no odors			0	
10			Bottom of test pit at 10 feet				

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TP-7

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 8 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, no odors			0 0	
5	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, no odors			0 0 0 0 0	
			Bottom of test pit at 8 feet				

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TP-8

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, no odors			0	
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, no odors			0	
						0	
						0	
5						0	
						0	
						0	
						0	
						0	
10			Bottom of test pit at 10 feet				

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TP-9

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS

Start to Finish Date: 8/13/2024 - 8/13/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, no odors			0.5	
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, slight odors			0.5	
						0.5	
						0	
5						0	
						0	
						0	
						0	
						0	
10			Bottom of test pit at 10 feet				

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TP-10

Client:	Site:	Project Number:
NOCO Black Dirt Prop LLC	3701 River Road	4369.0005B000
Address:	**City/State:**	**Logged By:**
3701 River Road	Tonawanda, NY	NAS

Start to Finish Date:	Contractor:	Drill Type:	Sampler Type/Method:
8/13/2024 - 8/13/2024	Roux		
Borehole Depth:	**Backfill:**	**Borehole Diameter:**	**DTW:**
10 feet			
Area:	**Elevation:**	**Northing:**	**Easting:**
NM	NM	NM	NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, petroleum-like odors			1.5 1.5	
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			50 100 150 350 1700 1890 250	
5							
10			Bottom of test pit at 10 feet				

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TP-11

Client:	Site:	Project Number:
NOCO Black Dirt Prop LLC	3701 River Road	4369.0005B000
Address:	**City/State:**	**Logged By:**
3701 River Road	Tonawanda, NY	NAS

Start to Finish Date:	Contractor:	Drill Type:	Sampler Type/Method:
8/14/2024 - 8/14/2024	Roux		
Borehole Depth:	**Backfill:**	**Borehole Diameter:**	**DTW:**
8 feet			
Area:	**Elevation:**	**Northing:**	**Easting:**
NM	NM	NM	NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
			Silty Sand- Brown/grey, moist, mostly silty sand, no odors			0	
						0	
	SPG					0	
						0	
5						0	
			Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			300	
	CL					300	
			Bottom of test pit at 8 feet				

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TP-12

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000	
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS	
Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings			0	
			Silty Sand- Brown/grey, moist, mostly silty sand, few fill (tires, wood), no odors			0	
	SPG					0	
5						0	
			Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, slight petroleum-like odors			15	
	CL					15	
						1	
10			Bottom of test pit at 10 feet			1	

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TP-13

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 6 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, petroleum-like odors				
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors- UST encountered			200 200 200 450 450 450	
5			Bottom of test pit at 6 feet				

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TP-14

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Subrounded gravel- Grey, moist, mostly subrounded gravel, loose when disturbed, no odors			5	
5	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, slight petroleum-like odors			5 0 0 0 0 0 0 0	
10			Bottom of test pit at 10 feet				

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TP-15

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, no odors			0	
						0	
						0	
						0	
5						0	
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, no odors			0	
						0	
						0	
						0	
10			Bottom of test pit at 10 feet				

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TP-16

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS

Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
			Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, no odors			0	
						0	
						0	
						0	
5	CL					0	
						0	
						0	
						0	
						0	
10			Bottom of test pit at 10 feet				

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TP-17

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000	
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS	
Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 5 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	GP		Gravel				
1	MIXD		Fill- Black, moist, mostly subangular gravel, some fine sand, some fill (wood) old railbed, loose when disturbed, water rushing in, no odors			0	
2						0	
3						0	
4							
5			Bottom of test pit at 5 feet				

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TP-18

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 10 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, no odors			0	
						0	
						0	
						0	
5						0	
						0	
						0	
						0	
						0	
10			Bottom of test pit at 10 feet				

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TP-19

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 9 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings			0	
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, no odors			0	
5	CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, no odors Impacts noted around old petroleum lines at 5 ft, nothing below or above.			0 0 100 0 0 0	
			Bottom of test pit at 9 feet			0	

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TP-20

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road		Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY		Logged By: NAS
Start to Finish Date: 8/14/2024 - 8/14/2024	Contractor: Roux	Drill Type:	Sampler Type/Method:
Borehole Depth: 9 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	ASPH		Asphalt millings				
	SPG		Silty Sand- Brown/grey, moist, mostly silty sand, no odors			0	
			Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, no odors			0	
						0	
						50	
5	CL					20	
						20	
			Bottom of test pit at 9 feet				

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SB-1/ 1W

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS

Start to Finish Date: 8/15/2024 - 8/15/2024	Contractor: Trec Environmental Inc.	Drill Type: Geoprobe	Sampler Type/Method: 2" Macro-Core
Borehole Depth: 20 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Well Depth: 20 feet	Well Dia./Materials: 1-inch PVC	Screen Interval: 10-20 feet	Screen Slot Size: 10-Slot	Sand/Filter Pack Size: #00	Annular Seal:

Depth (ft)	Well Diagram	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
5		CL		Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			400 500 550 565 690 700 800 300 100 90 85 110 100 60 130 16 3 0 0	
10								
15								

Bottom of borehole at 20 feet

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SB-2/ 2W

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS

Start to Finish Date: 8/15/2024 - 8/15/2024	Contractor: Trec Environmental Inc.	Drill Type: Geoprobe	Sampler Type/Method: 2" Macro-Core
Borehole Depth: 20 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Well Depth: 20 feet	Well Dia./Materials: 1-inch PVC	Screen Interval: 10-20 feet	Screen Slot Size: 10-Slot	Sand/Filter Pack Size: #00	Annular Seal:

Depth (ft)	Well Diagram	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
0				Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			0	
							0	
							0	
							7	
5							10	
							15	
							19	
							17	
							20	
10		CL					28	
							30	
							37	
							35	
							35	
15							35	
							32	
							0	
							0	
							0	

Bottom of borehole at 20 feet

ROUX STANDARD LOG_ - 8/23/24 14:59 - F:\GINT\PROJECTS\3701 RIVER ROAD\3701 RIVER ROAD TEST PIT AND SOIL BORING LOGS.GPJ

SB-3/ 3W

Client:	Site:	Project Number:
NOCO Black Dirt Prop LLC	3701 River Road	4369.0005B000
Address:	**City/State:**	**Logged By:**
3701 River Road	Tonawanda, NY	NAS

Start to Finish Date:	Contractor:	Drill Type:	Sampler Type/Method:
8/15/2024 - 8/15/2024	Trec Environmental Inc.	Geoprobe	2" Macro-Core
Borehole Depth:	**Backfill:**	**Borehole Diameter:**	**DTW:**
20 feet			
Area:	**Elevation:**	**Northing:**	**Easting:**
NM	NM	NM	NM

Well Depth:	Well Dia./Materials:	Screen Interval:	Screen Slot Size:	Sand/Filter Pack Size:	Annular Seal:
20 feet	1-inch PVC	10-20 feet	10-Slot	#00	

Depth (ft)	Well Diagram	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
		CONC		Concrete			30	
		SPG		Fine Sand and Gravel- Black, moist, mostly fine sand, some subrounded gravel, petroleum-like odors			100	
				Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			300	
							800	
5							1000	
							227	
							3	
							6	
							4	
10		CL					3	
							2	
							0	
							0	
							0	
15							0	
							0	
							0	
							0	
							0	

Bottom of borehole at 20 feet

ROUX STANDARD LOG_ - 8/23/24 14:59 - F:\GINT\PROJECTS\3701 RIVER ROAD\3701 RIVER ROAD TEST PIT AND SOIL BORING LOGS.GPJ

SB-4

Client: NOCO Black Dirt Prop LLC	Site: 3701 River Road	Project Number: 4369.0005B000
Address: 3701 River Road	City/State: Tonawanda, NY	Logged By: NAS

Start to Finish Date: 8/15/2024 - 8/15/2024	Contractor: Trec Environmental Inc.	Drill Type: Geoprobe	Sampler Type/Method: 2" Macro-Core
Borehole Depth: 12 feet	Backfill:	Borehole Diameter:	DTW:
Area: NM	Elevation: NM	Northing: NM	Easting: NM

Depth (ft)	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
	CONC		Concrete				
	SPG		Fine Sand and Gravel- Black, moist, mostly fine sand, some subrounded gravel, petroleum-like odors			190	
			Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			500	
						700	
						1000	
5						1000	
	CL					165	
						78	
						30	
						8	
10						0	
						0	
			Bottom of borehole at 12 feet				

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SB-5/ 5W

Client:	Site:	Project Number:
NOCO Black Dirt Prop LLC	3701 River Road	4369.0005B000
Address:	**City/State:**	**Logged By:**
3701 River Road	Tonawanda, NY	NAS

Start to Finish Date:	Contractor:	Drill Type:	Sampler Type/Method:
8/15/2024 - 8/15/2024	Trec Environmental Inc.	Geoprobe	2" Macro-Core
Borehole Depth:	**Backfill:**	**Borehole Diameter:**	**DTW:**
20 feet			
Area:	**Elevation:**	**Northing:**	**Easting:**
NM	NM	NM	NM

Well Depth:	Well Dia./Materials:	Screen Interval:	Screen Slot Size:	Sand/Filter Pack Size:	Annular Seal:
20 feet	1-inch PVC	10-20 feet	10-Slot	#00	

Depth (ft)	Well Diagram	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
0				Sandy Lean Clay- Reddish brown, moist, mostly sandy lean clay, petroleum-like odors			3	
							3	
							3	
							3	
5							3	
							3	
							3	
							3	
							3	
10		CL					3	
							3	
							0	
							0	
							0	
15							0	
							0	
							0	
							0	
							0	

Bottom of borehole at 20 feet

ROUX STANDARD LOG_ - 8/23/24 14:59 - F:\GINT\PROJECTS\3701 RIVER ROAD\3701 RIVER ROAD TEST PIT AND SOIL BORING LOGS.GPJ

ATTACHMENT 2 – Photo Log

SITE PHOTOGRAPHS

Photo 1:



Photo 2:



Photo 3:



Photo 4:



Photo 1: View of TP-2.

Photo 2: View of TP-3.

Photo 3: View of TP-4.

Photo 4: View of TP-5.

SITE PHOTOGRAPHS

Photo 5:



Photo 6:



Photo 7:



Photo 8:



Photo 5: View of TP-13, UST encountered.

Photo 6: View of the uncovering of the UST.

Photo 7: View of the UST top.

Photo 8: View of TP-16.

ATTACHMENT 3 – Laboratory Analytical Report

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Bryan Mayback
Roux Environmental Engineering and Geology DPC
2558 Hamburg Turnpike
Suite 300
Lackawanna, New York 14218

Generated 8/23/2024 12:47:44 PM

JOB DESCRIPTION

3701 River Rd

JOB NUMBER

480-222654-1

Eurofins Buffalo
10 Hazelwood Drive
Amherst NY 14228-2298

See page two for job notes and contact information.

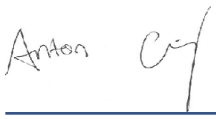
my EOL

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Northeast, LLC Project Manager.

Authorization



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8/23/2024 12:47:44 PM

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Definitions/Glossary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.
vs	Reported analyte concentrations are below 200 ug/kg and may be biased low due to the sample not being collected according to 5035A-L low-level specifications.

GC/MS VOA TICs

Qualifier	Qualifier Description
J	Indicates an Estimated Value for TICs
N	This flag indicates the presumptive evidence of a compound.
T	Result is a tentatively identified compound (TIC) and an estimated value.

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
S1-	Surrogate recovery exceeds control limits, low biased.
U	Indicates the analyte was analyzed for but not detected.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 480-222654-1 Eurofins Buffalo

Job Narrative
480-222654-1

Analytical test results meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page unless otherwise noted under the individual analysis. Data qualifiers and/or narrative comments are included to explain any exceptions, if applicable.

- Matrix QC may not be reported if insufficient sample is provided or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD may be performed, unless otherwise specified in the method.
- Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.

Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Receipt
The samples were received on 8/17/2024 8:00 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 4.4°C.

GC/MS VOA
Method 8260C: The following samples were analyzed using medium level soil analysis and diluted to bring the concentration of target analytes within the calibration range: TP-4 3-4 FT (480-222654-2) and TP-10 8-9 FT (480-222654-3). Elevated reporting limits (RLs) are provided.

Method 8260C: The following samples were analyzed using medium level soil analysis and diluted due to the nature of the sample matrix: SB-3 4-5 FT (480-222654-9) and SB-4 4-5 FT (480-222654-10). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

GC/MS Semi VOA
Method 8270D: Due to the matrix, the following sample could not be concentrated to the final method required volume: TP-1 4-6 FT (480-222654-1). The reporting limits (RLs) are elevated proportionately.

Method 8270D: The following samples were diluted due to color, appearance, and viscosity: TP-1 4-6 FT (480-222654-1) and SB-4 4-5 FT (480-222654-10). Elevated reporting limits (RL) are provided.

Method 8270D: The following sample was diluted due to the nature of the sample matrix: TP-1 4-6 FT (480-222654-1). As such, surrogate recoveries are below the calibration range or are not reported, and elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

General Chemistry
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: TP-1 4-6 FT
Lab Sample ID: 480-222654-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Methylene Chloride	8.0	vs	5.7	2.6	ug/Kg	1	☼	8260C	Total/NA
Anthracene	5000	J	19000	4700	ug/Kg	10	☼	8270D	Total/NA
Benzo[a]anthracene	8700	J	19000	1900	ug/Kg	10	☼	8270D	Total/NA
Benzo[a]pyrene	6500	J	19000	2800	ug/Kg	10	☼	8270D	Total/NA
Benzo[b]fluoranthene	7400	J	19000	3000	ug/Kg	10	☼	8270D	Total/NA
Benzo[g,h,i]perylene	3600	J	19000	2000	ug/Kg	10	☼	8270D	Total/NA
Benzo[k]fluoranthene	3900	J	19000	2500	ug/Kg	10	☼	8270D	Total/NA
Chrysene	7600	J	19000	4300	ug/Kg	10	☼	8270D	Total/NA
Fluoranthene	21000		19000	2000	ug/Kg	10	☼	8270D	Total/NA
Fluorene	2700	J	19000	2200	ug/Kg	10	☼	8270D	Total/NA
Indeno[1,2,3-cd]pyrene	3200	J	19000	2400	ug/Kg	10	☼	8270D	Total/NA
Naphthalene	2500	J	19000	2500	ug/Kg	10	☼	8270D	Total/NA
Pyrene	16000	J	19000	2200	ug/Kg	10	☼	8270D	Total/NA
Phenanthrene	21000		19000	2800	ug/Kg	10	☼	8270D	Total/NA

Client Sample ID: TP-4 3-4 FT
Lab Sample ID: 480-222654-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,2,4-Trimethylbenzene	14000		500	140	ug/Kg	4	☼	8260C	Total/NA
1,3,5-Trimethylbenzene	3200		500	150	ug/Kg	4	☼	8260C	Total/NA
Ethylbenzene	790		500	150	ug/Kg	4	☼	8260C	Total/NA
Isopropylbenzene	130	J	500	75	ug/Kg	4	☼	8260C	Total/NA
m,p-Xylene	2300		1000	280	ug/Kg	4	☼	8260C	Total/NA
n-Butylbenzene	1600		500	150	ug/Kg	4	☼	8260C	Total/NA
N-Propylbenzene	690		500	130	ug/Kg	4	☼	8260C	Total/NA
o-Xylene	1900		500	65	ug/Kg	4	☼	8260C	Total/NA
sec-Butylbenzene	200	J	500	180	ug/Kg	4	☼	8260C	Total/NA
Toluene	130	J	500	130	ug/Kg	4	☼	8260C	Total/NA
Xylenes, Total	4200		1000	280	ug/Kg	4	☼	8260C	Total/NA
Fluoranthene	21	J	200	21	ug/Kg	1	☼	8270D	Total/NA
Fluorene	33	J	200	23	ug/Kg	1	☼	8270D	Total/NA
Naphthalene	190	J	200	25	ug/Kg	1	☼	8270D	Total/NA
Pyrene	27	J	200	23	ug/Kg	1	☼	8270D	Total/NA
Phenanthrene	98	J	200	29	ug/Kg	1	☼	8270D	Total/NA

Client Sample ID: TP-10 8-9 FT
Lab Sample ID: 480-222654-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,2,4-Trimethylbenzene	120000		1300	370	ug/Kg	10	☼	8260C	Total/NA
1,3,5-Trimethylbenzene	32000		1300	400	ug/Kg	10	☼	8260C	Total/NA
4-Isopropyltoluene	930	J	1300	440	ug/Kg	10	☼	8260C	Total/NA
Cyclohexane	820	J	1300	290	ug/Kg	10	☼	8260C	Total/NA
Ethylbenzene	34000		1300	380	ug/Kg	10	☼	8260C	Total/NA
Isopropylbenzene	3900		1300	200	ug/Kg	10	☼	8260C	Total/NA
Methylcyclohexane	5400		1300	610	ug/Kg	10	☼	8260C	Total/NA
m,p-Xylene	130000		2600	730	ug/Kg	10	☼	8260C	Total/NA
n-Butylbenzene	1700		1300	380	ug/Kg	10	☼	8260C	Total/NA
N-Propylbenzene	15000		1300	340	ug/Kg	10	☼	8260C	Total/NA
o-Xylene	34000		1300	170	ug/Kg	10	☼	8260C	Total/NA
sec-Butylbenzene	640	J	1300	480	ug/Kg	10	☼	8260C	Total/NA
Xylenes, Total	160000		2600	730	ug/Kg	10	☼	8260C	Total/NA
Naphthalene	74	J	200	26	ug/Kg	1	☼	8270D	Total/NA

This Detection Summary does not include radiochemical test results.

Eurofins Buffalo

Detection Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: TP-11 6-8 FT
Lab Sample ID: 480-222654-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	52	vs	29	4.9	ug/Kg	1	☼	8260C	Total/NA
Methylene Chloride	6.0	vs	5.8	2.7	ug/Kg	1	☼	8260C	Total/NA
N-Propylbenzene	0.62	J vs	5.8	0.47	ug/Kg	1	☼	8260C	Total/NA

Client Sample ID: TP-12 6-8 FT
Lab Sample ID: 480-222654-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	43	vs	29	4.8	ug/Kg	1	☼	8260C	Total/NA
Methylene Chloride	13	vs	5.7	2.6	ug/Kg	1	☼	8260C	Total/NA

Client Sample ID: TP-14 4-5 FT
Lab Sample ID: 480-222654-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	28	J vs	29	4.9	ug/Kg	1	☼	8260C	Total/NA
Methylene Chloride	8.3	vs	5.9	2.7	ug/Kg	1	☼	8260C	Total/NA
Fluoranthene	29	J	200	21	ug/Kg	1	☼	8270D	Total/NA
Pyrene	25	J	200	23	ug/Kg	1	☼	8270D	Total/NA

Client Sample ID: SB-3 4-5 FT
Lab Sample ID: 480-222654-9

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,2,4-Trimethylbenzene	2000		630	180	ug/Kg	5	☼	8260C	Total/NA
1,3,5-Trimethylbenzene	1800		630	190	ug/Kg	5	☼	8260C	Total/NA
4-Isopropyltoluene	760		630	210	ug/Kg	5	☼	8260C	Total/NA
Cyclohexane	1500		630	140	ug/Kg	5	☼	8260C	Total/NA
Ethylbenzene	750		630	180	ug/Kg	5	☼	8260C	Total/NA
Isopropylbenzene	460	J	630	95	ug/Kg	5	☼	8260C	Total/NA
Methylcyclohexane	10000		630	300	ug/Kg	5	☼	8260C	Total/NA
m,p-Xylene	630	J	1300	350	ug/Kg	5	☼	8260C	Total/NA
n-Butylbenzene	1200		630	180	ug/Kg	5	☼	8260C	Total/NA
N-Propylbenzene	680		630	170	ug/Kg	5	☼	8260C	Total/NA
sec-Butylbenzene	390	J	630	230	ug/Kg	5	☼	8260C	Total/NA
Xylenes, Total	630	J	1300	350	ug/Kg	5	☼	8260C	Total/NA
Fluorene	37	J	200	23	ug/Kg	1	☼	8270D	Total/NA
Naphthalene	250		200	26	ug/Kg	1	☼	8270D	Total/NA
Phenanthrene	55	J	200	29	ug/Kg	1	☼	8270D	Total/NA

Client Sample ID: SB-4 4-5 FT
Lab Sample ID: 480-222654-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,2,4-Trimethylbenzene	6300		2300	650	ug/Kg	20	☼	8260C	Total/NA
1,3,5-Trimethylbenzene	2100	J	2300	710	ug/Kg	20	☼	8260C	Total/NA
4-Isopropyltoluene	1300	J	2300	790	ug/Kg	20	☼	8260C	Total/NA
Cyclohexane	37000		2300	520	ug/Kg	20	☼	8260C	Total/NA
Ethylbenzene	1200	J	2300	680	ug/Kg	20	☼	8260C	Total/NA
Isopropylbenzene	750	J	2300	350	ug/Kg	20	☼	8260C	Total/NA
Methylcyclohexane	180000		2300	1100	ug/Kg	20	☼	8260C	Total/NA
n-Butylbenzene	940	J	2300	680	ug/Kg	20	☼	8260C	Total/NA
N-Propylbenzene	830	J	2300	610	ug/Kg	20	☼	8260C	Total/NA

This Detection Summary does not include radiochemical test results.

Client: Roux Environmental Engineering and Geology DPC
Project/Site: 3701 River Rd

Job ID: 480-222654-1

Client Sample ID: TP-1 4-6 FT
Date Collected: 08/13/24 09:00
Date Received: 08/17/24 08:00

Lab Sample ID: 480-222654-1
Matrix: Solid
Percent Solids: 87.4

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	5.7	U vs	5.7	0.41	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,1,2,2-Tetrachloroethane	5.7	U vs	5.7	0.92	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,1,2-Trichloro-1,2,2-trifluoroethane	5.7	U vs	5.7	1.3	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,1,2-Trichloroethane	5.7	U vs	5.7	0.74	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,1-Dichloroethane	5.7	U vs	5.7	0.69	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,1-Dichloroethene	5.7	U vs	5.7	0.69	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,2,4-Trichlorobenzene	5.7	U vs	5.7	0.34	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,2,4-Trimethylbenzene	5.7	U vs	5.7	1.1	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,2-Dibromo-3-Chloropropane	5.7	U vs	5.7	2.8	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,2-Dichlorobenzene	5.7	U vs	5.7	0.44	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,2-Dichloroethane	5.7	U vs	5.7	0.28	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,2-Dichloropropane	5.7	U vs	5.7	2.8	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,3,5-Trimethylbenzene	5.7	U vs	5.7	0.36	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,3-Dichlorobenzene	5.7	U vs	5.7	0.29	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,4-Dichlorobenzene	5.7	U vs	5.7	0.79	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
2-Butanone (MEK)	28	U vs	28	2.1	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
2-Hexanone	28	U vs	28	2.8	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
4-Isopropyltoluene	5.7	U vs	5.7	0.45	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
4-Methyl-2-pentanone (MIBK)	28	U vs	28	1.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Acetone	28	U vs	28	4.8	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Benzene	5.7	U vs	5.7	0.28	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Bromoform	5.7	U vs	5.7	2.8	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Bromomethane	5.7	U vs	5.7	0.51	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Carbon disulfide	5.7	U vs	5.7	2.8	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Carbon tetrachloride	5.7	U vs	5.7	0.55	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Chlorobenzene	5.7	U vs	5.7	0.75	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Dibromochloromethane	5.7	U vs	5.7	0.72	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Chloroethane	5.7	U vs	5.7	1.3	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Chloroform	5.7	U vs	5.7	0.35	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Chloromethane	5.7	U vs	5.7	0.34	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
cis-1,2-Dichloroethene	5.7	U vs	5.7	0.72	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Cyclohexane	5.7	U vs	5.7	0.79	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Bromodichloromethane	5.7	U vs	5.7	0.76	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Dichlorodifluoromethane	5.7	U vs	5.7	0.47	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Ethylbenzene	5.7	U vs	5.7	0.39	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
1,2-Dibromoethane	5.7	U vs	5.7	0.73	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Isopropylbenzene	5.7	U vs	5.7	0.85	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Methyl acetate	28	U vs	28	3.4	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Methyl tert-butyl ether	5.7	U vs	5.7	0.56	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Methylcyclohexane	5.7	U vs	5.7	0.86	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Methylene Chloride	**8.0**	**vs**	5.7	2.6	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
m,p-Xylene	11	U vs	11	0.95	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
n-Butylbenzene	5.7	U vs	5.7	0.49	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
N-Propylbenzene	5.7	U vs	5.7	0.45	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
o-Xylene	5.7	U vs	5.7	0.74	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
sec-Butylbenzene	5.7	U vs	5.7	0.49	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Tetrachloroethene	5.7	U vs	5.7	0.76	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Toluene	5.7	U vs	5.7	0.43	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
trans-1,2-Dichloroethene	5.7	U vs	5.7	0.58	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1

Client Sample ID: TP-1 4-6 FT
Lab Sample ID: 480-222654-1

Date Collected: 08/13/24 09:00
Matrix: Solid

Date Received: 08/17/24 08:00
Percent Solids: 87.4

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	5.7	U vs	5.7	2.5	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Trichloroethene	5.7	U vs	5.7	1.2	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Trichlorofluoromethane	5.7	U vs	5.7	0.53	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Vinyl chloride	5.7	U vs	5.7	0.69	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Xylenes, Total	11	U vs	11	0.95	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
cis-1,3-Dichloropropene	5.7	U vs	5.7	0.81	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
Styrene	5.7	U vs	5.7	0.28	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1
tert-Butylbenzene	5.7	U vs	5.7	0.59	ug/Kg	☼	08/19/24 10:41	08/19/24 15:07	1

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Tentatively Identified Compound	*None*		*ug/Kg*	☼		*N/A*	*08/19/24 10:41*	*08/19/24 15:07*	*1*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*105*		*64 - 126*	*08/19/24 10:41*	*08/19/24 15:07*	*1*
4-Bromofluorobenzene (Surr)	*97*		*72 - 126*	*08/19/24 10:41*	*08/19/24 15:07*	*1*
Toluene-d8 (Surr)	*94*		*71 - 125*	*08/19/24 10:41*	*08/19/24 15:07*	*1*
Dibromofluoromethane (Surr)	*101*		*60 - 140*	*08/19/24 10:41*	*08/19/24 15:07*	*1*

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	19000	U	19000	2800	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Acenaphthylene	19000	U	19000	2500	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Anthracene	**5000**	**J**	19000	4700	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Benzo[a]anthracene	**8700**	**J**	19000	1900	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Benzo[a]pyrene	**6500**	**J**	19000	2800	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Benzo[b]fluoranthene	**7400**	**J**	19000	3000	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Benzo[g,h,i]perylene	**3600**	**J**	19000	2000	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Benzo[k]fluoranthene	**3900**	**J**	19000	2500	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Chrysene	**7600**	**J**	19000	4300	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Dibenz(a,h)anthracene	19000	U	19000	3400	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Fluoranthene	**21000**		19000	2000	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Fluorene	**2700**	**J**	19000	2200	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Indeno[1,2,3-cd]pyrene	**3200**	**J**	19000	2400	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Naphthalene	**2500**	**J**	19000	2500	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Pyrene	**16000**	**J**	19000	2200	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10
Phenanthrene	**21000**		19000	2800	ug/Kg	☼	08/20/24 16:30	08/21/24 17:24	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*0*	*S1-*	*26 - 143*	*08/20/24 16:30*	*08/21/24 17:24*	*10*
2-Fluorobiphenyl (Surr)	*73*		*50 - 121*	*08/20/24 16:30*	*08/21/24 17:24*	*10*
2-Fluorophenol (Surr)	*80*		*36 - 120*	*08/20/24 16:30*	*08/21/24 17:24*	*10*
Phenol-d5 (Surr)	*81*		*41 - 120*	*08/20/24 16:30*	*08/21/24 17:24*	*10*
p-Terphenyl-d14 (Surr)	*81*		*46 - 143*	*08/20/24 16:30*	*08/21/24 17:24*	*10*
Nitrobenzene-d5 (Surr)	*87*		*40 - 121*	*08/20/24 16:30*	*08/21/24 17:24*	*10*

Client Sample ID: TP-4 3-4 FT

Date Collected: 08/13/24 11:30
Date Received: 08/17/24 08:00

Lab Sample ID: 480-222654-2

Matrix: Solid
Percent Solids: 85.4

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	500	U	500	140	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,1,2,2-Tetrachloroethane	500	U	500	81	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,1,2-Trichloro-1,2,2-trifluoroethane	500	U	500	250	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,1,2-Trichloroethane	500	U	500	100	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,1-Dichloroethane	500	U	500	150	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,1-Dichloroethene	500	U	500	170	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,2,4-Trichlorobenzene	500	U	500	190	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,2,4-Trimethylbenzene	**14000**		500	140	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,2-Dibromo-3-Chloropropane	500	U	500	250	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,2-Dichlorobenzene	500	U	500	130	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,2-Dichloroethane	500	U	500	200	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,2-Dichloropropane	500	U	500	81	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,3,5-Trimethylbenzene	**3200**		500	150	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,3-Dichlorobenzene	500	U	500	130	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,4-Dichlorobenzene	500	U	500	70	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
2-Butanone (MEK)	2500	U	2500	1500	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
2-Hexanone	2500	U	2500	1000	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
4-Isopropyltoluene	500	U	500	170	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
4-Methyl-2-pentanone (MIBK)	2500	U	2500	160	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Acetone	2500	U	2500	2100	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Benzene	500	U	500	95	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Bromoform	500	U	500	250	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Bromomethane	500	U	500	110	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Carbon disulfide	500	U	500	230	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Carbon tetrachloride	500	U	500	130	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Chlorobenzene	500	U	500	66	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Dibromochloromethane	500	U	500	240	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Chloroethane	500	U	500	100	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Chloroform	500	U	500	340	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Chloromethane	500	U	500	120	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
cis-1,2-Dichloroethene	500	U	500	140	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Cyclohexane	500	U	500	110	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Bromodichloromethane	500	U	500	100	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Dichlorodifluoromethane	500	U	500	220	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Ethylbenzene	**790**		500	150	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
1,2-Dibromoethane	500	U	500	87	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Isopropylbenzene	**130**	**J**	500	75	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Methyl acetate	2500	U	2500	240	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Methyl tert-butyl ether	500	U	500	190	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Methylcyclohexane	500	U	500	230	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Methylene Chloride	500	U	500	99	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
m,p-Xylene	**2300**		1000	280	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
n-Butylbenzene	**1600**		500	150	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
N-Propylbenzene	**690**		500	130	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
o-Xylene	**1900**		500	65	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
sec-Butylbenzene	**200**	**J**	500	180	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Tetrachloroethene	500	U	500	67	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Toluene	**130**	**J**	500	130	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
trans-1,2-Dichloroethene	500	U	500	120	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4

Client Sample ID: TP-4 3-4 FT
Date Collected: 08/13/24 11:30
Date Received: 08/17/24 08:00

Lab Sample ID: 480-222654-2
Matrix: Solid
Percent Solids: 85.4

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	500	U	500	49	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Trichloroethene	500	U	500	140	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Trichlorofluoromethane	500	U	500	230	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Vinyl chloride	500	U	500	170	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Xylenes, Total	**4200**		1000	280	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
cis-1,3-Dichloropropene	500	U	500	120	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
Styrene	500	U	500	120	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4
tert-Butylbenzene	500	U	500	140	ug/Kg	☼	08/19/24 09:39	08/19/24 13:48	4

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Benzene, 1-ethyl-2-methyl-	*3200*	*T J N*	*ug/Kg*	☼	*9.33*	*611-14-3*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Benzene, 1,2,3-trimethyl-	*5100*	*T J N*	*ug/Kg*	☼	*10.22*	*526-73-8*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Benzene, 1-ethenyl-2-methyl-	*4900*	*T J N*	*ug/Kg*	☼	*10.41*	*611-15-4*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Benzene, 1-methyl-3-(1-methylethyl)-	*2800*	*T J N*	*ug/Kg*	☼	*10.75*	*535-77-3*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Benzene, 1-ethyl-2,4-dimethyl-	*4200*	*T J N*	*ug/Kg*	☼	*10.85*	*874-41-9*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Benzene, 1,2,4,5-tetramethyl-	*2900*	*T J N*	*ug/Kg*	☼	*11.21*	*95-93-2*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Benzene, 1,2,3,4-tetramethyl-	*3700*	*T J N*	*ug/Kg*	☼	*11.26*	*488-23-3*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
1-Phenyl-1-butene	*4700*	*T J N*	*ug/Kg*	☼	*11.63*	*824-90-8*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Naphthalene, 2-methyl-	*4300*	*T J N*	*ug/Kg*	☼	*13.10*	*91-57-6*	*08/19/24 09:39*	*08/19/24 13:48*	*4*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*102*		*53 - 146*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
4-Bromofluorobenzene (Surr)	*92*		*49 - 148*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Toluene-d8 (Surr)	*102*		*50 - 149*	*08/19/24 09:39*	*08/19/24 13:48*	*4*
Dibromofluoromethane (Surr)	*96*		*60 - 140*	*08/19/24 09:39*	*08/19/24 13:48*	*4*

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Acenaphthylene	200	U	200	25	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Anthracene	200	U	200	49	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Benzo[a]anthracene	200	U	200	20	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Benzo[a]pyrene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Benzo[b]fluoranthene	200	U	200	31	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Benzo[g,h,i]perylene	200	U	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Benzo[k]fluoranthene	200	U	200	25	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Chrysene	200	U	200	44	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Dibenz(a,h)anthracene	200	U	200	35	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Fluoranthene	**21**	**J**	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Fluorene	**33**	**J**	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Indeno[1,2,3-cd]pyrene	200	U	200	24	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Naphthalene	**190**	**J**	200	25	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Pyrene	**27**	**J**	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1
Phenanthrene	**98**	**J**	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 17:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*81*		*26 - 143*	*08/20/24 16:30*	*08/21/24 17:49*	*1*
2-Fluorobiphenyl (Surr)	*59*		*50 - 121*	*08/20/24 16:30*	*08/21/24 17:49*	*1*
2-Fluorophenol (Surr)	*56*		*36 - 120*	*08/20/24 16:30*	*08/21/24 17:49*	*1*
Phenol-d5 (Surr)	*53*		*41 - 120*	*08/20/24 16:30*	*08/21/24 17:49*	*1*

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: TP-4 3-4 FT
Lab Sample ID: 480-222654-2
Date Collected: 08/13/24 11:30
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 85.4

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
p-Terphenyl-d14 (Surr)	88		46 - 143	08/20/24 16:30	08/21/24 17:49	1
Nitrobenzene-d5 (Surr)	55		40 - 121	08/20/24 16:30	08/21/24 17:49	1

Client: Roux Environmental Engineering and Geology DPC
Project/Site: 3701 River Rd

Job ID: 480-222654-1

Client Sample ID: TP-10 8-9 FT
Date Collected: 08/13/24 16:00
Date Received: 08/17/24 08:00

Lab Sample ID: 480-222654-3
Matrix: Solid
Percent Solids: 82.7

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	1300	U	1300	360	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,1,2,2-Tetrachloroethane	1300	U	1300	210	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,1,2-Trichloro-1,2,2-trifluoroethane	1300	U	1300	660	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,1,2-Trichloroethane	1300	U	1300	280	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,1-Dichloroethane	1300	U	1300	410	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,1-Dichloroethene	1300	U	1300	450	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,2,4-Trichlorobenzene	1300	U	1300	500	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,2,4-Trimethylbenzene	**120000**		1300	370	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,2-Dibromo-3-Chloropropane	1300	U	1300	660	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,2-Dichlorobenzene	1300	U	1300	330	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,2-Dichloroethane	1300	U	1300	540	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,2-Dichloropropane	1300	U	1300	210	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,3,5-Trimethylbenzene	**32000**		1300	400	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,3-Dichlorobenzene	1300	U	1300	350	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,4-Dichlorobenzene	1300	U	1300	180	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
2-Butanone (MEK)	6600	U	6600	3900	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
2-Hexanone	6600	U	6600	2700	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
4-Isopropyltoluene	**930**	**J**	1300	440	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
4-Methyl-2-pentanone (MIBK)	6600	U	6600	420	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Acetone	6600	U	6600	5400	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Benzene	1300	U	1300	250	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Bromoform	1300	U	1300	660	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Bromomethane	1300	U	1300	290	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Carbon disulfide	1300	U	1300	600	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Carbon tetrachloride	1300	U	1300	330	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Chlorobenzene	1300	U	1300	170	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Dibromochloromethane	1300	U	1300	640	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Chloroethane	1300	U	1300	270	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Chloroform	1300	U	1300	900	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Chloromethane	1300	U	1300	310	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
cis-1,2-Dichloroethene	1300	U	1300	360	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Cyclohexane	**820**	**J**	1300	290	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Bromodichloromethane	1300	U	1300	260	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Dichlorodifluoromethane	1300	U	1300	570	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Ethylbenzene	**34000**		1300	380	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
1,2-Dibromoethane	1300	U	1300	230	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Isopropylbenzene	**3900**		1300	200	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Methyl acetate	6600	U	6600	630	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Methyl tert-butyl ether	1300	U	1300	500	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Methylcyclohexane	**5400**		1300	610	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Methylene Chloride	1300	U	1300	260	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
m,p-Xylene	**130000**		2600	730	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
n-Butylbenzene	**1700**		1300	380	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
N-Propylbenzene	**15000**		1300	340	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
o-Xylene	**34000**		1300	170	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
sec-Butylbenzene	**640**	**J**	1300	480	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Tetrachloroethene	1300	U	1300	180	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Toluene	1300	U	1300	350	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
trans-1,2-Dichloroethene	1300	U	1300	310	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10

Client Sample ID: TP-10 8-9 FT
Date Collected: 08/13/24 16:00
Date Received: 08/17/24 08:00

Lab Sample ID: 480-222654-3
Matrix: Solid
Percent Solids: 82.7

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	1300	U	1300	130	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Trichloroethene	1300	U	1300	370	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Trichlorofluoromethane	1300	U	1300	620	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Vinyl chloride	1300	U	1300	440	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Xylenes, Total	**160000**		2600	730	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
cis-1,3-Dichloropropene	1300	U	1300	310	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
Styrene	1300	U	1300	320	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10
tert-Butylbenzene	1300	U	1300	370	ug/Kg	☼	08/19/24 09:39	08/19/24 14:09	10

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Heptane	*5500*	*T J N*	*ug/Kg*	☼	*4.68*	*142-82-5*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Octane	*5800*	*T J N*	*ug/Kg*	☼	*6.38*	*111-65-9*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Unknown	*4900*	*T J*	*ug/Kg*	☼	*8.57*	*N/A*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Benzene, 1-ethyl-3-methyl-	*95000*	*T J N*	*ug/Kg*	☼	*9.31*	*620-14-4*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Benzene, 1-ethyl-2-methyl-	*27000*	*T J N*	*ug/Kg*	☼	*9.61*	*611-14-3*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Benzene, 1,2,3-trimethyl-	*31000*	*T J N*	*ug/Kg*	☼	*10.22*	*526-73-8*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Indane	*13000*	*T J N*	*ug/Kg*	☼	*10.40*	*496-11-7*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Undecane	*7200*	*T J N*	*ug/Kg*	☼	*10.59*	*1120-21-4*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Benzene, 1-methyl-2-(1-methylethyl)-	*5000*	*T J N*	*ug/Kg*	☼	*10.77*	*527-84-4*	*08/19/24 09:39*	*08/19/24 14:09*	*10*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*102*		*53 - 146*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
4-Bromofluorobenzene (Surr)	*96*		*49 - 148*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Toluene-d8 (Surr)	*102*		*50 - 149*	*08/19/24 09:39*	*08/19/24 14:09*	*10*
Dibromofluoromethane (Surr)	*96*		*60 - 140*	*08/19/24 09:39*	*08/19/24 14:09*	*10*

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	200	U	200	30	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Acenaphthylene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Anthracene	200	U	200	50	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Benzo[a]anthracene	200	U	200	20	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Benzo[a]pyrene	200	U	200	30	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Benzo[b]fluoranthene	200	U	200	32	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Benzo[g,h,i]perylene	200	U	200	22	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Benzo[k]fluoranthene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Chrysene	200	U	200	45	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Dibenz(a,h)anthracene	200	U	200	36	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Fluoranthene	200	U	200	22	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Fluorene	200	U	200	24	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Indeno[1,2,3-cd]pyrene	200	U	200	25	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Naphthalene	**74**	**J**	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Pyrene	200	U	200	24	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1
Phenanthrene	200	U	200	30	ug/Kg	☼	08/20/24 16:30	08/21/24 18:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*86*		*26 - 143*	*08/20/24 16:30*	*08/21/24 18:13*	*1*
2-Fluorobiphenyl (Surr)	*69*		*50 - 121*	*08/20/24 16:30*	*08/21/24 18:13*	*1*
2-Fluorophenol (Surr)	*64*		*36 - 120*	*08/20/24 16:30*	*08/21/24 18:13*	*1*
Phenol-d5 (Surr)	*70*		*41 - 120*	*08/20/24 16:30*	*08/21/24 18:13*	*1*

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: TP-10 8-9 FT
Lab Sample ID: 480-222654-3
Date Collected: 08/13/24 16:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 82.7

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
p-Terphenyl-d14 (Surr)	87		46 - 143	08/20/24 16:30	08/21/24 18:13	1
Nitrobenzene-d5 (Surr)	68		40 - 121	08/20/24 16:30	08/21/24 18:13	1

Client Sample ID: TP-11 6-8 FT
Lab Sample ID: 480-222654-4

Date Collected: 08/14/24 09:00
Matrix: Solid

Date Received: 08/17/24 08:00
Percent Solids: 83.9

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	5.8	U vs	5.8	0.42	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,1,2,2-Tetrachloroethane	5.8	U vs	5.8	0.94	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,1,2-Trichloro-1,2,2-trifluoroethane	5.8	U vs	5.8	1.3	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,1,2-Trichloroethane	5.8	U vs	5.8	0.76	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,1-Dichloroethane	5.8	U vs	5.8	0.71	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,1-Dichloroethene	5.8	U vs	5.8	0.71	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,2,4-Trichlorobenzene	5.8	U vs	5.8	0.35	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,2,4-Trimethylbenzene	5.8	U vs	5.8	1.1	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,2-Dibromo-3-Chloropropane	5.8	U vs	5.8	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,2-Dichlorobenzene	5.8	U vs	5.8	0.46	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,2-Dichloroethane	5.8	U vs	5.8	0.29	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,2-Dichloropropane	5.8	U vs	5.8	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,3,5-Trimethylbenzene	5.8	U vs	5.8	0.37	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,3-Dichlorobenzene	5.8	U vs	5.8	0.30	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,4-Dichlorobenzene	5.8	U vs	5.8	0.81	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
2-Butanone (MEK)	29	U vs	29	2.1	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
2-Hexanone	29	U vs	29	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
4-Isopropyltoluene	5.8	U vs	5.8	0.47	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
4-Methyl-2-pentanone (MIBK)	29	U vs	29	1.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Acetone	**52**	**vs**	29	4.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Benzene	5.8	U vs	5.8	0.29	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Bromoform	5.8	U vs	5.8	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Bromomethane	5.8	U vs	5.8	0.52	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Carbon disulfide	5.8	U vs	5.8	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Carbon tetrachloride	5.8	U vs	5.8	0.56	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Chlorobenzene	5.8	U vs	5.8	0.77	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Dibromochloromethane	5.8	U vs	5.8	0.74	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Chloroethane	5.8	U vs	5.8	1.3	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Chloroform	5.8	U vs	5.8	0.36	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Chloromethane	5.8	U vs	5.8	0.35	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
cis-1,2-Dichloroethene	5.8	U vs	5.8	0.74	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Cyclohexane	5.8	U vs	5.8	0.81	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Bromodichloromethane	5.8	U vs	5.8	0.78	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Dichlorodifluoromethane	5.8	U vs	5.8	0.48	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Ethylbenzene	5.8	U vs	5.8	0.40	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
1,2-Dibromoethane	5.8	U vs	5.8	0.75	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Isopropylbenzene	5.8	U vs	5.8	0.88	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Methyl acetate	29	U vs	29	3.5	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Methyl tert-butyl ether	5.8	U vs	5.8	0.57	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Methylcyclohexane	5.8	U vs	5.8	0.88	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Methylene Chloride	**6.0**	**vs**	5.8	2.7	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
m,p-Xylene	12	U vs	12	0.98	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
n-Butylbenzene	5.8	U vs	5.8	0.51	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
N-Propylbenzene	**0.62**	**J vs**	5.8	0.47	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
o-Xylene	5.8	U vs	5.8	0.76	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
sec-Butylbenzene	5.8	U vs	5.8	0.51	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Tetrachloroethene	5.8	U vs	5.8	0.78	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Toluene	5.8	U vs	5.8	0.44	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
trans-1,2-Dichloroethene	5.8	U vs	5.8	0.60	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1

Client Sample ID: TP-11 6-8 FT
Lab Sample ID: 480-222654-4
Date Collected: 08/14/24 09:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 83.9

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	5.8	U vs	5.8	2.6	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Trichloroethene	5.8	U vs	5.8	1.3	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Trichlorofluoromethane	5.8	U vs	5.8	0.55	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Vinyl chloride	5.8	U vs	5.8	0.71	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Xylenes, Total	12	U vs	12	0.98	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
cis-1,3-Dichloropropene	5.8	U vs	5.8	0.84	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
Styrene	5.8	U vs	5.8	0.29	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1
tert-Butylbenzene	5.8	U vs	5.8	0.61	ug/Kg	☼	08/19/24 10:41	08/19/24 15:31	1

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Pentane, 2,3,3-trimethyl-	*12*	*T J N*	*ug/Kg*	☼	*6.35*	*560-21-4*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Naphthalene, decahydro-2-methyl-	*13*	*T J N*	*ug/Kg*	☼	*11.79*	*2958-76-1*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Unknown	*29*	*T J*	*ug/Kg*	☼	*12.72*	*N/A*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Unknown	*13*	*T J*	*ug/Kg*	☼	*12.78*	*N/A*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Dodecane, 2,6,10-trimethyl-	*22*	*T J N*	*ug/Kg*	☼	*13.53*	*3891-98-3*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Unknown	*10*	*T J*	*ug/Kg*	☼	*13.69*	*N/A*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Unknown	*10*	*T J*	*ug/Kg*	☼	*13.91*	*N/A*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Hexadecane	*28*	*T J N*	*ug/Kg*	☼	*14.12*	*544-76-3*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Unknown	*25*	*T J*	*ug/Kg*	☼	*14.34*	*N/A*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Unknown	*14*	*T J*	*ug/Kg*	☼	*14.63*	*N/A*	*08/19/24 10:41*	*08/19/24 15:31*	*1*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*104*		*64 - 126*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
4-Bromofluorobenzene (Surr)	*98*		*72 - 126*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Toluene-d8 (Surr)	*94*		*71 - 125*	*08/19/24 10:41*	*08/19/24 15:31*	*1*
Dibromofluoromethane (Surr)	*104*		*60 - 140*	*08/19/24 10:41*	*08/19/24 15:31*	*1*

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Acenaphthylene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Anthracene	200	U	200	49	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Benzo[a]anthracene	200	U	200	20	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Benzo[a]pyrene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Benzo[b]fluoranthene	200	U	200	32	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Benzo[g,h,i]perylene	200	U	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Benzo[k]fluoranthene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Chrysene	200	U	200	44	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Dibenz(a,h)anthracene	200	U	200	35	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Fluoranthene	200	U	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Fluorene	200	U	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Indeno[1,2,3-cd]pyrene	200	U	200	25	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Naphthalene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Pyrene	200	U	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1
Phenanthrene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 16:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*94*		*26 - 143*	*08/20/24 16:30*	*08/21/24 16:59*	*1*
2-Fluorobiphenyl (Surr)	*76*		*50 - 121*	*08/20/24 16:30*	*08/21/24 16:59*	*1*
2-Fluorophenol (Surr)	*69*		*36 - 120*	*08/20/24 16:30*	*08/21/24 16:59*	*1*

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: TP-11 6-8 FT
Lab Sample ID: 480-222654-4
Date Collected: 08/14/24 09:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 83.9

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Phenol-d5 (Surr)	73		41 - 120	08/20/24 16:30	08/21/24 16:59	1
p-Terphenyl-d14 (Surr)	98		46 - 143	08/20/24 16:30	08/21/24 16:59	1
Nitrobenzene-d5 (Surr)	69		40 - 121	08/20/24 16:30	08/21/24 16:59	1

Client: Roux Environmental Engineering and Geology DPC
Project/Site: 3701 River Rd

Job ID: 480-222654-1

Client Sample ID: TP-12 6-8 FT
Date Collected: 08/14/24 11:00
Date Received: 08/17/24 08:00

Lab Sample ID: 480-222654-5
Matrix: Solid
Percent Solids: 83.8

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	5.7	U vs	5.7	0.41	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,1,2,2-Tetrachloroethane	5.7	U vs	5.7	0.93	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,1,2-Trichloro-1,2,2-trifluoroethane	5.7	U vs	5.7	1.3	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,1,2-Trichloroethane	5.7	U vs	5.7	0.74	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,1-Dichloroethane	5.7	U vs	5.7	0.70	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,1-Dichloroethene	5.7	U vs	5.7	0.70	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,2,4-Trichlorobenzene	5.7	U vs	5.7	0.35	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,2,4-Trimethylbenzene	5.7	U vs	5.7	1.1	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,2-Dibromo-3-Chloropropane	5.7	U vs	5.7	2.9	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,2-Dichlorobenzene	5.7	U vs	5.7	0.45	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,2-Dichloroethane	5.7	U vs	5.7	0.29	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,2-Dichloropropane	5.7	U vs	5.7	2.9	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,3,5-Trimethylbenzene	5.7	U vs	5.7	0.37	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,3-Dichlorobenzene	5.7	U vs	5.7	0.29	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,4-Dichlorobenzene	5.7	U vs	5.7	0.80	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
2-Butanone (MEK)	29	U vs	29	2.1	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
2-Hexanone	29	U vs	29	2.9	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
4-Isopropyltoluene	5.7	U vs	5.7	0.46	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
4-Methyl-2-pentanone (MIBK)	29	U vs	29	1.9	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Acetone	**43**	**vs**	29	4.8	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Benzene	5.7	U vs	5.7	0.28	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Bromoform	5.7	U vs	5.7	2.9	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Bromomethane	5.7	U vs	5.7	0.51	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Carbon disulfide	5.7	U vs	5.7	2.9	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Carbon tetrachloride	5.7	U vs	5.7	0.55	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Chlorobenzene	5.7	U vs	5.7	0.75	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Dibromochloromethane	5.7	U vs	5.7	0.73	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Chloroethane	5.7	U vs	5.7	1.3	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Chloroform	5.7	U vs	5.7	0.35	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Chloromethane	5.7	U vs	5.7	0.34	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
cis-1,2-Dichloroethene	5.7	U vs	5.7	0.73	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Cyclohexane	5.7	U vs	5.7	0.80	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Bromodichloromethane	5.7	U vs	5.7	0.76	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Dichlorodifluoromethane	5.7	U vs	5.7	0.47	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Ethylbenzene	5.7	U vs	5.7	0.39	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
1,2-Dibromoethane	5.7	U vs	5.7	0.73	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Isopropylbenzene	5.7	U vs	5.7	0.86	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Methyl acetate	29	U vs	29	3.4	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Methyl tert-butyl ether	5.7	U vs	5.7	0.56	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Methylcyclohexane	5.7	U vs	5.7	0.87	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Methylene Chloride	**13**	**vs**	5.7	2.6	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
m,p-Xylene	11	U vs	11	0.96	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
n-Butylbenzene	5.7	U vs	5.7	0.50	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
N-Propylbenzene	5.7	U vs	5.7	0.46	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
o-Xylene	5.7	U vs	5.7	0.75	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
sec-Butylbenzene	5.7	U vs	5.7	0.50	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Tetrachloroethene	5.7	U vs	5.7	0.77	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Toluene	5.7	U vs	5.7	0.43	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
trans-1,2-Dichloroethene	5.7	U vs	5.7	0.59	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1

Client Sample ID: TP-12 6-8 FT
Lab Sample ID: 480-222654-5

Date Collected: 08/14/24 11:00
Matrix: Solid

Date Received: 08/17/24 08:00
Percent Solids: 83.8

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	5.7	U vs	5.7	2.5	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Trichloroethene	5.7	U vs	5.7	1.3	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Trichlorofluoromethane	5.7	U vs	5.7	0.54	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Vinyl chloride	5.7	U vs	5.7	0.70	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Xylenes, Total	11	U vs	11	0.96	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
cis-1,3-Dichloropropene	5.7	U vs	5.7	0.82	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
Styrene	5.7	U vs	5.7	0.29	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1
tert-Butylbenzene	5.7	U vs	5.7	0.59	ug/Kg	☼	08/19/24 12:55	08/19/24 20:39	1

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Dodecane	*7.2*	*T J N*	*ug/Kg*	☼	*12.10*	*112-40-3*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Undecane, 2,6-dimethyl-	*7.4*	*T J N*	*ug/Kg*	☼	*12.22*	*17301-23-4*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Unknown	*21*	*T J*	*ug/Kg*	☼	*12.72*	*N/A*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Tridecane	*15*	*T J N*	*ug/Kg*	☼	*12.93*	*629-50-5*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Dodecane, 2,6,11-trimethyl-	*17*	*T J N*	*ug/Kg*	☼	*13.53*	*31295-56-4*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Tetradecane	*22*	*T J N*	*ug/Kg*	☼	*13.68*	*629-59-4*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Hexadecane, 2,6,10,14-tetramethyl-	*24*	*T J N*	*ug/Kg*	☼	*14.12*	*638-36-8*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Pentadecane	*15*	*T J N*	*ug/Kg*	☼	*14.37*	*629-62-9*	*08/19/24 12:55*	*08/19/24 20:39*	*1*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*108*		*64 - 126*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
4-Bromofluorobenzene (Surr)	*95*		*72 - 126*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Toluene-d8 (Surr)	*94*		*71 - 125*	*08/19/24 12:55*	*08/19/24 20:39*	*1*
Dibromofluoromethane (Surr)	*109*		*60 - 140*	*08/19/24 12:55*	*08/19/24 20:39*	*1*

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Acenaphthylene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Anthracene	200	U	200	49	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Benzo[a]anthracene	200	U	200	20	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Benzo[a]pyrene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Benzo[b]fluoranthene	200	U	200	32	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Benzo[g,h,i]perylene	200	U	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Benzo[k]fluoranthene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Chrysene	200	U	200	44	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Dibenz(a,h)anthracene	200	U	200	35	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Fluoranthene	200	U	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Fluorene	200	U	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Indeno[1,2,3-cd]pyrene	200	U	200	25	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Naphthalene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Pyrene	200	U	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1
Phenanthrene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 18:37	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*93*		*26 - 143*	*08/20/24 16:30*	*08/21/24 18:37*	*1*
2-Fluorobiphenyl (Surr)	*73*		*50 - 121*	*08/20/24 16:30*	*08/21/24 18:37*	*1*
2-Fluorophenol (Surr)	*69*		*36 - 120*	*08/20/24 16:30*	*08/21/24 18:37*	*1*
Phenol-d5 (Surr)	*73*		*41 - 120*	*08/20/24 16:30*	*08/21/24 18:37*	*1*
p-Terphenyl-d14 (Surr)	*95*		*46 - 143*	*08/20/24 16:30*	*08/21/24 18:37*	*1*

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: TP-12 6-8 FT
Lab Sample ID: 480-222654-5
Date Collected: 08/14/24 11:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 83.8

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Nitrobenzene-d5 (Surr)	67		40 - 121	08/20/24 16:30	08/21/24 18:37	1

Client Sample ID: TP-14 4-5 FT
Lab Sample ID: 480-222654-6
Date Collected: 08/14/24 13:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 85.1

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	5.9	U vs	5.9	0.42	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,1,2,2-Tetrachloroethane	5.9	U vs	5.9	0.95	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,1,2-Trichloro-1,2,2-trifluoroethane	5.9	U vs	5.9	1.3	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,1,2-Trichloroethane	5.9	U vs	5.9	0.76	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,1-Dichloroethane	5.9	U vs	5.9	0.71	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,1-Dichloroethene	5.9	U vs	5.9	0.72	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,2,4-Trichlorobenzene	5.9	U vs	5.9	0.36	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,2,4-Trimethylbenzene	5.9	U vs	5.9	1.1	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,2-Dibromo-3-Chloropropane	5.9	U vs	5.9	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,2-Dichlorobenzene	5.9	U vs	5.9	0.46	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,2-Dichloroethane	5.9	U vs	5.9	0.29	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,2-Dichloropropane	5.9	U vs	5.9	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,3,5-Trimethylbenzene	5.9	U vs	5.9	0.38	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,3-Dichlorobenzene	5.9	U vs	5.9	0.30	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,4-Dichlorobenzene	5.9	U vs	5.9	0.82	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
2-Butanone (MEK)	29	U vs	29	2.1	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
2-Hexanone	29	U vs	29	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
4-Isopropyltoluene	5.9	U vs	5.9	0.47	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
4-Methyl-2-pentanone (MIBK)	29	U vs	29	1.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Acetone	**28**	**J vs**	29	4.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Benzene	5.9	U vs	5.9	0.29	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Bromoform	5.9	U vs	5.9	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Bromomethane	5.9	U vs	5.9	0.53	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Carbon disulfide	5.9	U vs	5.9	2.9	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Carbon tetrachloride	5.9	U vs	5.9	0.57	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Chlorobenzene	5.9	U vs	5.9	0.77	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Dibromochloromethane	5.9	U vs	5.9	0.75	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Chloroethane	5.9	U vs	5.9	1.3	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Chloroform	5.9	U vs	5.9	0.36	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Chloromethane	5.9	U vs	5.9	0.35	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
cis-1,2-Dichloroethene	5.9	U vs	5.9	0.75	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Cyclohexane	5.9	U vs	5.9	0.82	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Bromodichloromethane	5.9	U vs	5.9	0.78	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Dichlorodifluoromethane	5.9	U vs	5.9	0.48	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Ethylbenzene	5.9	U vs	5.9	0.40	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
1,2-Dibromoethane	5.9	U vs	5.9	0.75	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Isopropylbenzene	5.9	U vs	5.9	0.88	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Methyl acetate	29	U vs	29	3.5	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Methyl tert-butyl ether	5.9	U vs	5.9	0.57	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Methylcyclohexane	5.9	U vs	5.9	0.89	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Methylene Chloride	**8.3**	**vs**	5.9	2.7	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
m,p-Xylene	12	U vs	12	0.98	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
n-Butylbenzene	5.9	U vs	5.9	0.51	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
N-Propylbenzene	5.9	U vs	5.9	0.47	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
o-Xylene	5.9	U vs	5.9	0.76	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
sec-Butylbenzene	5.9	U vs	5.9	0.51	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Tetrachloroethene	5.9	U vs	5.9	0.79	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Toluene	5.9	U vs	5.9	0.44	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
trans-1,2-Dichloroethene	5.9	U vs	5.9	0.60	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1

Client Sample ID: TP-14 4-5 FT
Lab Sample ID: 480-222654-6

Date Collected: 08/14/24 13:00
Matrix: Solid

Date Received: 08/17/24 08:00
Percent Solids: 85.1

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	5.9	U vs	5.9	2.6	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Trichloroethene	5.9	U vs	5.9	1.3	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Trichlorofluoromethane	5.9	U vs	5.9	0.55	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Vinyl chloride	5.9	U vs	5.9	0.71	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Xylenes, Total	12	U vs	12	0.98	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
cis-1,3-Dichloropropene	5.9	U vs	5.9	0.84	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
Styrene	5.9	U vs	5.9	0.29	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1
tert-Butylbenzene	5.9	U vs	5.9	0.61	ug/Kg	☼	08/19/24 10:41	08/19/24 15:54	1

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Tentatively Identified Compound	*None*		*ug/Kg*	☼		*N/A*	*08/19/24 10:41*	*08/19/24 15:54*	*1*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*104*		*64 - 126*	*08/19/24 10:41*	*08/19/24 15:54*	*1*
4-Bromofluorobenzene (Surr)	*98*		*72 - 126*	*08/19/24 10:41*	*08/19/24 15:54*	*1*
Toluene-d8 (Surr)	*94*		*71 - 125*	*08/19/24 10:41*	*08/19/24 15:54*	*1*
Dibromofluoromethane (Surr)	*103*		*60 - 140*	*08/19/24 10:41*	*08/19/24 15:54*	*1*

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Acenaphthylene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Anthracene	200	U	200	49	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Benzo[a]anthracene	200	U	200	20	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Benzo[a]pyrene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Benzo[b]fluoranthene	200	U	200	32	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Benzo[g,h,i]perylene	200	U	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Benzo[k]fluoranthene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Chrysene	200	U	200	44	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Dibenz(a,h)anthracene	200	U	200	35	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Fluoranthene	**29**	**J**	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Fluorene	200	U	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Indeno[1,2,3-cd]pyrene	200	U	200	25	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Naphthalene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Pyrene	**25**	**J**	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1
Phenanthrene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 19:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*95*		*26 - 143*	*08/20/24 16:30*	*08/21/24 19:03*	*1*
2-Fluorobiphenyl (Surr)	*82*		*50 - 121*	*08/20/24 16:30*	*08/21/24 19:03*	*1*
2-Fluorophenol (Surr)	*81*		*36 - 120*	*08/20/24 16:30*	*08/21/24 19:03*	*1*
Phenol-d5 (Surr)	*86*		*41 - 120*	*08/20/24 16:30*	*08/21/24 19:03*	*1*
p-Terphenyl-d14 (Surr)	*92*		*46 - 143*	*08/20/24 16:30*	*08/21/24 19:03*	*1*
Nitrobenzene-d5 (Surr)	*79*		*40 - 121*	*08/20/24 16:30*	*08/21/24 19:03*	*1*

Client Sample ID: SB-3 4-5 FT
Lab Sample ID: 480-222654-9

Date Collected: 08/15/24 12:30
Matrix: Solid

Date Received: 08/17/24 08:00
Percent Solids: 84.9

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	630	U	630	170	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,1,2,2-Tetrachloroethane	630	U	630	100	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,1,2-Trichloro-1,2,2-trifluoroethane	630	U	630	320	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,1,2-Trichloroethane	630	U	630	130	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,1-Dichloroethane	630	U	630	200	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,1-Dichloroethene	630	U	630	220	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,2,4-Trichlorobenzene	630	U	630	240	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,2,4-Trimethylbenzene	**2000**		630	180	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,2-Dibromo-3-Chloropropane	630	U	630	320	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,2-Dichlorobenzene	630	U	630	160	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,2-Dichloroethane	630	U	630	260	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,2-Dichloropropane	630	U	630	100	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,3,5-Trimethylbenzene	**1800**		630	190	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,3-Dichlorobenzene	630	U	630	170	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,4-Dichlorobenzene	630	U	630	88	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
2-Butanone (MEK)	3200	U	3200	1900	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
2-Hexanone	3200	U	3200	1300	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
4-Isopropyltoluene	**760**		630	210	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
4-Methyl-2-pentanone (MIBK)	3200	U	3200	200	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Acetone	3200	U	3200	2600	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Benzene	630	U	630	120	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Bromoform	630	U	630	320	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Bromomethane	630	U	630	140	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Carbon disulfide	630	U	630	290	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Carbon tetrachloride	630	U	630	160	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Chlorobenzene	630	U	630	83	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Dibromochloromethane	630	U	630	310	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Chloroethane	630	U	630	130	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Chloroform	630	U	630	430	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Chloromethane	630	U	630	150	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
cis-1,2-Dichloroethene	630	U	630	170	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Cyclohexane	**1500**		630	140	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Bromodichloromethane	630	U	630	130	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Dichlorodifluoromethane	630	U	630	280	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Ethylbenzene	**750**		630	180	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
1,2-Dibromoethane	630	U	630	110	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Isopropylbenzene	**460**	**J**	630	95	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Methyl acetate	3200	U	3200	300	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Methyl tert-butyl ether	630	U	630	240	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Methylcyclohexane	**10000**		630	300	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Methylene Chloride	630	U	630	130	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
m,p-Xylene	**630**	**J**	1300	350	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
n-Butylbenzene	**1200**		630	180	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
N-Propylbenzene	**680**		630	170	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
o-Xylene	630	U	630	82	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
sec-Butylbenzene	**390**	**J**	630	230	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Tetrachloroethene	630	U	630	85	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Toluene	630	U	630	170	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
trans-1,2-Dichloroethene	630	U	630	150	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5

Client Sample ID: SB-3 4-5 FT
Date Collected: 08/15/24 12:30
Date Received: 08/17/24 08:00

Lab Sample ID: 480-222654-9
Matrix: Solid
Percent Solids: 84.9

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	630	U	630	62	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Trichloroethene	630	U	630	180	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Trichlorofluoromethane	630	U	630	300	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Vinyl chloride	630	U	630	210	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Xylenes, Total	**630**	**J**	1300	350	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
cis-1,3-Dichloropropene	630	U	630	150	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
Styrene	630	U	630	150	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5
tert-Butylbenzene	630	U	630	180	ug/Kg	☼	08/19/24 09:39	08/19/24 15:06	5

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Cyclohexane, 1,3-dimethyl-, cis-	*7200*	*T J N*	*ug/Kg*	☼	*6.13*	*638-04-0*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Octane, 2,6-dimethyl-	*4700*	*T J N*	*ug/Kg*	☼	*8.46*	*2051-30-1*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Cyclohexane, propyl-	*4400*	*T J N*	*ug/Kg*	☼	*8.57*	*1678-92-8*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Benzene, 1-ethyl-2,4-dimethyl-	*5100*	*T J N*	*ug/Kg*	☼	*10.77*	*874-41-9*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Unknown	*4300*	*T J*	*ug/Kg*	☼	*10.95*	*N/A*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Unknown	*4400*	*T J*	*ug/Kg*	☼	*11.12*	*N/A*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Dodecane	*4800*	*T J N*	*ug/Kg*	☼	*11.57*	*112-40-3*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
1-Phenyl-1-butene	*6500*	*T J N*	*ug/Kg*	☼	*11.63*	*824-90-8*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
1H-Indene, 2,3-dihydro-1,2-dimethyl-	*5400*	*T J N*	*ug/Kg*	☼	*12.04*	*17057-82-8*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Naphthalene, 2-methyl-	*4100*	*T J N*	*ug/Kg*	☼	*13.10*	*91-57-6*	*08/19/24 09:39*	*08/19/24 15:06*	*5*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*102*		*53 - 146*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
4-Bromofluorobenzene (Surr)	*89*		*49 - 148*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Toluene-d8 (Surr)	*100*		*50 - 149*	*08/19/24 09:39*	*08/19/24 15:06*	*5*
Dibromofluoromethane (Surr)	*95*		*60 - 140*	*08/19/24 09:39*	*08/19/24 15:06*	*5*

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Acenaphthylene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Anthracene	200	U	200	49	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Benzo[a]anthracene	200	U	200	20	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Benzo[a]pyrene	200	U	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Benzo[b]fluoranthene	200	U	200	31	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Benzo[g,h,i]perylene	200	U	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Benzo[k]fluoranthene	200	U	200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Chrysene	200	U	200	44	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Dibenz(a,h)anthracene	200	U	200	35	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Fluoranthene	200	U	200	21	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Fluorene	**37**	**J**	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Indeno[1,2,3-cd]pyrene	200	U	200	24	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Naphthalene	**250**		200	26	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Pyrene	200	U	200	23	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1
Phenanthrene	**55**	**J**	200	29	ug/Kg	☼	08/20/24 16:30	08/21/24 19:31	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*101*		*26 - 143*	*08/20/24 16:30*	*08/21/24 19:31*	*1*
2-Fluorobiphenyl (Surr)	*85*		*50 - 121*	*08/20/24 16:30*	*08/21/24 19:31*	*1*
2-Fluorophenol (Surr)	*88*		*36 - 120*	*08/20/24 16:30*	*08/21/24 19:31*	*1*

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: SB-3 4-5 FT
Lab Sample ID: 480-222654-9
Date Collected: 08/15/24 12:30
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 84.9

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Phenol-d5 (Surr)	83		41 - 120	08/20/24 16:30	08/21/24 19:31	1
p-Terphenyl-d14 (Surr)	113		46 - 143	08/20/24 16:30	08/21/24 19:31	1
Nitrobenzene-d5 (Surr)	83		40 - 121	08/20/24 16:30	08/21/24 19:31	1

Client: Roux Environmental Engineering and Geology DPC
Project/Site: 3701 River Rd

Job ID: 480-222654-1

Client Sample ID: SB-4 4-5 FT
Date Collected: 08/15/24 14:00
Date Received: 08/17/24 08:00

Lab Sample ID: 480-222654-10
Matrix: Solid
Percent Solids: 89.6

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	2300	U	2300	650	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,1,2,2-Tetrachloroethane	2300	U	2300	380	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,1,2-Trichloro-1,2,2-trifluoroethane	2300	U	2300	1200	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,1,2-Trichloroethane	2300	U	2300	490	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,1-Dichloroethane	2300	U	2300	720	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,1-Dichloroethene	2300	U	2300	810	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,2,4-Trichlorobenzene	2300	U	2300	890	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,2,4-Trimethylbenzene	**6300**		2300	650	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,2-Dibromo-3-Chloropropane	2300	U	2300	1200	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,2-Dichlorobenzene	2300	U	2300	600	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,2-Dichloroethane	2300	U	2300	960	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,2-Dichloropropane	2300	U	2300	380	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,3,5-Trimethylbenzene	**2100**	**J**	2300	710	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,3-Dichlorobenzene	2300	U	2300	630	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,4-Dichlorobenzene	2300	U	2300	330	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
2-Butanone (MEK)	12000	U	12000	7000	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
2-Hexanone	12000	U	12000	4800	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
4-Isopropyltoluene	**1300**	**J**	2300	790	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
4-Methyl-2-pentanone (MIBK)	12000	U	12000	750	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Acetone	12000	U	12000	9600	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Benzene	2300	U	2300	450	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Bromoform	2300	U	2300	1200	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Bromomethane	2300	U	2300	520	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Carbon disulfide	2300	U	2300	1100	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Carbon tetrachloride	2300	U	2300	600	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Chlorobenzene	2300	U	2300	310	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Dibromochloromethane	2300	U	2300	1100	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Chloroethane	2300	U	2300	490	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Chloroform	2300	U	2300	1600	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Chloromethane	2300	U	2300	560	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
cis-1,2-Dichloroethene	2300	U	2300	650	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Cyclohexane	**37000**		2300	520	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Bromodichloromethane	2300	U	2300	470	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Dichlorodifluoromethane	2300	U	2300	1000	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Ethylbenzene	**1200**	**J**	2300	680	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
1,2-Dibromoethane	2300	U	2300	410	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Isopropylbenzene	**750**	**J**	2300	350	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Methyl acetate	12000	U	12000	1100	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Methyl tert-butyl ether	2300	U	2300	890	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Methylcyclohexane	**180000**		2300	1100	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Methylene Chloride	2300	U	2300	460	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
m,p-Xylene	4700	U	4700	1300	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
n-Butylbenzene	**940**	**J**	2300	680	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
N-Propylbenzene	**830**	**J**	2300	610	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
o-Xylene	2300	U	2300	300	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
sec-Butylbenzene	2300	U	2300	860	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Tetrachloroethene	2300	U	2300	320	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Toluene	2300	U	2300	630	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
trans-1,2-Dichloroethene	2300	U	2300	550	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20

Client Sample ID: SB-4 4-5 FT
Lab Sample ID: 480-222654-10
Date Collected: 08/15/24 14:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 89.6

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	2300	U	2300	230	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Trichloroethene	2300	U	2300	650	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Trichlorofluoromethane	2300	U	2300	1100	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Vinyl chloride	2300	U	2300	790	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Xylenes, Total	4700	U	4700	1300	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
cis-1,3-Dichloropropene	2300	U	2300	560	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
Styrene	2300	U	2300	570	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20
tert-Butylbenzene	2300	U	2300	650	ug/Kg	☼	08/19/24 09:39	08/19/24 15:31	20

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Hexane, 3-methyl-	*84000*	*T J N*	*ug/Kg*	☼	*4.27*	*589-34-4*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Cyclopentane, 1,3-dimethyl-	*50000*	*T J N*	*ug/Kg*	☼	*4.53*	*2453-00-1*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Cyclopentane, 1,2-dimethyl-, cis-	*44000*	*T J N*	*ug/Kg*	☼	*4.58*	*1192-18-3*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Cyclopentane, 1,2,4-trimethyl-	*52000*	*T J N*	*ug/Kg*	☼	*5.45*	*2815-58-9*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Cyclopentane, 1,2,3-trimethyl-, (1.alpha.,2.alpha.,3.beta.)-	*58000*	*T J N*	*ug/Kg*	☼	*5.59*	*15890-40-1*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Cyclohexane, 1,3-dimethyl-, cis-	*110000*	*T J N*	*ug/Kg*	☼	*6.14*	*638-04-0*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Cyclohexane, 1,2-dimethyl-, trans-	*47000*	*T J N*	*ug/Kg*	☼	*6.49*	*6876-23-9*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Undecane	*50000*	*T J N*	*ug/Kg*	☼	*10.59*	*1120-21-4*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Dodecane	*57000*	*T J N*	*ug/Kg*	☼	*11.57*	*112-40-3*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Tridecane	*42000*	*T J N*	*ug/Kg*	☼	*12.42*	*629-50-5*	*08/19/24 09:39*	*08/19/24 15:31*	*20*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*113*		*53 - 146*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
4-Bromofluorobenzene (Surr)	*91*		*49 - 148*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Toluene-d8 (Surr)	*98*		*50 - 149*	*08/19/24 09:39*	*08/19/24 15:31*	*20*
Dibromofluoromethane (Surr)	*93*		*60 - 140*	*08/19/24 09:39*	*08/19/24 15:31*	*20*

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	930	U	930	140	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Acenaphthylene	930	U	930	120	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Anthracene	930	U	930	230	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Benzo[a]anthracene	930	U	930	93	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Benzo[a]pyrene	930	U	930	140	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Benzo[b]fluoranthene	930	U	930	150	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Benzo[g,h,i]perylene	930	U	930	98	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Benzo[k]fluoranthene	930	U	930	120	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Chrysene	930	U	930	210	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Dibenz(a,h)anthracene	930	U	930	160	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Fluoranthene	930	U	930	98	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Fluorene	930	U	930	110	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Indeno[1,2,3-cd]pyrene	930	U	930	110	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Naphthalene	930	U	930	120	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Pyrene	930	U	930	110	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5
Phenanthrene	930	U	930	140	ug/Kg	☼	08/20/24 16:30	08/21/24 19:56	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*85*		*26 - 143*	*08/20/24 16:30*	*08/21/24 19:56*	*5*
2-Fluorobiphenyl (Surr)	*79*		*50 - 121*	*08/20/24 16:30*	*08/21/24 19:56*	*5*
2-Fluorophenol (Surr)	*77*		*36 - 120*	*08/20/24 16:30*	*08/21/24 19:56*	*5*

Client Sample ID: SB-4 4-5 FT
Lab Sample ID: 480-222654-10
Date Collected: 08/15/24 14:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 89.6

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Phenol-d5 (Surr)	81		41 - 120	08/20/24 16:30	08/21/24 19:56	5
p-Terphenyl-d14 (Surr)	85		46 - 143	08/20/24 16:30	08/21/24 19:56	5
Nitrobenzene-d5 (Surr)	96		40 - 121	08/20/24 16:30	08/21/24 19:56	5

Surrogate Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCA	BFB	TOL	DBFM
Lab Sample ID	Client Sample ID	(64-126)	(72-126)	(71-125)	(60-140)
480-222654-1	TP-1 4-6 FT	105	97	94	101
480-222654-4	TP-11 6-8 FT	104	98	94	104
480-222654-5	TP-12 6-8 FT	108	95	94	109
480-222654-6	TP-14 4-5 FT	104	98	94	103
LCS 480-722313/1-A	Lab Control Sample	103	97	93	97
MB 480-722313/2-A	Method Blank	99	96	96	103

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCA	BFB	TOL	DBFM
Lab Sample ID	Client Sample ID	(53-146)	(49-148)	(50-149)	(60-140)
480-222654-2	TP-4 3-4 FT	102	92	102	96
480-222654-3	TP-10 8-9 FT	102	96	102	96
480-222654-9	SB-3 4-5 FT	102	89	100	95
480-222654-10	SB-4 4-5 FT	113	91	98	93
LCS 480-722297/1-A	Lab Control Sample	99	96	106	95
MB 480-722297/3-A	Method Blank	101	90	103	92

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)					
		TBP	FBP	2FP	PHL	TPHd14	NBZ
Lab Sample ID	Client Sample ID	(26-143)	(50-121)	(36-120)	(41-120)	(46-143)	(40-121)
480-222654-1	TP-1 4-6 FT	0 S1-	73	80	81	81	87
480-222654-2	TP-4 3-4 FT	81	59	56	53	88	55
480-222654-3	TP-10 8-9 FT	86	69	64	70	87	68
480-222654-4	TP-11 6-8 FT	94	76	69	73	98	69
480-222654-4 MS	TP-11 6-8 FT	108	84	74	78	102	76
480-222654-4 MSD	TP-11 6-8 FT	109	88	79	85	107	81
480-222654-5	TP-12 6-8 FT	93	73	69	73	95	67
480-222654-6	TP-14 4-5 FT	95	82	81	86	92	79
480-222654-9	SB-3 4-5 FT	101	85	88	83	113	83
480-222654-10	SB-4 4-5 FT	85	79	77	81	85	96
LCS 480-722519/2-A	Lab Control Sample	102	84	80	85	91	78
MB 480-722519/1-A	Method Blank	97	86	90	87	99	80

Surrogate Legend

Surrogate Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

TBP = 2,4,6-Tribromophenol (Surr)
FBP = 2-Fluorobiphenyl (Surr)
2FP = 2-Fluorophenol (Surr)
PHL = Phenol-d5 (Surr)
TPHd14 = p-Terphenyl-d14 (Surr)
NBZ = Nitrobenzene-d5 (Surr)

Method: 8260C - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 480-722297/3-A
Matrix: Solid
Analysis Batch: 722261

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 722297

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	100	U	100	28	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,1,2,2-Tetrachloroethane	100	U	100	16	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,1,2-Trichloro-1,2,2-trifluoroethane	100	U	100	50	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,1,2-Trichloroethane	100	U	100	21	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,1-Dichloroethane	100	U	100	31	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,1-Dichloroethene	100	U	100	35	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,2,4-Trichlorobenzene	100	U	100	38	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,2,4-Trimethylbenzene	100	U	100	28	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,2-Dibromo-3-Chloropropane	100	U	100	50	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,2-Dichlorobenzene	100	U	100	26	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,2-Dichloroethane	100	U	100	41	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,2-Dichloropropane	100	U	100	16	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,3,5-Trimethylbenzene	100	U	100	30	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,3-Dichlorobenzene	100	U	100	27	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,4-Dichlorobenzene	100	U	100	14	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
2-Butanone (MEK)	500	U	500	300	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
2-Hexanone	500	U	500	210	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
4-Isopropyltoluene	100	U	100	34	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
4-Methyl-2-pentanone (MIBK)	500	U	500	32	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Acetone	500	U	500	410	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Benzene	100	U	100	19	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Bromoform	100	U	100	50	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Bromomethane	100	U	100	22	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Carbon disulfide	100	U	100	46	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Carbon tetrachloride	100	U	100	26	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Chlorobenzene	100	U	100	13	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Dibromochloromethane	100	U	100	48	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Chloroethane	100	U	100	21	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Chloroform	100	U	100	69	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Chloromethane	100	U	100	24	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
cis-1,2-Dichloroethene	100	U	100	28	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Cyclohexane	100	U	100	22	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Bromodichloromethane	100	U	100	20	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Dichlorodifluoromethane	100	U	100	44	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Ethylbenzene	100	U	100	29	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
1,2-Dibromoethane	100	U	100	18	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Isopropylbenzene	100	U	100	15	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Methyl acetate	500	U	500	48	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Methyl tert-butyl ether	100	U	100	38	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Methylcyclohexane	100	U	100	47	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Methylene Chloride	100	U	100	20	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
m,p-Xylene	200	U	200	55	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
n-Butylbenzene	100	U	100	29	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
N-Propylbenzene	100	U	100	26	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
o-Xylene	100	U	100	13	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
sec-Butylbenzene	100	U	100	37	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Tetrachloroethene	100	U	100	13	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Toluene	100	U	100	27	ug/Kg		08/19/24 09:39	08/19/24 13:04	1

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 480-722297/3-A
Matrix: Solid
Analysis Batch: 722261

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 722297

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,2-Dichloroethene	100	U	100	24	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
trans-1,3-Dichloropropene	100	U	100	9.8	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Trichloroethene	100	U	100	28	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Trichlorofluoromethane	100	U	100	47	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Vinyl chloride	100	U	100	34	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Xylenes, Total	200	U	200	55	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
cis-1,3-Dichloropropene	100	U	100	24	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
Styrene	100	U	100	24	ug/Kg		08/19/24 09:39	08/19/24 13:04	1
tert-Butylbenzene	100	U	100	28	ug/Kg		08/19/24 09:39	08/19/24 13:04	1

Tentatively Identified Compound	*Est. Result*	*MB Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Tentatively Identified Compound	*None*		*ug/Kg*			*N/A*	*08/19/24 09:39*	*08/19/24 13:04*	*1*

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*101*		*53 - 146*	*08/19/24 09:39*	*08/19/24 13:04*	*1*
4-Bromofluorobenzene (Surr)	*90*		*49 - 148*	*08/19/24 09:39*	*08/19/24 13:04*	*1*
Toluene-d8 (Surr)	*103*		*50 - 149*	*08/19/24 09:39*	*08/19/24 13:04*	*1*
Dibromofluoromethane (Surr)	*92*		*60 - 140*	*08/19/24 09:39*	*08/19/24 13:04*	*1*

Lab Sample ID: LCS 480-722297/1-A
Matrix: Solid
Analysis Batch: 722261

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 722297

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	2500	2430		ug/Kg		97	68 - 130
1,1,2,2-Tetrachloroethane	2500	2280		ug/Kg		91	73 - 120
1,1,2-Trichloro-1,2,2-trifluoroethane	2500	1940		ug/Kg		77	10 - 179
1,1,2-Trichloroethane	2500	2550		ug/Kg		102	80 - 120
1,1-Dichloroethane	2500	2620		ug/Kg		105	78 - 121
1,1-Dichloroethene	2500	2200		ug/Kg		88	48 - 133
1,2,4-Trichlorobenzene	2500	2880		ug/Kg		115	70 - 140
1,2,4-Trimethylbenzene	2500	2660		ug/Kg		106	77 - 127
1,2-Dibromo-3-Chloropropane	2500	2170		ug/Kg		87	56 - 122
1,2-Dichlorobenzene	2500	2530		ug/Kg		101	78 - 125
1,2-Dichloroethane	2500	2370		ug/Kg		95	74 - 127
1,2-Dichloropropane	2500	2640		ug/Kg		106	80 - 120
1,3,5-Trimethylbenzene	2500	2640		ug/Kg		106	79 - 120
1,3-Dichlorobenzene	2500	2460		ug/Kg		99	80 - 120
1,4-Dichlorobenzene	2500	2370		ug/Kg		95	80 - 120
2-Butanone (MEK)	12500	13700		ug/Kg		110	54 - 149
2-Hexanone	12500	11600		ug/Kg		93	59 - 127
4-Isopropyltoluene	2500	2790		ug/Kg		111	80 - 120
4-Methyl-2-pentanone (MIBK)	12500	12400		ug/Kg		99	74 - 120
Acetone	12500	15100		ug/Kg		120	47 - 141
Benzene	2500	2630		ug/Kg		105	77 - 125
Bromoform	2500	2040		ug/Kg		82	48 - 125
Bromomethane	2500	1730		ug/Kg		69	39 - 149

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 480-722297/1-A
Matrix: Solid
Analysis Batch: 722261

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 722297

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Carbon disulfide	2500	2350		ug/Kg		94	40 - 136
Carbon tetrachloride	2500	2380		ug/Kg		95	54 - 135
Chlorobenzene	2500	2580		ug/Kg		103	76 - 126
Dibromochloromethane	2500	2260		ug/Kg		90	64 - 120
Chloroethane	2500	1660		ug/Kg		66	23 - 150
Chloroform	2500	2380		ug/Kg		95	78 - 120
Chloromethane	2500	2490		ug/Kg		100	61 - 124
cis-1,2-Dichloroethene	2500	2600		ug/Kg		104	79 - 124
Cyclohexane	2500	2480		ug/Kg		99	49 - 129
Bromodichloromethane	2500	2430		ug/Kg		97	71 - 121
Dichlorodifluoromethane	2500	1550		ug/Kg		62	10 - 150
Ethylbenzene	2500	2610		ug/Kg		104	78 - 124
1,2-Dibromoethane	2500	2460		ug/Kg		99	80 - 120
Isopropylbenzene	2500	2640		ug/Kg		106	76 - 120
Methyl acetate	5000	5280		ug/Kg		106	71 - 123
Methyl tert-butyl ether	2500	2420		ug/Kg		97	67 - 137
Methylcyclohexane	2500	2390		ug/Kg		96	50 - 130
Methylene Chloride	2500	2640		ug/Kg		106	75 - 118
m,p-Xylene	2500	2620		ug/Kg		105	77 - 125
n-Butylbenzene	2500	2830		ug/Kg		113	80 - 120
N-Propylbenzene	2500	2570		ug/Kg		103	76 - 120
o-Xylene	2500	2590		ug/Kg		104	80 - 124
sec-Butylbenzene	2500	2770		ug/Kg		111	79 - 120
Tetrachloroethene	2500	2650		ug/Kg		106	73 - 133
Toluene	2500	2680		ug/Kg		107	75 - 124
trans-1,2-Dichloroethene	2500	2580		ug/Kg		103	74 - 129
trans-1,3-Dichloropropene	2500	2520		ug/Kg		101	73 - 120
Trichloroethene	2500	2540		ug/Kg		102	75 - 131
Trichlorofluoromethane	2500	1930		ug/Kg		77	29 - 158
Vinyl chloride	2500	2500		ug/Kg		100	59 - 124
cis-1,3-Dichloropropene	2500	2640		ug/Kg		106	75 - 121
Styrene	2500	2600		ug/Kg		104	80 - 120
tert-Butylbenzene	2500	2690		ug/Kg		108	78 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*99*		*53 - 146*
4-Bromofluorobenzene (Surr)	*96*		*49 - 148*
Toluene-d8 (Surr)	*106*		*50 - 149*
Dibromofluoromethane (Surr)	*95*		*60 - 140*

Lab Sample ID: MB 480-722313/2-A
Matrix: Solid
Analysis Batch: 722312

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 722313

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	5.0	U	5.0	0.36	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,1,2,2-Tetrachloroethane	5.0	U	5.0	0.81	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,1,2-Trichloro-1,2,2-trifluoroethane	5.0	U	5.0	1.1	ug/Kg		08/19/24 10:41	08/19/24 14:10	1

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 480-722313/2-A
Matrix: Solid
Analysis Batch: 722312

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 722313

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,2-Trichloroethane	5.0	U	5.0	0.65	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,1-Dichloroethane	5.0	U	5.0	0.61	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,1-Dichloroethene	5.0	U	5.0	0.61	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,2,4-Trichlorobenzene	5.0	U	5.0	0.30	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,2,4-Trimethylbenzene	5.0	U	5.0	0.96	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,2-Dibromo-3-Chloropropane	5.0	U	5.0	2.5	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,2-Dichlorobenzene	5.0	U	5.0	0.39	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,2-Dichloroethane	5.0	U	5.0	0.25	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,2-Dichloropropane	5.0	U	5.0	2.5	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,3,5-Trimethylbenzene	5.0	U	5.0	0.32	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,3-Dichlorobenzene	5.0	U	5.0	0.26	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,4-Dichlorobenzene	5.0	U	5.0	0.70	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
2-Butanone (MEK)	25	U	25	1.8	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
2-Hexanone	25	U	25	2.5	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
4-Isopropyltoluene	5.0	U	5.0	0.40	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
4-Methyl-2-pentanone (MIBK)	25	U	25	1.6	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Acetone	25	U	25	4.2	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Benzene	5.0	U	5.0	0.25	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Bromoform	5.0	U	5.0	2.5	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Bromomethane	5.0	U	5.0	0.45	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Carbon disulfide	5.0	U	5.0	2.5	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Carbon tetrachloride	5.0	U	5.0	0.48	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Chlorobenzene	5.0	U	5.0	0.66	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Dibromochloromethane	5.0	U	5.0	0.64	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Chloroethane	5.0	U	5.0	1.1	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Chloroform	5.0	U	5.0	0.31	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Chloromethane	5.0	U	5.0	0.30	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
cis-1,2-Dichloroethene	5.0	U	5.0	0.64	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Cyclohexane	5.0	U	5.0	0.70	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Bromodichloromethane	5.0	U	5.0	0.67	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Dichlorodifluoromethane	5.0	U	5.0	0.41	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Ethylbenzene	5.0	U	5.0	0.35	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
1,2-Dibromoethane	5.0	U	5.0	0.64	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Isopropylbenzene	5.0	U	5.0	0.75	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Methyl acetate	25	U	25	3.0	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Methyl tert-butyl ether	5.0	U	5.0	0.49	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Methylcyclohexane	5.0	U	5.0	0.76	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Methylene Chloride	5.0	U	5.0	2.3	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
m,p-Xylene	10	U	10	0.84	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
n-Butylbenzene	5.0	U	5.0	0.44	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
N-Propylbenzene	5.0	U	5.0	0.40	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
o-Xylene	5.0	U	5.0	0.65	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
sec-Butylbenzene	5.0	U	5.0	0.44	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Tetrachloroethene	5.0	U	5.0	0.67	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Toluene	5.0	U	5.0	0.38	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
trans-1,2-Dichloroethene	5.0	U	5.0	0.52	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
trans-1,3-Dichloropropene	5.0	U	5.0	2.2	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Trichloroethene	5.0	U	5.0	1.1	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Trichlorofluoromethane	5.0	U	5.0	0.47	ug/Kg		08/19/24 10:41	08/19/24 14:10	1

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 480-722313/2-A
Matrix: Solid
Analysis Batch: 722312

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 722313

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl chloride	5.0	U	5.0	0.61	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Xylenes, Total	10	U	10	0.84	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
cis-1,3-Dichloropropene	5.0	U	5.0	0.72	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
Styrene	5.0	U	5.0	0.25	ug/Kg		08/19/24 10:41	08/19/24 14:10	1
tert-Butylbenzene	5.0	U	5.0	0.52	ug/Kg		08/19/24 10:41	08/19/24 14:10	1

Tentatively Identified Compound	*MB Est. Result*	*MB Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Tentatively Identified Compound	*None*		*ug/Kg*			*N/A*	*08/19/24 10:41*	*08/19/24 14:10*	*1*

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*99*		*64 - 126*	*08/19/24 10:41*	*08/19/24 14:10*	*1*
4-Bromofluorobenzene (Surr)	*96*		*72 - 126*	*08/19/24 10:41*	*08/19/24 14:10*	*1*
Toluene-d8 (Surr)	*96*		*71 - 125*	*08/19/24 10:41*	*08/19/24 14:10*	*1*
Dibromofluoromethane (Surr)	*103*		*60 - 140*	*08/19/24 10:41*	*08/19/24 14:10*	*1*

Lab Sample ID: LCS 480-722313/1-A
Matrix: Solid
Analysis Batch: 722312

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 722313

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	50.0	43.7		ug/Kg		87	77 - 121
1,1,2,2-Tetrachloroethane	50.0	44.6		ug/Kg		89	80 - 120
1,1,2-Trichloro-1,2,2-trifluoroethane	50.0	39.5		ug/Kg		79	60 - 140
1,1,2-Trichloroethane	50.0	45.3		ug/Kg		91	78 - 122
1,1-Dichloroethane	50.0	45.2		ug/Kg		90	73 - 126
1,1-Dichloroethene	50.0	41.1		ug/Kg		82	59 - 125
1,2,4-Trichlorobenzene	50.0	42.6		ug/Kg		85	64 - 120
1,2,4-Trimethylbenzene	50.0	44.4		ug/Kg		89	74 - 120
1,2-Dibromo-3-Chloropropane	50.0	42.9		ug/Kg		86	63 - 124
1,2-Dichlorobenzene	50.0	43.9		ug/Kg		88	75 - 120
1,2-Dichloroethane	50.0	44.8		ug/Kg		90	77 - 122
1,2-Dichloropropane	50.0	46.9		ug/Kg		94	75 - 124
1,3,5-Trimethylbenzene	50.0	44.0		ug/Kg		88	74 - 120
1,3-Dichlorobenzene	50.0	44.9		ug/Kg		90	74 - 120
1,4-Dichlorobenzene	50.0	45.5		ug/Kg		91	73 - 120
2-Butanone (MEK)	250	264		ug/Kg		105	70 - 134
2-Hexanone	250	255		ug/Kg		102	59 - 130
4-Isopropyltoluene	50.0	44.5		ug/Kg		89	74 - 120
4-Methyl-2-pentanone (MIBK)	250	240		ug/Kg		96	65 - 133
Acetone	250	243		ug/Kg		97	61 - 137
Benzene	50.0	45.5		ug/Kg		91	79 - 127
Bromoform	50.0	44.2		ug/Kg		88	68 - 126
Bromomethane	50.0	45.1		ug/Kg		90	37 - 149
Carbon disulfide	50.0	39.0		ug/Kg		78	64 - 131
Carbon tetrachloride	50.0	43.2		ug/Kg		86	75 - 135
Chlorobenzene	50.0	44.3		ug/Kg		89	76 - 124
Dibromochloromethane	50.0	44.6		ug/Kg		89	76 - 125

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 480-722313/1-A
Matrix: Solid
Analysis Batch: 722312

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 722313

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Chloroethane	50.0	47.8		ug/Kg		96	69 - 135
Chloroform	50.0	43.4		ug/Kg		87	80 - 120
Chloromethane	50.0	47.5		ug/Kg		95	63 - 127
cis-1,2-Dichloroethene	50.0	42.3		ug/Kg		85	81 - 120
Cyclohexane	50.0	42.5		ug/Kg		85	65 - 120
Bromodichloromethane	50.0	46.0		ug/Kg		92	80 - 122
Dichlorodifluoromethane	50.0	37.5		ug/Kg		75	57 - 142
Ethylbenzene	50.0	43.6		ug/Kg		87	80 - 120
1,2-Dibromoethane	50.0	44.7		ug/Kg		89	78 - 120
Isopropylbenzene	50.0	43.4		ug/Kg		87	72 - 120
Methyl acetate	100	86.9		ug/Kg		87	55 - 136
Methyl tert-butyl ether	50.0	42.8		ug/Kg		86	63 - 125
Methylcyclohexane	50.0	41.2		ug/Kg		82	60 - 140
Methylene Chloride	50.0	45.2		ug/Kg		90	61 - 127
m,p-Xylene	50.0	43.5		ug/Kg		87	70 - 130
n-Butylbenzene	50.0	45.0		ug/Kg		90	70 - 120
N-Propylbenzene	50.0	45.5		ug/Kg		91	70 - 130
o-Xylene	50.0	43.4		ug/Kg		87	70 - 130
sec-Butylbenzene	50.0	44.2		ug/Kg		88	74 - 120
Tetrachloroethene	50.0	43.0		ug/Kg		86	74 - 122
Toluene	50.0	44.4		ug/Kg		89	74 - 128
trans-1,2-Dichloroethene	50.0	41.6		ug/Kg		83	78 - 126
trans-1,3-Dichloropropene	50.0	46.6		ug/Kg		93	73 - 123
Trichloroethene	50.0	45.5		ug/Kg		91	77 - 129
Trichlorofluoromethane	50.0	47.1		ug/Kg		94	65 - 146
Vinyl chloride	50.0	46.2		ug/Kg		92	61 - 133
cis-1,3-Dichloropropene	50.0	48.0		ug/Kg		96	80 - 120
Styrene	50.0	45.1		ug/Kg		90	80 - 120
tert-Butylbenzene	50.0	43.6		ug/Kg		87	73 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*103*		*64 - 126*
4-Bromofluorobenzene (Surr)	*97*		*72 - 126*
Toluene-d8 (Surr)	*93*		*71 - 125*
Dibromofluoromethane (Surr)	*97*		*60 - 140*

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 480-722519/1-A
Matrix: Solid
Analysis Batch: 722554

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 722519

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	170	U	170	25	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Acenaphthylene	170	U	170	22	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Anthracene	170	U	170	42	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Benzo[a]anthracene	170	U	170	17	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Benzo[a]pyrene	170	U	170	25	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Benzo[b]fluoranthene	170	U	170	27	ug/Kg		08/20/24 16:30	08/21/24 15:20	1

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-722519/1-A
Matrix: Solid
Analysis Batch: 722554

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 722519

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzo[g,h,i]perylene	170	U	170	18	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Benzo[k]fluoranthene	170	U	170	22	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Chrysene	170	U	170	38	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Dibenz(a,h)anthracene	170	U	170	30	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Fluoranthene	170	U	170	18	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Fluorene	170	U	170	20	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Indeno[1,2,3-cd]pyrene	170	U	170	21	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Naphthalene	170	U	170	22	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Pyrene	170	U	170	20	ug/Kg		08/20/24 16:30	08/21/24 15:20	1
Phenanthrene	170	U	170	25	ug/Kg		08/20/24 16:30	08/21/24 15:20	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*97*		*26 - 143*	*08/20/24 16:30*	*08/21/24 15:20*	*1*
2-Fluorobiphenyl (Surr)	*86*		*50 - 121*	*08/20/24 16:30*	*08/21/24 15:20*	*1*
2-Fluorophenol (Surr)	*90*		*36 - 120*	*08/20/24 16:30*	*08/21/24 15:20*	*1*
Phenol-d5 (Surr)	*87*		*41 - 120*	*08/20/24 16:30*	*08/21/24 15:20*	*1*
p-Terphenyl-d14 (Surr)	*99*		*46 - 143*	*08/20/24 16:30*	*08/21/24 15:20*	*1*
Nitrobenzene-d5 (Surr)	*80*		*40 - 121*	*08/20/24 16:30*	*08/21/24 15:20*	*1*

Lab Sample ID: LCS 480-722519/2-A
Matrix: Solid
Analysis Batch: 722554

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 722519

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Acenaphthene	1330	1170		ug/Kg		88	62 - 120
Acenaphthylene	1330	1230		ug/Kg		92	58 - 121
Anthracene	1330	1260		ug/Kg		95	62 - 120
Benzo[a]anthracene	1330	1250		ug/Kg		94	65 - 120
Benzo[a]pyrene	1330	1260		ug/Kg		94	64 - 120
Benzo[b]fluoranthene	1330	1200		ug/Kg		90	64 - 120
Benzo[g,h,i]perylene	1330	1280		ug/Kg		96	45 - 145
Benzo[k]fluoranthene	1330	1340		ug/Kg		100	65 - 120
Chrysene	1330	1230		ug/Kg		92	64 - 120
Dibenz(a,h)anthracene	1330	1300		ug/Kg		98	54 - 132
Fluoranthene	1330	1270		ug/Kg		95	62 - 120
Fluorene	1330	1220		ug/Kg		92	63 - 120
Indeno[1,2,3-cd]pyrene	1330	1290		ug/Kg		97	56 - 134
Naphthalene	1330	1090		ug/Kg		82	55 - 120
Pyrene	1330	1260		ug/Kg		95	61 - 133
Phenanthrene	1330	1210		ug/Kg		91	60 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*102*		*26 - 143*
2-Fluorobiphenyl (Surr)	*84*		*50 - 121*
2-Fluorophenol (Surr)	*80*		*36 - 120*
Phenol-d5 (Surr)	*85*		*41 - 120*
p-Terphenyl-d14 (Surr)	*91*		*46 - 143*
Nitrobenzene-d5 (Surr)	*78*		*40 - 121*

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: 480-222654-4 MS
Matrix: Solid
Analysis Batch: 722554

Client Sample ID: TP-11 6-8 FT
Prep Type: Total/NA
Prep Batch: 722519

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Acenaphthene	200	U	1550	1340		ug/Kg	☼	87	60 - 120
Acenaphthylene	200	U	1550	1400		ug/Kg	☼	90	58 - 121
Anthracene	200	U	1550	1470		ug/Kg	☼	95	62 - 120
Benzo[a]anthracene	200	U	1550	1500		ug/Kg	☼	97	65 - 120
Benzo[a]pyrene	200	U	1550	1460		ug/Kg	☼	94	64 - 120
Benzo[b]fluoranthene	200	U	1550	1410		ug/Kg	☼	91	10 - 150
Benzo[g,h,i]perylene	200	U	1550	1530		ug/Kg	☼	99	45 - 145
Benzo[k]fluoranthene	200	U	1550	1540		ug/Kg	☼	99	23 - 150
Chrysene	200	U	1550	1460		ug/Kg	☼	94	64 - 120
Dibenz(a,h)anthracene	200	U	1550	1530		ug/Kg	☼	99	54 - 132
Fluoranthene	200	U	1550	1380		ug/Kg	☼	89	62 - 120
Fluorene	200	U	1550	1380		ug/Kg	☼	89	63 - 120
Indeno[1,2,3-cd]pyrene	200	U	1550	1500		ug/Kg	☼	97	56 - 134
Naphthalene	200	U	1550	1210		ug/Kg	☼	78	46 - 120
Pyrene	200	U	1550	1620		ug/Kg	☼	104	61 - 133
Phenanthrene	200	U	1550	1430		ug/Kg	☼	92	60 - 122

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*108*		*26 - 143*
2-Fluorobiphenyl (Surr)	*84*		*50 - 121*
2-Fluorophenol (Surr)	*74*		*36 - 120*
Phenol-d5 (Surr)	*78*		*41 - 120*
p-Terphenyl-d14 (Surr)	*102*		*46 - 143*
Nitrobenzene-d5 (Surr)	*76*		*40 - 121*

Lab Sample ID: 480-222654-4 MSD
Matrix: Solid
Analysis Batch: 722554

Client Sample ID: TP-11 6-8 FT
Prep Type: Total/NA
Prep Batch: 722519

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Acenaphthene	200	U	1550	1410		ug/Kg	☼	91	60 - 120	5	35
Acenaphthylene	200	U	1550	1480		ug/Kg	☼	96	58 - 121	6	18
Anthracene	200	U	1550	1520		ug/Kg	☼	98	62 - 120	3	15
Benzo[a]anthracene	200	U	1550	1530		ug/Kg	☼	99	65 - 120	2	15
Benzo[a]pyrene	200	U	1550	1520		ug/Kg	☼	98	64 - 120	4	15
Benzo[b]fluoranthene	200	U	1550	1420		ug/Kg	☼	92	10 - 150	0	15
Benzo[g,h,i]perylene	200	U	1550	1670		ug/Kg	☼	108	45 - 145	9	15
Benzo[k]fluoranthene	200	U	1550	1620		ug/Kg	☼	105	23 - 150	5	22
Chrysene	200	U	1550	1510		ug/Kg	☼	97	64 - 120	4	15
Dibenz(a,h)anthracene	200	U	1550	1630		ug/Kg	☼	105	54 - 132	6	15
Fluoranthene	200	U	1550	1390		ug/Kg	☼	90	62 - 120	0	15
Fluorene	200	U	1550	1410		ug/Kg	☼	91	63 - 120	2	15
Indeno[1,2,3-cd]pyrene	200	U	1550	1630		ug/Kg	☼	105	56 - 134	8	15
Naphthalene	200	U	1550	1290		ug/Kg	☼	83	46 - 120	7	29
Pyrene	200	U	1550	1690		ug/Kg	☼	109	61 - 133	4	35
Phenanthrene	200	U	1550	1450		ug/Kg	☼	94	60 - 122	2	15

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 480-222654-4 MSD
Matrix: Solid
Analysis Batch: 722554

Client Sample ID: TP-11 6-8 FT
Prep Type: Total/NA
Prep Batch: 722519

Surrogate	MSD %Recovery	MSD Qualifier	Limits
2,4,6-Tribromophenol (Surr)	109		26 - 143
2-Fluorobiphenyl (Surr)	88		50 - 121
2-Fluorophenol (Surr)	79		36 - 120
Phenol-d5 (Surr)	85		41 - 120
p-Terphenyl-d14 (Surr)	107		46 - 143
Nitrobenzene-d5 (Surr)	81		40 - 121

GC/MS VOA

Analysis Batch: 722261

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	8260C	722297
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	8260C	722297
480-222654-9	SB-3 4-5 FT	Total/NA	Solid	8260C	722297
480-222654-10	SB-4 4-5 FT	Total/NA	Solid	8260C	722297
MB 480-722297/3-A	Method Blank	Total/NA	Solid	8260C	722297
LCS 480-722297/1-A	Lab Control Sample	Total/NA	Solid	8260C	722297

Prep Batch: 722297

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	5035A_H	
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	5035A_H	
480-222654-9	SB-3 4-5 FT	Total/NA	Solid	5035A_H	
480-222654-10	SB-4 4-5 FT	Total/NA	Solid	5035A_H	
MB 480-722297/3-A	Method Blank	Total/NA	Solid	5035A_H	
LCS 480-722297/1-A	Lab Control Sample	Total/NA	Solid	5035A_H	

Analysis Batch: 722312

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-1	TP-1 4-6 FT	Total/NA	Solid	8260C	722313
480-222654-4	TP-11 6-8 FT	Total/NA	Solid	8260C	722313
480-222654-5	TP-12 6-8 FT	Total/NA	Solid	8260C	722313
480-222654-6	TP-14 4-5 FT	Total/NA	Solid	8260C	722313
MB 480-722313/2-A	Method Blank	Total/NA	Solid	8260C	722313
LCS 480-722313/1-A	Lab Control Sample	Total/NA	Solid	8260C	722313

Prep Batch: 722313

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-1	TP-1 4-6 FT	Total/NA	Solid	5035A_L	
480-222654-4	TP-11 6-8 FT	Total/NA	Solid	5035A_L	
480-222654-5	TP-12 6-8 FT	Total/NA	Solid	5035A_L	
480-222654-6	TP-14 4-5 FT	Total/NA	Solid	5035A_L	
MB 480-722313/2-A	Method Blank	Total/NA	Solid	5035A_L	
LCS 480-722313/1-A	Lab Control Sample	Total/NA	Solid	5035A_L	

GC/MS Semi VOA

Prep Batch: 722519

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-1	TP-1 4-6 FT	Total/NA	Solid	3550C	
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	3550C	
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	3550C	
480-222654-4	TP-11 6-8 FT	Total/NA	Solid	3550C	
480-222654-5	TP-12 6-8 FT	Total/NA	Solid	3550C	
480-222654-6	TP-14 4-5 FT	Total/NA	Solid	3550C	
480-222654-9	SB-3 4-5 FT	Total/NA	Solid	3550C	
480-222654-10	SB-4 4-5 FT	Total/NA	Solid	3550C	
MB 480-722519/1-A	Method Blank	Total/NA	Solid	3550C	
LCS 480-722519/2-A	Lab Control Sample	Total/NA	Solid	3550C	
480-222654-4 MS	TP-11 6-8 FT	Total/NA	Solid	3550C	
480-222654-4 MSD	TP-11 6-8 FT	Total/NA	Solid	3550C	

GC/MS Semi VOA

Analysis Batch: 722554

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-1	TP-1 4-6 FT	Total/NA	Solid	8270D	722519
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	8270D	722519
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	8270D	722519
480-222654-4	TP-11 6-8 FT	Total/NA	Solid	8270D	722519
480-222654-5	TP-12 6-8 FT	Total/NA	Solid	8270D	722519
480-222654-6	TP-14 4-5 FT	Total/NA	Solid	8270D	722519
480-222654-9	SB-3 4-5 FT	Total/NA	Solid	8270D	722519
480-222654-10	SB-4 4-5 FT	Total/NA	Solid	8270D	722519
MB 480-722519/1-A	Method Blank	Total/NA	Solid	8270D	722519
LCS 480-722519/2-A	Lab Control Sample	Total/NA	Solid	8270D	722519
480-222654-4 MS	TP-11 6-8 FT	Total/NA	Solid	8270D	722519
480-222654-4 MSD	TP-11 6-8 FT	Total/NA	Solid	8270D	722519

General Chemistry

Analysis Batch: 722373

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-1	TP-1 4-6 FT	Total/NA	Solid	Moisture	
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	Moisture	
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	Moisture	
480-222654-4	TP-11 6-8 FT	Total/NA	Solid	Moisture	
480-222654-5	TP-12 6-8 FT	Total/NA	Solid	Moisture	
480-222654-6	TP-14 4-5 FT	Total/NA	Solid	Moisture	
480-222654-9	SB-3 4-5 FT	Total/NA	Solid	Moisture	
480-222654-10	SB-4 4-5 FT	Total/NA	Solid	Moisture	

Lab Chronicle

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: TP-1 4-6 FT
Lab Sample ID: 480-222654-1
Date Collected: 08/13/24 09:00
Matrix: Solid
Date Received: 08/17/24 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	722373	DSC	EET BUF	08/19/24 15:27

Client Sample ID: TP-1 4-6 FT
Lab Sample ID: 480-222654-1
Date Collected: 08/13/24 09:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 87.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	5035A_L			722313	LCH	EET BUF	08/19/24 10:41
Total/NA	Analysis	8260C		1	722312	LCH	EET BUF	08/19/24 15:07
Total/NA	Prep	3550C			722519	SJM	EET BUF	08/20/24 16:30
Total/NA	Analysis	8270D		10	722554	JMM	EET BUF	08/21/24 17:24

Client Sample ID: TP-4 3-4 FT
Lab Sample ID: 480-222654-2
Date Collected: 08/13/24 11:30
Matrix: Solid
Date Received: 08/17/24 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	722373	DSC	EET BUF	08/19/24 15:27

Client Sample ID: TP-4 3-4 FT
Lab Sample ID: 480-222654-2
Date Collected: 08/13/24 11:30
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 85.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	5035A_H			722297	ZN	EET BUF	08/19/24 09:39
Total/NA	Analysis	8260C		4	722261	ZN	EET BUF	08/19/24 13:48
Total/NA	Prep	3550C			722519	SJM	EET BUF	08/20/24 16:30
Total/NA	Analysis	8270D		1	722554	JMM	EET BUF	08/21/24 17:49

Client Sample ID: TP-10 8-9 FT
Lab Sample ID: 480-222654-3
Date Collected: 08/13/24 16:00
Matrix: Solid
Date Received: 08/17/24 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	722373	DSC	EET BUF	08/19/24 15:27

Client Sample ID: TP-10 8-9 FT
Lab Sample ID: 480-222654-3
Date Collected: 08/13/24 16:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 82.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	5035A_H			722297	ZN	EET BUF	08/19/24 09:39
Total/NA	Analysis	8260C		10	722261	ZN	EET BUF	08/19/24 14:09
Total/NA	Prep	3550C			722519	SJM	EET BUF	08/20/24 16:30
Total/NA	Analysis	8270D		1	722554	JMM	EET BUF	08/21/24 18:13

Client Sample ID: TP-11 6-8 FT
Lab Sample ID: 480-222654-4
Date Collected: 08/14/24 09:00
Matrix: Solid
Date Received: 08/17/24 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	722373	DSC	EET BUF	08/19/24 15:27

Client Sample ID: TP-11 6-8 FT
Lab Sample ID: 480-222654-4
Date Collected: 08/14/24 09:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 83.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	5035A_L			722313	LCH	EET BUF	08/19/24 10:41
Total/NA	Analysis	8260C		1	722312	LCH	EET BUF	08/19/24 15:31
Total/NA	Prep	3550C			722519	SJM	EET BUF	08/20/24 16:30
Total/NA	Analysis	8270D		1	722554	JMM	EET BUF	08/21/24 16:59

Client Sample ID: TP-12 6-8 FT
Lab Sample ID: 480-222654-5
Date Collected: 08/14/24 11:00
Matrix: Solid
Date Received: 08/17/24 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	722373	DSC	EET BUF	08/19/24 15:27

Client Sample ID: TP-12 6-8 FT
Lab Sample ID: 480-222654-5
Date Collected: 08/14/24 11:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 83.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	5035A_L			722313	LCH	EET BUF	08/19/24 12:55
Total/NA	Analysis	8260C		1	722312	LCH	EET BUF	08/19/24 20:39
Total/NA	Prep	3550C			722519	SJM	EET BUF	08/20/24 16:30
Total/NA	Analysis	8270D		1	722554	JMM	EET BUF	08/21/24 18:37

Client Sample ID: TP-14 4-5 FT
Lab Sample ID: 480-222654-6
Date Collected: 08/14/24 13:00
Matrix: Solid
Date Received: 08/17/24 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	722373	DSC	EET BUF	08/19/24 15:27

Client Sample ID: TP-14 4-5 FT
Lab Sample ID: 480-222654-6
Date Collected: 08/14/24 13:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 85.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	5035A_L			722313	LCH	EET BUF	08/19/24 10:41
Total/NA	Analysis	8260C		1	722312	LCH	EET BUF	08/19/24 15:54
Total/NA	Prep	3550C			722519	SJM	EET BUF	08/20/24 16:30
Total/NA	Analysis	8270D		1	722554	JMM	EET BUF	08/21/24 19:03

Lab Chronicle

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Client Sample ID: SB-3 4-5 FT
Lab Sample ID: 480-222654-9
Date Collected: 08/15/24 12:30
Matrix: Solid
Date Received: 08/17/24 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	722373	DSC	EET BUF	08/19/24 15:27

Client Sample ID: SB-3 4-5 FT
Lab Sample ID: 480-222654-9
Date Collected: 08/15/24 12:30
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 84.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	5035A_H			722297	ZN	EET BUF	08/19/24 09:39
Total/NA	Analysis	8260C		5	722261	ZN	EET BUF	08/19/24 15:06
Total/NA	Prep	3550C			722519	SJM	EET BUF	08/20/24 16:30
Total/NA	Analysis	8270D		1	722554	JMM	EET BUF	08/21/24 19:31

Client Sample ID: SB-4 4-5 FT
Lab Sample ID: 480-222654-10
Date Collected: 08/15/24 14:00
Matrix: Solid
Date Received: 08/17/24 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	722373	DSC	EET BUF	08/19/24 15:27

Client Sample ID: SB-4 4-5 FT
Lab Sample ID: 480-222654-10
Date Collected: 08/15/24 14:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 89.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	5035A_H			722297	ZN	EET BUF	08/19/24 09:39
Total/NA	Analysis	8260C		20	722261	ZN	EET BUF	08/19/24 15:31
Total/NA	Prep	3550C			722519	SJM	EET BUF	08/20/24 16:30
Total/NA	Analysis	8270D		5	722554	JMM	EET BUF	08/21/24 19:56

Laboratory References:
EET BUF = Eurofins Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Accreditation/Certification Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Laboratory: Eurofins Buffalo

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
New York	NELAP	10026	03-31-25

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
Moisture		Solid	Percent Moisture
Moisture		Solid	Percent Solids

Method Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	EET BUF
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	EET BUF
Moisture	Percent Moisture	EPA	EET BUF
3550C	Ultrasonic Extraction	SW846	EET BUF
5035A_H	Closed System Purge and Trap	SW846	EET BUF
5035A_L	Closed System Purge and Trap	SW846	EET BUF

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET BUF = Eurofins Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Sample Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-1
Project/Site: 3701 River Rd

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
480-222654-1	TP-1 4-6 FT	Solid	08/13/24 09:00	08/17/24 08:00
480-222654-2	TP-4 3-4 FT	Solid	08/13/24 11:30	08/17/24 08:00
480-222654-3	TP-10 8-9 FT	Solid	08/13/24 16:00	08/17/24 08:00
480-222654-4	TP-11 6-8 FT	Solid	08/14/24 09:00	08/17/24 08:00
480-222654-5	TP-12 6-8 FT	Solid	08/14/24 11:00	08/17/24 08:00
480-222654-6	TP-14 4-5 FT	Solid	08/14/24 13:00	08/17/24 08:00
480-222654-9	SB-3 4-5 FT	Solid	08/15/24 12:30	08/17/24 08:00
480-222654-10	SB-4 4-5 FT	Solid	08/15/24 14:00	08/17/24 08:00

Environment Testing
TestAmerica

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Company Name: Roux Inc	Tel/Email:	Lab Contact:	Carrier:	of COCs
Address: 2558 Hamburg Turnpike				Sampler:
City/State/Zip: Buffalo NY 14218				For Lab Use Only:
Phone: 716-713-3137				Walk-in Client:
Fax:				Lab Sampling:
Project Name: 3201 River Rd				Job / SDG No.:
Site:				
PO # 4369.0005 8000				

Analysis Turnaround Time

☐ CALENDAR DAYS ☐ WORKING DAYS

TAT if different from Below _____

☐ 2 weeks
☒ 1 week
☐ 2 days
☐ 1 day

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	TCL+CP+STARS+TICs	PAH's + TICs
TP-1 4-6 Ft	8/13/24	9:00	G	Soil	2			X	X
TP-4 3-4 Ft		11:30						X	X
TP-10 8-9 Ft		1600						X	X
TP-11 6-8 Ft	8/14/24	9:00						X	X
TP-12 6-8 Ft		11:00						X	X
TP-14 4-5 Ft		13:00						X	X
TP-16 6-8 Ft		1430							on hold
TP-18 6-8 Ft		1600							on hold
SB-3 4-5 Ft	8/15/24	1230						X	X
SB-4 4-5 Ft		1400						X	X

Sample Specific Notes:

480-222654 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

4.4 #1 ICE

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temp.(°C): Obs'd:_____ Corr'd:_____		Therm ID No.:_____
Relinquished by:	Company: Roux	Date/Time: 8/16/24 12:36	Received by:	Company: Roux	Date/Time: 8/16/24 12:36
Relinquished by:	Company: EET	Date/Time: 8/16/24 14:58	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company: TMTO	Date/Time: 8/17/24 800

8/23/2024

Login Sample Receipt Checklist

Client: Roux Environmental Engineering and Geology DPC

Job Number: 480-222654-1

Login Number: 222654
List Number: 1
Creator: Stopa, Erik S

List Source: Eurofins Buffalo

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time (Excluding tests with immediate HTs)..	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Sampling Company provided.	True	roux
Samples received within 48 hours of sampling.	False	
Samples requiring field filtration have been filtered in the field.	N/A	
Chlorine Residual checked.	N/A	

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ANALYTICAL REPORT

PREPARED FOR

Attn: Bryan Mayback
Roux Environmental Engineering and Geology DPC
2558 Hamburg Turnpike
Suite 300
Lackawanna, New York 14218

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JOB DESCRIPTION

3701 River Rd

JOB NUMBER

480-222654-3

Eurofins Buffalo
10 Hazelwood Drive
Amherst NY 14228-2298

See page two for job notes and contact information.

myEOL

Eurofins Buffalo

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Northeast, LLC Project Manager.

Authorization



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Definitions/Glossary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
*+	LCS and/or LCSD is outside acceptance limits, high biased.
H	Sample was prepped or analyzed beyond the specified holding time. This does not meet regulatory requirements.
S1-	Surrogate recovery exceeds control limits, low biased.
U	Indicates the analyte was analyzed for but not detected.

Metals

Qualifier	Qualifier Description
U	Indicates the analyte was analyzed for but not detected.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 480-222654-3 Eurofins Buffalo

Job Narrative
480-222654-3

Analytical test results meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page unless otherwise noted under the individual analysis. Data qualifiers and/or narrative comments are included to explain any exceptions, if applicable.

- Matrix QC may not be reported if insufficient sample is provided or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD may be performed, unless otherwise specified in the method.
- Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.

Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Receipt
The samples were received on 8/17/2024 8:00 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 4.4°C.

GC/MS Semi VOA
Method 8270D: The following samples were prepared outside of preparation holding time due to activated out of hold : TP-4 3-4 FT (480-222654-2) and TP-10 8-9 FT (480-222654-3).

Method 8270D: The following samples were diluted due to color, appearance, and viscosity: TP-4 3-4 FT (480-222654-2) and TP-10 8-9 FT (480-222654-3). Elevated reporting limits (RL) are provided.

Method 8270D: The laboratory control sample (LCS) for preparation batch 480-724117 and analytical batch 480-724363 recovered outside control limits for the following analytes: Tetraethyl lead. These analytes were biased high in the LCS and were not detected in the associated samples; therefore, the data have been reported.

Method 8270D: Six surrogates are used for this analysis. The laboratory's SOP allows one acid and one base of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following sample contained an allowable number of surrogate compounds outside limits: TP-4 3-4 FT (480-222654-2). These results have been reported and qualified.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

Client Sample ID: TP-4 3-4 FT
Lab Sample ID: 480-222654-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Lead	12.1		1.2	0.54	mg/Kg	1	☼	6010D	Total/NA

Client Sample ID: TP-10 8-9 FT
Lab Sample ID: 480-222654-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Lead	11.6		1.2	0.55	mg/Kg	1	☼	6010D	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: TP-4 3-4 FT
Lab Sample ID: 480-222654-2

Date Collected: 08/13/24 11:30
Matrix: Solid

Date Received: 08/17/24 08:00
Percent Solids: 85.4

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Tetraethyl lead	5800	U H *+	5800	940	ug/Kg	☼	09/05/24 17:13	09/09/24 14:34	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Nitrobenzene-d5 (Surr)	*43*		*40 - 121*	*09/05/24 17:13*	*09/09/24 14:34*	*5*
Phenol-d5 (Surr)	*44*		*41 - 120*	*09/05/24 17:13*	*09/09/24 14:34*	*5*
p-Terphenyl-d14 (Surr)	*64*		*46 - 143*	*09/05/24 17:13*	*09/09/24 14:34*	*5*
2,4,6-Tribromophenol (Surr)	*59*		*26 - 143*	*09/05/24 17:13*	*09/09/24 14:34*	*5*
2-Fluorobiphenyl (Surr)	*49*	*S1-*	*50 - 121*	*09/05/24 17:13*	*09/09/24 14:34*	*5*
2-Fluorophenol (Surr)	*48*		*36 - 120*	*09/05/24 17:13*	*09/09/24 14:34*	*5*

Method: SW846 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**12.1**		1.2	0.54	mg/Kg	☼	09/05/24 15:33	09/09/24 16:43	1

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

Client Sample ID: TP-10 8-9 FT
Lab Sample ID: 480-222654-3

Date Collected: 08/13/24 16:00
Matrix: Solid

Date Received: 08/17/24 08:00
Percent Solids: 82.7

Method: SW846 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Tetraethyl lead	6000	U H *+	6000	970	ug/Kg	☼	09/05/24 17:13	09/09/24 14:59	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Nitrobenzene-d5 (Surr)	*54*		*40 - 121*	*09/05/24 17:13*	*09/09/24 14:59*	*5*
Phenol-d5 (Surr)	*57*		*41 - 120*	*09/05/24 17:13*	*09/09/24 14:59*	*5*
p-Terphenyl-d14 (Surr)	*68*		*46 - 143*	*09/05/24 17:13*	*09/09/24 14:59*	*5*
2,4,6-Tribromophenol (Surr)	*69*		*26 - 143*	*09/05/24 17:13*	*09/09/24 14:59*	*5*
2-Fluorobiphenyl (Surr)	*59*		*50 - 121*	*09/05/24 17:13*	*09/09/24 14:59*	*5*
2-Fluorophenol (Surr)	*55*		*36 - 120*	*09/05/24 17:13*	*09/09/24 14:59*	*5*

Method: SW846 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**11.6**		1.2	0.55	mg/Kg	☼	09/05/24 15:33	09/09/24 16:45	1

Surrogate Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)							
		NBZ	PHL	TPHd14	TBP	FBP	2FP		
Lab Sample ID	Client Sample ID	(40-121)	(41-120)	(46-143)	(26-143)	(50-121)	(36-120)		
480-222654-2	TP-4 3-4 FT	43	44	64	59	49 S1-	48		
480-222654-3	TP-10 8-9 FT	54	57	68	69	59	55		
LCS 480-724117/2-A	Lab Control Sample	86	91	95	117	89	76		
MB 480-724117/1-A	Method Blank	87	92	91	103	90	83		

Surrogate Legend

NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPHd14 = p-Terphenyl-d14 (Surr)
TBP = 2,4,6-Tribromophenol (Surr)
FBP = 2-Fluorobiphenyl (Surr)
2FP = 2-Fluorophenol (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 480-724117/1-A
Matrix: Solid
Analysis Batch: 724170

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 724117

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Tetraethyl lead	1000	U	1000	160	ug/Kg		09/05/24 17:13	09/06/24 20:27	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Nitrobenzene-d5 (Surr)	*87*		*40 - 121*	*09/05/24 17:13*	*09/06/24 20:27*	*1*
Phenol-d5 (Surr)	*92*		*41 - 120*	*09/05/24 17:13*	*09/06/24 20:27*	*1*
p-Terphenyl-d14 (Surr)	*91*		*46 - 143*	*09/05/24 17:13*	*09/06/24 20:27*	*1*
2,4,6-Tribromophenol (Surr)	*103*		*26 - 143*	*09/05/24 17:13*	*09/06/24 20:27*	*1*
2-Fluorobiphenyl (Surr)	*90*		*50 - 121*	*09/05/24 17:13*	*09/06/24 20:27*	*1*
2-Fluorophenol (Surr)	*83*		*36 - 120*	*09/05/24 17:13*	*09/06/24 20:27*	*1*

Lab Sample ID: LCS 480-724117/2-A
Matrix: Solid
Analysis Batch: 724170

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 724117

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Nitrobenzene-d5 (Surr)	*86*		*40 - 121*
Phenol-d5 (Surr)	*91*		*41 - 120*
p-Terphenyl-d14 (Surr)	*95*		*46 - 143*
2,4,6-Tribromophenol (Surr)	*117*		*26 - 143*
2-Fluorobiphenyl (Surr)	*89*		*50 - 121*
2-Fluorophenol (Surr)	*76*		*36 - 120*

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 480-724050/1-A
Matrix: Solid
Analysis Batch: 724472

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 724050

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	0.95	U	0.95	0.44	mg/Kg		09/05/24 15:33	09/09/24 15:38	1

Lab Sample ID: LCSSRM 480-724050/2-A
Matrix: Solid
Analysis Batch: 724472

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 724050

Analyte			Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec Limits		
Lead			92.8	90.96		mg/Kg		98.0	81.8 - 118.5		

QC Association Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

GC/MS Semi VOA

Prep Batch: 724117

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	3550C	
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	3550C	
MB 480-724117/1-A	Method Blank	Total/NA	Solid	3550C	
LCS 480-724117/2-A	Lab Control Sample	Total/NA	Solid	3550C	

Analysis Batch: 724170

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 480-724117/1-A	Method Blank	Total/NA	Solid	8270D	724117
LCS 480-724117/2-A	Lab Control Sample	Total/NA	Solid	8270D	724117

Analysis Batch: 724363

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	8270D	724117
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	8270D	724117

Metals

Prep Batch: 724050

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	3050B	
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	3050B	
MB 480-724050/1-A	Method Blank	Total/NA	Solid	3050B	
LCSSRM 480-724050/2-A	Lab Control Sample	Total/NA	Solid	3050B	

Analysis Batch: 724472

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222654-2	TP-4 3-4 FT	Total/NA	Solid	6010D	724050
480-222654-3	TP-10 8-9 FT	Total/NA	Solid	6010D	724050
MB 480-724050/1-A	Method Blank	Total/NA	Solid	6010D	724050
LCSSRM 480-724050/2-A	Lab Control Sample	Total/NA	Solid	6010D	724050

Lab Chronicle

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

Client Sample ID: TP-4 3-4 FT
Lab Sample ID: 480-222654-2
Date Collected: 08/13/24 11:30
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 85.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3550C			724117	SJM	EET BUF	09/05/24 17:13
Total/NA	Analysis	8270D		5	724363	JMM	EET BUF	09/09/24 14:34
Total/NA	Prep	3050B			724050	ET	EET BUF	09/05/24 15:33
Total/NA	Analysis	6010D		1	724472	NZG	EET BUF	09/09/24 16:43

Client Sample ID: TP-10 8-9 FT
Lab Sample ID: 480-222654-3
Date Collected: 08/13/24 16:00
Matrix: Solid
Date Received: 08/17/24 08:00
Percent Solids: 82.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3550C			724117	SJM	EET BUF	09/05/24 17:13
Total/NA	Analysis	8270D		5	724363	JMM	EET BUF	09/09/24 14:59
Total/NA	Prep	3050B			724050	ET	EET BUF	09/05/24 15:33
Total/NA	Analysis	6010D		1	724472	NZG	EET BUF	09/09/24 16:45

Laboratory References:

EET BUF = Eurofins Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Accreditation/Certification Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

Laboratory: Eurofins Buffalo

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
New York	NELAP	10026	03-31-25

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
8270D	3550C	Solid	Tetraethyl lead

Method Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

Method	Method Description	Protocol	Laboratory
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	EET BUF
6010D	Metals (ICP)	SW846	EET BUF
3050B	Preparation, Metals	SW846	EET BUF
3550C	Ultrasonic Extraction	SW846	EET BUF

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET BUF = Eurofins Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Sample Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222654-3
Project/Site: 3701 River Rd

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
480-222654-2	TP-4 3-4 FT	Solid	08/13/24 11:30	08/17/24 08:00
480-222654-3	TP-10 8-9 FT	Solid	08/13/24 16:00	08/17/24 08:00

Environment Testing
TestAmerica

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Company Name: Roux Inc	Tel/Email:	Lab Contact:	Carrier:	of COCs
Address: 2558 Hamburg Turnpike				Sampler:
City/State/Zip: Buffalo NY 14218				For Lab Use Only:
Phone: 716-713-3107				Walk-in Client:
Fax:				Lab Sampling:
Project Name: 3201 River Rd				Job / SDG No.:
Site:				
PO # 4369.0005 8000				

Analysis Turnaround Time

☐ CALENDAR DAYS ☐ WORKING DAYS

TAT if different from Below _____

☐ 2 weeks
☒ 1 week
☐ 2 days
☐ 1 day

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	TCL + CP Sl Volatiles	PAH's + TICs
TP-1 4-6 Ft	8/13/24	9:00	G	Sol	2			X	X
TP-4 3-4 Ft		11:30						X	X
TP-10 8-9 Ft		1600						X	X
TP-11 6-8 Ft	8/14/24	9:00						X	X
TP-12 6-8 Ft		11:00						X	X
TP-14 4-5 Ft		13:00						X	X
TP-16 6-8 Ft		1430							on hold
TP-18 6-8 Ft		1600							on hold
SB-3 4-5 Ft	8/15/24	1230						X	X
SB-4 4-5 Ft		1400						X	X

Sample Specific Notes:

480-222654 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

4.4 #1 ICE

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp.(°C): Obs'd:_____ Corr'd:_____ | Therm ID No.:_____

	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Roux	8/16/24 12:36		Roux	8/16/24 12:36
Relinquished by:	EET	8/16/24 14:58	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company: TMTO	Date/Time: 8/17/24 800

9/10/2024

Login Sample Receipt Checklist

Client: Roux Environmental Engineering and Geology DPC

Job Number: 480-222654-3

Login Number: 222654
List Number: 1
Creator: Stopa, Erik S

List Source: Eurofins Buffalo

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time (Excluding tests with immediate HTs)..	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Sampling Company provided.	True	roux
Samples received within 48 hours of sampling.	False	
Samples requiring field filtration have been filtered in the field.	N/A	
Chlorine Residual checked.	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Bryan Mayback
Roux Environmental Engineering and Geology DPC
2558 Hamburg Turnpike
Suite 300
Lackawanna, New York 14218

Generated 8/28/2024 10:12:53 AM

JOB DESCRIPTION

3701 River Rd

JOB NUMBER

480-222771-1

Eurofins Buffalo
10 Hazelwood Drive
Amherst NY 14228-2298

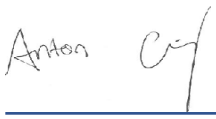
See page two for job notes and contact information.

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Northeast, LLC Project Manager.

Authorization



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Definitions/Glossary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
*+	LCS and/or LCSD is outside acceptance limits, high biased.
*1	LCS/LCSD RPD exceeds control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.

GC/MS VOA TICs

Qualifier	Qualifier Description
J	Indicates an Estimated Value for TICs
N	This flag indicates the presumptive evidence of a compound.
T	Result is a tentatively identified compound (TIC) and an estimated value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 480-222771-1 Eurofins Buffalo

Job Narrative
480-222771-1

Analytical test results meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page unless otherwise noted under the individual analysis. Data qualifiers and/or narrative comments are included to explain any exceptions, if applicable.

- Matrix QC may not be reported if insufficient sample is provided or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD may be performed, unless otherwise specified in the method.
- Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.

Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Receipt
The samples were received on 8/23/2024 9:15 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 5.5°C.

GC/MS VOA
Method 8260C: The following volatiles samples were diluted due to foaming at the time of purging during the original sample analysis: SB-1W (480-222771-1), SB-2W (480-222771-2), SB-3W (480-222771-3) and SB-5W (480-222771-4). Elevated reporting limits (RLs) are provided.

Method 8260C: The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for analytical batch 480-723037 recovered outside control limits for the following analytes: Carbon tetrachloride. These analytes were biased high in the LCS and were not detected in the associated samples; therefore, the data have been reported. The associated samples are impacted: SB-1W (480-222771-1), SB-2W (480-222771-2), SB-3W (480-222771-3) and SB-5W (480-222771-4).

Method 8260C: The RPD of the laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) for analytical batch 480-723037 recovered outside control limits for the following analytes: Carbon tetrachloride. The associated samples are impacted: SB-1W (480-222771-1), SB-2W (480-222771-2), SB-3W (480-222771-3) and SB-5W (480-222771-4).

Method 8260C: The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for analytical batch 480-723037 recovered outside control limits for the following analytes: 1,2-Dibromo-3-Chloropropane. These analytes were biased high in the LCS and were not detected in the associated samples; therefore, the data have been reported. The associated samples are impacted: SB-1W (480-222771-1), SB-2W (480-222771-2), SB-3W (480-222771-3) and SB-5W (480-222771-4).

Method 8260C: The continuing calibration verification (CCV) associated with batch 480-723037 recovered above the upper control limit for Chlorodibromomethane and 1,2-Dibromo-3-Chloropropane. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The associated samples are impacted: SB-1W (480-222771-1), SB-2W (480-222771-2), SB-3W (480-222771-3) and SB-5W (480-222771-4).

Method 8260C: The continuing calibration verification (CCV) associated with batch 480-723037 recovered above the upper control limit for Carbon tetrachloride. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The associated samples are impacted: SB-1W (480-222771-1), SB-2W (480-222771-2), SB-3W (480-222771-3) and SB-5W (480-222771-4).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Client Sample ID: SB-1W
Lab Sample ID: 480-222771-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,2,4-Trimethylbenzene	3.9	J	5.0	3.8	ug/L	5		8260C	Total/NA
Acetone	53		50	15	ug/L	5		8260C	Total/NA
Benzene	4.6	J	5.0	2.1	ug/L	5		8260C	Total/NA
Cyclohexane	2.6	J	5.0	0.90	ug/L	5		8260C	Total/NA
Ethylbenzene	8.3		5.0	3.7	ug/L	5		8260C	Total/NA
Methylcyclohexane	3.7	J	5.0	0.80	ug/L	5		8260C	Total/NA

Client Sample ID: SB-2W
Lab Sample ID: 480-222771-2

No Detections.

Client Sample ID: SB-3W
Lab Sample ID: 480-222771-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	42	J	50	15	ug/L	5		8260C	Total/NA
Cyclohexane	8.0		5.0	0.90	ug/L	5		8260C	Total/NA
Methylcyclohexane	8.8		5.0	0.80	ug/L	5		8260C	Total/NA

Client Sample ID: SB-5W
Lab Sample ID: 480-222771-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,2,4-Trimethylbenzene	49		10	7.5	ug/L	10		8260C	Total/NA
1,3,5-Trimethylbenzene	13		10	7.7	ug/L	10		8260C	Total/NA
Ethylbenzene	25		10	7.4	ug/L	10		8260C	Total/NA
Methylcyclohexane	1.8	J	10	1.6	ug/L	10		8260C	Total/NA
m,p-Xylene	80		20	6.6	ug/L	10		8260C	Total/NA
o-Xylene	22		10	7.6	ug/L	10		8260C	Total/NA
Xylenes, Total	100		20	6.6	ug/L	10		8260C	Total/NA

This Detection Summary does not include radiochemical test results.

Client: Roux Environmental Engineering and Geology DPC
Project/Site: 3701 River Rd

Job ID: 480-222771-1

Client Sample ID: SB-1W
Date Collected: 08/21/24 14:30
Date Received: 08/23/24 09:15

Lab Sample ID: 480-222771-1
Matrix: Water

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	5.0	U	5.0	4.1	ug/L			08/26/24 16:34	5
1,1,2,2-Tetrachloroethane	5.0	U	5.0	1.1	ug/L			08/26/24 16:34	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5.0	U	5.0	1.6	ug/L			08/26/24 16:34	5
1,1,2-Trichloroethane	5.0	U	5.0	1.2	ug/L			08/26/24 16:34	5
1,1-Dichloroethane	5.0	U	5.0	1.9	ug/L			08/26/24 16:34	5
1,1-Dichloroethene	5.0	U	5.0	1.5	ug/L			08/26/24 16:34	5
1,2,4-Trichlorobenzene	5.0	U	5.0	2.1	ug/L			08/26/24 16:34	5
1,2,4-Trimethylbenzene	**3.9**	**J**	5.0	3.8	ug/L			08/26/24 16:34	5
1,2-Dibromo-3-Chloropropane	5.0	U *+	5.0	2.0	ug/L			08/26/24 16:34	5
1,2-Dichlorobenzene	5.0	U	5.0	4.0	ug/L			08/26/24 16:34	5
1,2-Dichloroethane	5.0	U	5.0	1.1	ug/L			08/26/24 16:34	5
1,2-Dichloropropane	5.0	U	5.0	3.6	ug/L			08/26/24 16:34	5
1,3,5-Trimethylbenzene	5.0	U	5.0	3.9	ug/L			08/26/24 16:34	5
1,3-Dichlorobenzene	5.0	U	5.0	3.9	ug/L			08/26/24 16:34	5
1,4-Dichlorobenzene	5.0	U	5.0	4.2	ug/L			08/26/24 16:34	5
2-Butanone (MEK)	50	U	50	6.6	ug/L			08/26/24 16:34	5
2-Hexanone	25	U	25	6.2	ug/L			08/26/24 16:34	5
4-Isopropyltoluene	5.0	U	5.0	1.6	ug/L			08/26/24 16:34	5
4-Methyl-2-pentanone (MIBK)	25	U	25	11	ug/L			08/26/24 16:34	5
Acetone	**53**		50	15	ug/L			08/26/24 16:34	5
Benzene	**4.6**	**J**	5.0	2.1	ug/L			08/26/24 16:34	5
Bromoform	5.0	U	5.0	1.3	ug/L			08/26/24 16:34	5
Bromomethane	5.0	U	5.0	3.5	ug/L			08/26/24 16:34	5
Carbon disulfide	5.0	U	5.0	0.95	ug/L			08/26/24 16:34	5
Carbon tetrachloride	5.0	U *+ *1	5.0	1.4	ug/L			08/26/24 16:34	5
Chlorobenzene	5.0	U	5.0	3.8	ug/L			08/26/24 16:34	5
Dibromochloromethane	5.0	U	5.0	1.6	ug/L			08/26/24 16:34	5
Chloroethane	5.0	U	5.0	1.6	ug/L			08/26/24 16:34	5
Chloroform	5.0	U	5.0	1.7	ug/L			08/26/24 16:34	5
Chloromethane	5.0	U	5.0	1.8	ug/L			08/26/24 16:34	5
cis-1,2-Dichloroethene	5.0	U	5.0	4.1	ug/L			08/26/24 16:34	5
Cyclohexane	**2.6**	**J**	5.0	0.90	ug/L			08/26/24 16:34	5
Bromodichloromethane	5.0	U	5.0	2.0	ug/L			08/26/24 16:34	5
Dichlorodifluoromethane	5.0	U	5.0	3.4	ug/L			08/26/24 16:34	5
Ethylbenzene	**8.3**		5.0	3.7	ug/L			08/26/24 16:34	5
1,2-Dibromoethane	5.0	U	5.0	3.7	ug/L			08/26/24 16:34	5
Isopropylbenzene	5.0	U	5.0	4.0	ug/L			08/26/24 16:34	5
Methyl acetate	13	U	13	6.5	ug/L			08/26/24 16:34	5
Methyl tert-butyl ether	5.0	U	5.0	0.80	ug/L			08/26/24 16:34	5
Methylcyclohexane	**3.7**	**J**	5.0	0.80	ug/L			08/26/24 16:34	5
Methylene Chloride	5.0	U	5.0	2.2	ug/L			08/26/24 16:34	5
m,p-Xylene	10	U	10	3.3	ug/L			08/26/24 16:34	5
n-Butylbenzene	5.0	U	5.0	3.2	ug/L			08/26/24 16:34	5
N-Propylbenzene	5.0	U	5.0	3.5	ug/L			08/26/24 16:34	5
o-Xylene	5.0	U	5.0	3.8	ug/L			08/26/24 16:34	5
sec-Butylbenzene	5.0	U	5.0	3.8	ug/L			08/26/24 16:34	5
Tetrachloroethene	5.0	U	5.0	1.8	ug/L			08/26/24 16:34	5
Toluene	5.0	U	5.0	2.6	ug/L			08/26/24 16:34	5
trans-1,2-Dichloroethene	5.0	U	5.0	4.5	ug/L			08/26/24 16:34	5

Client Sample ID: SB-1W
Lab Sample ID: 480-222771-1
Date Collected: 08/21/24 14:30
Matrix: Water
Date Received: 08/23/24 09:15

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	5.0	U	5.0	1.9	ug/L			08/26/24 16:34	5
Trichloroethene	5.0	U	5.0	2.3	ug/L			08/26/24 16:34	5
Trichlorofluoromethane	5.0	U	5.0	4.4	ug/L			08/26/24 16:34	5
Vinyl chloride	5.0	U	5.0	4.5	ug/L			08/26/24 16:34	5
Xylenes, Total	10	U	10	3.3	ug/L			08/26/24 16:34	5
cis-1,3-Dichloropropene	5.0	U	5.0	1.8	ug/L			08/26/24 16:34	5
Styrene	5.0	U	5.0	3.7	ug/L			08/26/24 16:34	5
tert-Butylbenzene	5.0	U	5.0	4.1	ug/L			08/26/24 16:34	5

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Benzene, (1-methyl-1-propenyl)-, (E)-	*15*	*T J N*	*ug/L*		*11.69*	*768-00-3*		*08/26/24 16:34*	*5*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*92*		*77 - 120*		*08/26/24 16:34*	*5*
4-Bromofluorobenzene (Surr)	*104*		*73 - 120*		*08/26/24 16:34*	*5*
Toluene-d8 (Surr)	*92*		*80 - 120*		*08/26/24 16:34*	*5*
Dibromofluoromethane (Surr)	*92*		*75 - 123*		*08/26/24 16:34*	*5*

Client: Roux Environmental Engineering and Geology DPC
Project/Site: 3701 River Rd

Job ID: 480-222771-1

Client Sample ID: SB-2W
Date Collected: 08/21/24 14:00
Date Received: 08/23/24 09:15

Lab Sample ID: 480-222771-2
Matrix: Water

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	5.0	U	5.0	4.1	ug/L			08/26/24 16:56	5
1,1,2,2-Tetrachloroethane	5.0	U	5.0	1.1	ug/L			08/26/24 16:56	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5.0	U	5.0	1.6	ug/L			08/26/24 16:56	5
1,1,2-Trichloroethane	5.0	U	5.0	1.2	ug/L			08/26/24 16:56	5
1,1-Dichloroethane	5.0	U	5.0	1.9	ug/L			08/26/24 16:56	5
1,1-Dichloroethene	5.0	U	5.0	1.5	ug/L			08/26/24 16:56	5
1,2,4-Trichlorobenzene	5.0	U	5.0	2.1	ug/L			08/26/24 16:56	5
1,2,4-Trimethylbenzene	5.0	U	5.0	3.8	ug/L			08/26/24 16:56	5
1,2-Dibromo-3-Chloropropane	5.0	U *+	5.0	2.0	ug/L			08/26/24 16:56	5
1,2-Dichlorobenzene	5.0	U	5.0	4.0	ug/L			08/26/24 16:56	5
1,2-Dichloroethane	5.0	U	5.0	1.1	ug/L			08/26/24 16:56	5
1,2-Dichloropropane	5.0	U	5.0	3.6	ug/L			08/26/24 16:56	5
1,3,5-Trimethylbenzene	5.0	U	5.0	3.9	ug/L			08/26/24 16:56	5
1,3-Dichlorobenzene	5.0	U	5.0	3.9	ug/L			08/26/24 16:56	5
1,4-Dichlorobenzene	5.0	U	5.0	4.2	ug/L			08/26/24 16:56	5
2-Butanone (MEK)	50	U	50	6.6	ug/L			08/26/24 16:56	5
2-Hexanone	25	U	25	6.2	ug/L			08/26/24 16:56	5
4-Isopropyltoluene	5.0	U	5.0	1.6	ug/L			08/26/24 16:56	5
4-Methyl-2-pentanone (MIBK)	25	U	25	11	ug/L			08/26/24 16:56	5
Acetone	50	U	50	15	ug/L			08/26/24 16:56	5
Benzene	5.0	U	5.0	2.1	ug/L			08/26/24 16:56	5
Bromoform	5.0	U	5.0	1.3	ug/L			08/26/24 16:56	5
Bromomethane	5.0	U	5.0	3.5	ug/L			08/26/24 16:56	5
Carbon disulfide	5.0	U	5.0	0.95	ug/L			08/26/24 16:56	5
Carbon tetrachloride	5.0	U *+ *1	5.0	1.4	ug/L			08/26/24 16:56	5
Chlorobenzene	5.0	U	5.0	3.8	ug/L			08/26/24 16:56	5
Dibromochloromethane	5.0	U	5.0	1.6	ug/L			08/26/24 16:56	5
Chloroethane	5.0	U	5.0	1.6	ug/L			08/26/24 16:56	5
Chloroform	5.0	U	5.0	1.7	ug/L			08/26/24 16:56	5
Chloromethane	5.0	U	5.0	1.8	ug/L			08/26/24 16:56	5
cis-1,2-Dichloroethene	5.0	U	5.0	4.1	ug/L			08/26/24 16:56	5
Cyclohexane	5.0	U	5.0	0.90	ug/L			08/26/24 16:56	5
Bromodichloromethane	5.0	U	5.0	2.0	ug/L			08/26/24 16:56	5
Dichlorodifluoromethane	5.0	U	5.0	3.4	ug/L			08/26/24 16:56	5
Ethylbenzene	5.0	U	5.0	3.7	ug/L			08/26/24 16:56	5
1,2-Dibromoethane	5.0	U	5.0	3.7	ug/L			08/26/24 16:56	5
Isopropylbenzene	5.0	U	5.0	4.0	ug/L			08/26/24 16:56	5
Methyl acetate	13	U	13	6.5	ug/L			08/26/24 16:56	5
Methyl tert-butyl ether	5.0	U	5.0	0.80	ug/L			08/26/24 16:56	5
Methylcyclohexane	5.0	U	5.0	0.80	ug/L			08/26/24 16:56	5
Methylene Chloride	5.0	U	5.0	2.2	ug/L			08/26/24 16:56	5
m,p-Xylene	10	U	10	3.3	ug/L			08/26/24 16:56	5
n-Butylbenzene	5.0	U	5.0	3.2	ug/L			08/26/24 16:56	5
N-Propylbenzene	5.0	U	5.0	3.5	ug/L			08/26/24 16:56	5
o-Xylene	5.0	U	5.0	3.8	ug/L			08/26/24 16:56	5
sec-Butylbenzene	5.0	U	5.0	3.8	ug/L			08/26/24 16:56	5
Tetrachloroethene	5.0	U	5.0	1.8	ug/L			08/26/24 16:56	5
Toluene	5.0	U	5.0	2.6	ug/L			08/26/24 16:56	5
trans-1,2-Dichloroethene	5.0	U	5.0	4.5	ug/L			08/26/24 16:56	5

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Client Sample ID: SB-2W
Lab Sample ID: 480-222771-2
Date Collected: 08/21/24 14:00
Matrix: Water
Date Received: 08/23/24 09:15

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	5.0	U	5.0	1.9	ug/L			08/26/24 16:56	5
Trichloroethene	5.0	U	5.0	2.3	ug/L			08/26/24 16:56	5
Trichlorofluoromethane	5.0	U	5.0	4.4	ug/L			08/26/24 16:56	5
Vinyl chloride	5.0	U	5.0	4.5	ug/L			08/26/24 16:56	5
Xylenes, Total	10	U	10	3.3	ug/L			08/26/24 16:56	5
cis-1,3-Dichloropropene	5.0	U	5.0	1.8	ug/L			08/26/24 16:56	5
Styrene	5.0	U	5.0	3.7	ug/L			08/26/24 16:56	5
tert-Butylbenzene	5.0	U	5.0	4.1	ug/L			08/26/24 16:56	5

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Tentatively Identified Compound	*None*		*ug/L*			*N/A*		*08/26/24 16:56*	*5*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*86*		*77 - 120*		*08/26/24 16:56*	*5*
4-Bromofluorobenzene (Surr)	*101*		*73 - 120*		*08/26/24 16:56*	*5*
Toluene-d8 (Surr)	*90*		*80 - 120*		*08/26/24 16:56*	*5*
Dibromofluoromethane (Surr)	*89*		*75 - 123*		*08/26/24 16:56*	*5*

Client: Roux Environmental Engineering and Geology DPC
Project/Site: 3701 River Rd

Job ID: 480-222771-1

Client Sample ID: SB-3W
Date Collected: 08/21/24 13:30
Date Received: 08/23/24 09:15

Lab Sample ID: 480-222771-3
Matrix: Water

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	5.0	U	5.0	4.1	ug/L			08/26/24 17:19	5
1,1,2,2-Tetrachloroethane	5.0	U	5.0	1.1	ug/L			08/26/24 17:19	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5.0	U	5.0	1.6	ug/L			08/26/24 17:19	5
1,1,2-Trichloroethane	5.0	U	5.0	1.2	ug/L			08/26/24 17:19	5
1,1-Dichloroethane	5.0	U	5.0	1.9	ug/L			08/26/24 17:19	5
1,1-Dichloroethene	5.0	U	5.0	1.5	ug/L			08/26/24 17:19	5
1,2,4-Trichlorobenzene	5.0	U	5.0	2.1	ug/L			08/26/24 17:19	5
1,2,4-Trimethylbenzene	5.0	U	5.0	3.8	ug/L			08/26/24 17:19	5
1,2-Dibromo-3-Chloropropane	5.0	U *+	5.0	2.0	ug/L			08/26/24 17:19	5
1,2-Dichlorobenzene	5.0	U	5.0	4.0	ug/L			08/26/24 17:19	5
1,2-Dichloroethane	5.0	U	5.0	1.1	ug/L			08/26/24 17:19	5
1,2-Dichloropropane	5.0	U	5.0	3.6	ug/L			08/26/24 17:19	5
1,3,5-Trimethylbenzene	5.0	U	5.0	3.9	ug/L			08/26/24 17:19	5
1,3-Dichlorobenzene	5.0	U	5.0	3.9	ug/L			08/26/24 17:19	5
1,4-Dichlorobenzene	5.0	U	5.0	4.2	ug/L			08/26/24 17:19	5
2-Butanone (MEK)	50	U	50	6.6	ug/L			08/26/24 17:19	5
2-Hexanone	25	U	25	6.2	ug/L			08/26/24 17:19	5
4-Isopropyltoluene	5.0	U	5.0	1.6	ug/L			08/26/24 17:19	5
4-Methyl-2-pentanone (MIBK)	25	U	25	11	ug/L			08/26/24 17:19	5
Acetone	**42**	**J**	50	15	ug/L			08/26/24 17:19	5
Benzene	5.0	U	5.0	2.1	ug/L			08/26/24 17:19	5
Bromoform	5.0	U	5.0	1.3	ug/L			08/26/24 17:19	5
Bromomethane	5.0	U	5.0	3.5	ug/L			08/26/24 17:19	5
Carbon disulfide	5.0	U	5.0	0.95	ug/L			08/26/24 17:19	5
Carbon tetrachloride	5.0	U *+ *1	5.0	1.4	ug/L			08/26/24 17:19	5
Chlorobenzene	5.0	U	5.0	3.8	ug/L			08/26/24 17:19	5
Dibromochloromethane	5.0	U	5.0	1.6	ug/L			08/26/24 17:19	5
Chloroethane	5.0	U	5.0	1.6	ug/L			08/26/24 17:19	5
Chloroform	5.0	U	5.0	1.7	ug/L			08/26/24 17:19	5
Chloromethane	5.0	U	5.0	1.8	ug/L			08/26/24 17:19	5
cis-1,2-Dichloroethene	5.0	U	5.0	4.1	ug/L			08/26/24 17:19	5
Cyclohexane	**8.0**		5.0	0.90	ug/L			08/26/24 17:19	5
Bromodichloromethane	5.0	U	5.0	2.0	ug/L			08/26/24 17:19	5
Dichlorodifluoromethane	5.0	U	5.0	3.4	ug/L			08/26/24 17:19	5
Ethylbenzene	5.0	U	5.0	3.7	ug/L			08/26/24 17:19	5
1,2-Dibromoethane	5.0	U	5.0	3.7	ug/L			08/26/24 17:19	5
Isopropylbenzene	5.0	U	5.0	4.0	ug/L			08/26/24 17:19	5
Methyl acetate	13	U	13	6.5	ug/L			08/26/24 17:19	5
Methyl tert-butyl ether	5.0	U	5.0	0.80	ug/L			08/26/24 17:19	5
Methylcyclohexane	**8.8**		5.0	0.80	ug/L			08/26/24 17:19	5
Methylene Chloride	5.0	U	5.0	2.2	ug/L			08/26/24 17:19	5
m,p-Xylene	10	U	10	3.3	ug/L			08/26/24 17:19	5
n-Butylbenzene	5.0	U	5.0	3.2	ug/L			08/26/24 17:19	5
N-Propylbenzene	5.0	U	5.0	3.5	ug/L			08/26/24 17:19	5
o-Xylene	5.0	U	5.0	3.8	ug/L			08/26/24 17:19	5
sec-Butylbenzene	5.0	U	5.0	3.8	ug/L			08/26/24 17:19	5
Tetrachloroethene	5.0	U	5.0	1.8	ug/L			08/26/24 17:19	5
Toluene	5.0	U	5.0	2.6	ug/L			08/26/24 17:19	5
trans-1,2-Dichloroethene	5.0	U	5.0	4.5	ug/L			08/26/24 17:19	5

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Client Sample ID: SB-3W
Lab Sample ID: 480-222771-3
Date Collected: 08/21/24 13:30
Matrix: Water
Date Received: 08/23/24 09:15

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	5.0	U	5.0	1.9	ug/L			08/26/24 17:19	5
Trichloroethene	5.0	U	5.0	2.3	ug/L			08/26/24 17:19	5
Trichlorofluoromethane	5.0	U	5.0	4.4	ug/L			08/26/24 17:19	5
Vinyl chloride	5.0	U	5.0	4.5	ug/L			08/26/24 17:19	5
Xylenes, Total	10	U	10	3.3	ug/L			08/26/24 17:19	5
cis-1,3-Dichloropropene	5.0	U	5.0	1.8	ug/L			08/26/24 17:19	5
Styrene	5.0	U	5.0	3.7	ug/L			08/26/24 17:19	5
tert-Butylbenzene	5.0	U	5.0	4.1	ug/L			08/26/24 17:19	5

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Tentatively Identified Compound	*None*		*ug/L*			*N/A*		*08/26/24 17:19*	*5*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*90*		*77 - 120*		*08/26/24 17:19*	*5*
4-Bromofluorobenzene (Surr)	*100*		*73 - 120*		*08/26/24 17:19*	*5*
Toluene-d8 (Surr)	*93*		*80 - 120*		*08/26/24 17:19*	*5*
Dibromofluoromethane (Surr)	*92*		*75 - 123*		*08/26/24 17:19*	*5*

Client: Roux Environmental Engineering and Geology DPC
Project/Site: 3701 River Rd

Job ID: 480-222771-1

Client Sample ID: SB-5W
Date Collected: 08/21/24 13:00
Date Received: 08/23/24 09:15

Lab Sample ID: 480-222771-4
Matrix: Water

Method: SW846 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	10	U	10	8.2	ug/L			08/26/24 17:41	10
1,1,2,2-Tetrachloroethane	10	U	10	2.1	ug/L			08/26/24 17:41	10
1,1,2-Trichloro-1,2,2-trifluoroethane	10	U	10	3.1	ug/L			08/26/24 17:41	10
1,1,2-Trichloroethane	10	U	10	2.3	ug/L			08/26/24 17:41	10
1,1-Dichloroethane	10	U	10	3.8	ug/L			08/26/24 17:41	10
1,1-Dichloroethene	10	U	10	2.9	ug/L			08/26/24 17:41	10
1,2,4-Trichlorobenzene	10	U	10	4.1	ug/L			08/26/24 17:41	10
1,2,4-Trimethylbenzene	**49**		10	7.5	ug/L			08/26/24 17:41	10
1,2-Dibromo-3-Chloropropane	10	U *+	10	3.9	ug/L			08/26/24 17:41	10
1,2-Dichlorobenzene	10	U	10	7.9	ug/L			08/26/24 17:41	10
1,2-Dichloroethane	10	U	10	2.1	ug/L			08/26/24 17:41	10
1,2-Dichloropropane	10	U	10	7.2	ug/L			08/26/24 17:41	10
1,3,5-Trimethylbenzene	**13**		10	7.7	ug/L			08/26/24 17:41	10
1,3-Dichlorobenzene	10	U	10	7.8	ug/L			08/26/24 17:41	10
1,4-Dichlorobenzene	10	U	10	8.4	ug/L			08/26/24 17:41	10
2-Butanone (MEK)	100	U	100	13	ug/L			08/26/24 17:41	10
2-Hexanone	50	U	50	12	ug/L			08/26/24 17:41	10
4-Isopropyltoluene	10	U	10	3.1	ug/L			08/26/24 17:41	10
4-Methyl-2-pentanone (MIBK)	50	U	50	21	ug/L			08/26/24 17:41	10
Acetone	100	U	100	30	ug/L			08/26/24 17:41	10
Benzene	10	U	10	4.1	ug/L			08/26/24 17:41	10
Bromoform	10	U	10	2.6	ug/L			08/26/24 17:41	10
Bromomethane	10	U	10	6.9	ug/L			08/26/24 17:41	10
Carbon disulfide	10	U	10	1.9	ug/L			08/26/24 17:41	10
Carbon tetrachloride	10	U *+ *1	10	2.7	ug/L			08/26/24 17:41	10
Chlorobenzene	10	U	10	7.5	ug/L			08/26/24 17:41	10
Dibromochloromethane	10	U	10	3.2	ug/L			08/26/24 17:41	10
Chloroethane	10	U	10	3.2	ug/L			08/26/24 17:41	10
Chloroform	10	U	10	3.4	ug/L			08/26/24 17:41	10
Chloromethane	10	U	10	3.5	ug/L			08/26/24 17:41	10
cis-1,2-Dichloroethene	10	U	10	8.1	ug/L			08/26/24 17:41	10
Cyclohexane	10	U	10	1.8	ug/L			08/26/24 17:41	10
Bromodichloromethane	10	U	10	3.9	ug/L			08/26/24 17:41	10
Dichlorodifluoromethane	10	U	10	6.8	ug/L			08/26/24 17:41	10
Ethylbenzene	**25**		10	7.4	ug/L			08/26/24 17:41	10
1,2-Dibromoethane	10	U	10	7.3	ug/L			08/26/24 17:41	10
Isopropylbenzene	10	U	10	7.9	ug/L			08/26/24 17:41	10
Methyl acetate	25	U	25	13	ug/L			08/26/24 17:41	10
Methyl tert-butyl ether	10	U	10	1.6	ug/L			08/26/24 17:41	10
Methylcyclohexane	**1.8**	**J**	10	1.6	ug/L			08/26/24 17:41	10
Methylene Chloride	10	U	10	4.4	ug/L			08/26/24 17:41	10
m,p-Xylene	**80**		20	6.6	ug/L			08/26/24 17:41	10
n-Butylbenzene	10	U	10	6.4	ug/L			08/26/24 17:41	10
N-Propylbenzene	10	U	10	6.9	ug/L			08/26/24 17:41	10
o-Xylene	**22**		10	7.6	ug/L			08/26/24 17:41	10
sec-Butylbenzene	10	U	10	7.5	ug/L			08/26/24 17:41	10
Tetrachloroethene	10	U	10	3.6	ug/L			08/26/24 17:41	10
Toluene	10	U	10	5.1	ug/L			08/26/24 17:41	10
trans-1,2-Dichloroethene	10	U	10	9.0	ug/L			08/26/24 17:41	10

Client Sample ID: SB-5W
Lab Sample ID: 480-222771-4
Date Collected: 08/21/24 13:00
Matrix: Water
Date Received: 08/23/24 09:15

Method: SW846 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	10	U	10	3.7	ug/L			08/26/24 17:41	10
Trichloroethene	10	U	10	4.6	ug/L			08/26/24 17:41	10
Trichlorofluoromethane	10	U	10	8.8	ug/L			08/26/24 17:41	10
Vinyl chloride	10	U	10	9.0	ug/L			08/26/24 17:41	10
Xylenes, Total	**100**		20	6.6	ug/L			08/26/24 17:41	10
cis-1,3-Dichloropropene	10	U	10	3.6	ug/L			08/26/24 17:41	10
Styrene	10	U	10	7.3	ug/L			08/26/24 17:41	10
tert-Butylbenzene	10	U	10	8.1	ug/L			08/26/24 17:41	10

Tentatively Identified Compound	*Est. Result*	*Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Benzene, 1-ethyl-2-methyl-	*36*	*T J N*	*ug/L*		*9.38*	*611-14-3*		*08/26/24 17:41*	*10*

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*91*		*77 - 120*		*08/26/24 17:41*	*10*
4-Bromofluorobenzene (Surr)	*100*		*73 - 120*		*08/26/24 17:41*	*10*
Toluene-d8 (Surr)	*93*		*80 - 120*		*08/26/24 17:41*	*10*
Dibromofluoromethane (Surr)	*91*		*75 - 123*		*08/26/24 17:41*	*10*

Surrogate Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCA	BFB	TOL	DBFM
Lab Sample ID	Client Sample ID	(77-120)	(73-120)	(80-120)	(75-123)
480-222771-1	SB-1W	92	104	92	92
480-222771-2	SB-2W	86	101	90	89
480-222771-3	SB-3W	90	100	93	92
480-222771-4	SB-5W	91	100	93	91
LCS 480-723037/6	Lab Control Sample	90	98	90	92
LCSD 480-723037/30	Lab Control Sample Dup	90	101	93	91
MB 480-723037/9	Method Blank	90	100	92	85

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)

Method: 8260C - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 480-723037/9
Matrix: Water
Analysis Batch: 723037

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	1.0	U	1.0	0.82	ug/L			08/26/24 13:56	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.21	ug/L			08/26/24 13:56	1
1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U	1.0	0.31	ug/L			08/26/24 13:56	1
1,1,2-Trichloroethane	1.0	U	1.0	0.23	ug/L			08/26/24 13:56	1
1,1-Dichloroethane	1.0	U	1.0	0.38	ug/L			08/26/24 13:56	1
1,1-Dichloroethene	1.0	U	1.0	0.29	ug/L			08/26/24 13:56	1
1,2,4-Trichlorobenzene	1.0	U	1.0	0.41	ug/L			08/26/24 13:56	1
1,2,4-Trimethylbenzene	1.0	U	1.0	0.75	ug/L			08/26/24 13:56	1
1,2-Dibromo-3-Chloropropane	1.0	U	1.0	0.39	ug/L			08/26/24 13:56	1
1,2-Dichlorobenzene	1.0	U	1.0	0.79	ug/L			08/26/24 13:56	1
1,2-Dichloroethane	1.0	U	1.0	0.21	ug/L			08/26/24 13:56	1
1,2-Dichloropropane	1.0	U	1.0	0.72	ug/L			08/26/24 13:56	1
1,3,5-Trimethylbenzene	1.0	U	1.0	0.77	ug/L			08/26/24 13:56	1
1,3-Dichlorobenzene	1.0	U	1.0	0.78	ug/L			08/26/24 13:56	1
1,4-Dichlorobenzene	1.0	U	1.0	0.84	ug/L			08/26/24 13:56	1
2-Butanone (MEK)	10	U	10	1.3	ug/L			08/26/24 13:56	1
2-Hexanone	5.0	U	5.0	1.2	ug/L			08/26/24 13:56	1
4-Isopropyltoluene	1.0	U	1.0	0.31	ug/L			08/26/24 13:56	1
4-Methyl-2-pentanone (MIBK)	5.0	U	5.0	2.1	ug/L			08/26/24 13:56	1
Acetone	10	U	10	3.0	ug/L			08/26/24 13:56	1
Benzene	1.0	U	1.0	0.41	ug/L			08/26/24 13:56	1
Bromoform	1.0	U	1.0	0.26	ug/L			08/26/24 13:56	1
Bromomethane	1.0	U	1.0	0.69	ug/L			08/26/24 13:56	1
Carbon disulfide	1.0	U	1.0	0.19	ug/L			08/26/24 13:56	1
Carbon tetrachloride	1.0	U	1.0	0.27	ug/L			08/26/24 13:56	1
Chlorobenzene	1.0	U	1.0	0.75	ug/L			08/26/24 13:56	1
Dibromochloromethane	1.0	U	1.0	0.32	ug/L			08/26/24 13:56	1
Chloroethane	1.0	U	1.0	0.32	ug/L			08/26/24 13:56	1
Chloroform	1.0	U	1.0	0.34	ug/L			08/26/24 13:56	1
Chloromethane	1.0	U	1.0	0.35	ug/L			08/26/24 13:56	1
cis-1,2-Dichloroethene	1.0	U	1.0	0.81	ug/L			08/26/24 13:56	1
Cyclohexane	1.0	U	1.0	0.18	ug/L			08/26/24 13:56	1
Bromodichloromethane	1.0	U	1.0	0.39	ug/L			08/26/24 13:56	1
Dichlorodifluoromethane	1.0	U	1.0	0.68	ug/L			08/26/24 13:56	1
Ethylbenzene	1.0	U	1.0	0.74	ug/L			08/26/24 13:56	1
1,2-Dibromoethane	1.0	U	1.0	0.73	ug/L			08/26/24 13:56	1
Isopropylbenzene	1.0	U	1.0	0.79	ug/L			08/26/24 13:56	1
Methyl acetate	2.5	U	2.5	1.3	ug/L			08/26/24 13:56	1
Methyl tert-butyl ether	1.0	U	1.0	0.16	ug/L			08/26/24 13:56	1
Methylcyclohexane	1.0	U	1.0	0.16	ug/L			08/26/24 13:56	1
Methylene Chloride	1.0	U	1.0	0.44	ug/L			08/26/24 13:56	1
m,p-Xylene	2.0	U	2.0	0.66	ug/L			08/26/24 13:56	1
n-Butylbenzene	1.0	U	1.0	0.64	ug/L			08/26/24 13:56	1
N-Propylbenzene	1.0	U	1.0	0.69	ug/L			08/26/24 13:56	1
o-Xylene	1.0	U	1.0	0.76	ug/L			08/26/24 13:56	1
sec-Butylbenzene	1.0	U	1.0	0.75	ug/L			08/26/24 13:56	1
Tetrachloroethene	1.0	U	1.0	0.36	ug/L			08/26/24 13:56	1
Toluene	1.0	U	1.0	0.51	ug/L			08/26/24 13:56	1

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 480-723037/9
Matrix: Water
Analysis Batch: 723037

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,2-Dichloroethene	1.0	U	1.0	0.90	ug/L			08/26/24 13:56	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.37	ug/L			08/26/24 13:56	1
Trichloroethene	1.0	U	1.0	0.46	ug/L			08/26/24 13:56	1
Trichlorofluoromethane	1.0	U	1.0	0.88	ug/L			08/26/24 13:56	1
Vinyl chloride	1.0	U	1.0	0.90	ug/L			08/26/24 13:56	1
Xylenes, Total	2.0	U	2.0	0.66	ug/L			08/26/24 13:56	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.36	ug/L			08/26/24 13:56	1
Styrene	1.0	U	1.0	0.73	ug/L			08/26/24 13:56	1
tert-Butylbenzene	1.0	U	1.0	0.81	ug/L			08/26/24 13:56	1

Tentatively Identified Compound	*Est. Result*	*MB Qualifier*	*Unit*	*D*	*RT*	*CAS No.*	*Prepared*	*Analyzed*	*Dil Fac*
Tentatively Identified Compound	*None*		*ug/L*			*N/A*		*08/26/24 13:56*	*1*

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*90*		*77 - 120*		*08/26/24 13:56*	*1*
4-Bromofluorobenzene (Surr)	*100*		*73 - 120*		*08/26/24 13:56*	*1*
Toluene-d8 (Surr)	*92*		*80 - 120*		*08/26/24 13:56*	*1*
Dibromofluoromethane (Surr)	*85*		*75 - 123*		*08/26/24 13:56*	*1*

Lab Sample ID: LCS 480-723037/6
Matrix: Water
Analysis Batch: 723037

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	25.0	29.5		ug/L		118	73 - 126
1,1,2,2-Tetrachloroethane	25.0	25.6		ug/L		102	76 - 120
1,1,2-Trichloro-1,2,2-trifluoroethane	25.0	28.5		ug/L		114	61 - 148
1,1,2-Trichloroethane	25.0	24.9		ug/L		100	76 - 122
1,1-Dichloroethane	25.0	26.4		ug/L		106	77 - 120
1,1-Dichloroethene	25.0	25.9		ug/L		103	66 - 127
1,2,4-Trichlorobenzene	25.0	24.8		ug/L		99	79 - 122
1,2,4-Trimethylbenzene	25.0	24.9		ug/L		100	76 - 121
1,2-Dibromo-3-Chloropropane	25.0	35.1	*+	ug/L		140	56 - 134
1,2-Dichlorobenzene	25.0	24.6		ug/L		98	80 - 124
1,2-Dichloroethane	25.0	24.6		ug/L		98	75 - 120
1,2-Dichloropropane	25.0	26.0		ug/L		104	76 - 120
1,3,5-Trimethylbenzene	25.0	25.7		ug/L		103	77 - 121
1,3-Dichlorobenzene	25.0	24.5		ug/L		98	77 - 120
1,4-Dichlorobenzene	25.0	24.4		ug/L		98	80 - 120
2-Butanone (MEK)	125	133		ug/L		106	57 - 140
2-Hexanone	125	124		ug/L		99	65 - 127
4-Isopropyltoluene	25.0	25.4		ug/L		102	73 - 120
4-Methyl-2-pentanone (MIBK)	125	129		ug/L		103	71 - 125
Acetone	125	127		ug/L		101	56 - 142
Benzene	25.0	25.8		ug/L		103	71 - 124
Bromoform	25.0	27.6		ug/L		110	61 - 132
Bromomethane	25.0	27.1		ug/L		108	55 - 144

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 480-723037/6
Matrix: Water
Analysis Batch: 723037

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Carbon disulfide	25.0	25.6		ug/L		102	59 - 134
Carbon tetrachloride	25.0	37.4	*+	ug/L		150	72 - 134
Chlorobenzene	25.0	24.5		ug/L		98	80 - 120
Dibromochloromethane	25.0	29.5		ug/L		118	75 - 125
Chloroethane	25.0	23.8		ug/L		95	69 - 136
Chloroform	25.0	24.5		ug/L		98	73 - 127
Chloromethane	25.0	24.3		ug/L		97	68 - 124
cis-1,2-Dichloroethene	25.0	27.1		ug/L		108	74 - 124
Cyclohexane	25.0	26.5		ug/L		106	59 - 135
Bromodichloromethane	25.0	28.2		ug/L		113	80 - 122
Dichlorodifluoromethane	25.0	24.9		ug/L		100	59 - 135
Ethylbenzene	25.0	25.4		ug/L		101	77 - 123
1,2-Dibromoethane	25.0	26.4		ug/L		106	77 - 120
Isopropylbenzene	25.0	26.2		ug/L		105	77 - 122
Methyl acetate	50.0	51.1		ug/L		102	74 - 133
Methyl tert-butyl ether	25.0	24.8		ug/L		99	77 - 120
Methylcyclohexane	25.0	27.2		ug/L		109	68 - 134
Methylene Chloride	25.0	26.6		ug/L		106	75 - 124
m,p-Xylene	25.0	24.8		ug/L		99	76 - 122
n-Butylbenzene	25.0	25.2		ug/L		101	71 - 128
N-Propylbenzene	25.0	25.8		ug/L		103	75 - 127
o-Xylene	25.0	23.4		ug/L		94	76 - 122
sec-Butylbenzene	25.0	25.7		ug/L		103	74 - 127
Tetrachloroethene	25.0	25.9		ug/L		104	74 - 122
Toluene	25.0	24.9		ug/L		99	80 - 122
trans-1,2-Dichloroethene	25.0	25.5		ug/L		102	73 - 127
trans-1,3-Dichloropropene	25.0	28.4		ug/L		114	80 - 120
Trichloroethene	25.0	26.9		ug/L		108	74 - 123
Trichlorofluoromethane	25.0	28.0		ug/L		112	62 - 150
Vinyl chloride	25.0	26.8		ug/L		107	65 - 133
cis-1,3-Dichloropropene	25.0	27.5		ug/L		110	74 - 124
Styrene	25.0	25.0		ug/L		100	80 - 120
tert-Butylbenzene	25.0	26.5		ug/L		106	75 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*90*		*77 - 120*
4-Bromofluorobenzene (Surr)	*98*		*73 - 120*
Toluene-d8 (Surr)	*90*		*80 - 120*
Dibromofluoromethane (Surr)	*92*		*75 - 123*

Lab Sample ID: LCSD 480-723037/30
Matrix: Water
Analysis Batch: 723037

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
1,1,1-Trichloroethane	25.0	27.1		ug/L		108	73 - 126	8	15
1,1,2,2-Tetrachloroethane	25.0	25.4		ug/L		101	76 - 120	1	15
1,1,2-Trichloro-1,2,2-trifluoroethane	25.0	26.4		ug/L		106	61 - 148	8	20

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 480-723037/30
Matrix: Water
Analysis Batch: 723037

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
1,1,2-Trichloroethane	25.0	25.8		ug/L		103	76 - 122	4	15
1,1-Dichloroethane	25.0	25.3		ug/L		101	77 - 120	4	20
1,1-Dichloroethene	25.0	24.9		ug/L		100	66 - 127	4	16
1,2,4-Trichlorobenzene	25.0	25.0		ug/L		100	79 - 122	1	20
1,2,4-Trimethylbenzene	25.0	24.7		ug/L		99	76 - 121	1	20
1,2-Dibromo-3-Chloropropane	25.0	32.6		ug/L		130	56 - 134	7	15
1,2-Dichlorobenzene	25.0	24.5		ug/L		98	80 - 124	1	20
1,2-Dichloroethane	25.0	24.0		ug/L		96	75 - 120	2	20
1,2-Dichloropropane	25.0	24.8		ug/L		99	76 - 120	5	20
1,3,5-Trimethylbenzene	25.0	24.9		ug/L		100	77 - 121	3	20
1,3-Dichlorobenzene	25.0	24.1		ug/L		96	77 - 120	2	20
1,4-Dichlorobenzene	25.0	24.4		ug/L		97	80 - 120	0	20
2-Butanone (MEK)	125	142		ug/L		113	57 - 140	6	20
2-Hexanone	125	137		ug/L		110	65 - 127	10	15
4-Isopropyltoluene	25.0	25.8		ug/L		103	73 - 120	1	20
4-Methyl-2-pentanone (MIBK)	125	137		ug/L		110	71 - 125	6	35
Acetone	125	146		ug/L		117	56 - 142	14	15
Benzene	25.0	24.5		ug/L		98	71 - 124	5	13
Bromoform	25.0	24.7		ug/L		99	61 - 132	11	15
Bromomethane	25.0	26.0		ug/L		104	55 - 144	4	15
Carbon disulfide	25.0	24.5		ug/L		98	59 - 134	4	15
Carbon tetrachloride	25.0	31.5	*1	ug/L		126	72 - 134	17	15
Chlorobenzene	25.0	24.2		ug/L		97	80 - 120	1	25
Dibromochloromethane	25.0	25.8		ug/L		103	75 - 125	13	15
Chloroethane	25.0	23.5		ug/L		94	69 - 136	1	15
Chloroform	25.0	23.6		ug/L		94	73 - 127	4	20
Chloromethane	25.0	23.5		ug/L		94	68 - 124	3	15
cis-1,2-Dichloroethene	25.0	24.9		ug/L		100	74 - 124	8	15
Cyclohexane	25.0	25.6		ug/L		103	59 - 135	3	20
Bromodichloromethane	25.0	26.1		ug/L		104	80 - 122	8	15
Dichlorodifluoromethane	25.0	24.7		ug/L		99	59 - 135	1	20
Ethylbenzene	25.0	25.3		ug/L		101	77 - 123	0	15
1,2-Dibromoethane	25.0	26.2		ug/L		105	77 - 120	1	15
Isopropylbenzene	25.0	25.7		ug/L		103	77 - 122	2	20
Methyl acetate	50.0	51.1		ug/L		102	74 - 133	0	20
Methyl tert-butyl ether	25.0	24.0		ug/L		96	77 - 120	3	37
Methylcyclohexane	25.0	26.1		ug/L		104	68 - 134	4	20
Methylene Chloride	25.0	25.6		ug/L		103	75 - 124	4	15
m,p-Xylene	25.0	24.9		ug/L		100	76 - 122	1	16
n-Butylbenzene	25.0	25.7		ug/L		103	71 - 128	2	15
N-Propylbenzene	25.0	24.7		ug/L		99	75 - 127	4	15
o-Xylene	25.0	23.5		ug/L		94	76 - 122	0	16
sec-Butylbenzene	25.0	25.4		ug/L		102	74 - 127	1	15
Tetrachloroethene	25.0	24.5		ug/L		98	74 - 122	6	20
Toluene	25.0	24.9		ug/L		99	80 - 122	0	15
trans-1,2-Dichloroethene	25.0	24.4		ug/L		98	73 - 127	4	20
trans-1,3-Dichloropropene	25.0	26.8		ug/L		107	80 - 120	6	15
Trichloroethene	25.0	23.9		ug/L		95	74 - 123	12	16
Trichlorofluoromethane	25.0	26.3		ug/L		105	62 - 150	6	20

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 480-723037/30
Matrix: Water
Analysis Batch: 723037

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Vinyl chloride			25.0	25.6		ug/L		103	65 - 133	4	15
cis-1,3-Dichloropropene			25.0	24.0		ug/L		96	74 - 124	14	15
Styrene			25.0	24.3		ug/L		97	80 - 120	3	20
tert-Butylbenzene			25.0	25.7		ug/L		103	75 - 123	3	15

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*90*		*77 - 120*
4-Bromofluorobenzene (Surr)	*101*		*73 - 120*
Toluene-d8 (Surr)	*93*		*80 - 120*
Dibromofluoromethane (Surr)	*91*		*75 - 123*

QC Association Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

GC/MS VOA

Analysis Batch: 723037

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-222771-1	SB-1W	Total/NA	Water	8260C	
480-222771-2	SB-2W	Total/NA	Water	8260C	
480-222771-3	SB-3W	Total/NA	Water	8260C	
480-222771-4	SB-5W	Total/NA	Water	8260C	
MB 480-723037/9	Method Blank	Total/NA	Water	8260C	
LCS 480-723037/6	Lab Control Sample	Total/NA	Water	8260C	
LCSD 480-723037/30	Lab Control Sample Dup	Total/NA	Water	8260C	

Lab Chronicle

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Client Sample ID: SB-1W
Lab Sample ID: 480-222771-1
Date Collected: 08/21/24 14:30
Matrix: Water
Date Received: 08/23/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260C		5	723037	ERS	EET BUF	08/26/24 16:34

Client Sample ID: SB-2W
Lab Sample ID: 480-222771-2
Date Collected: 08/21/24 14:00
Matrix: Water
Date Received: 08/23/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260C		5	723037	ERS	EET BUF	08/26/24 16:56

Client Sample ID: SB-3W
Lab Sample ID: 480-222771-3
Date Collected: 08/21/24 13:30
Matrix: Water
Date Received: 08/23/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260C		5	723037	ERS	EET BUF	08/26/24 17:19

Client Sample ID: SB-5W
Lab Sample ID: 480-222771-4
Date Collected: 08/21/24 13:00
Matrix: Water
Date Received: 08/23/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260C		10	723037	ERS	EET BUF	08/26/24 17:41

Laboratory References:

EET BUF = Eurofins Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Accreditation/Certification Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Laboratory: Eurofins Buffalo

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
New York	NELAP	10026	03-31-25

Method Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	EET BUF
5030C	Purge and Trap	SW846	EET BUF

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET BUF = Eurofins Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Sample Summary

Client: Roux Environmental Engineering and Geology DPC
Job ID: 480-222771-1
Project/Site: 3701 River Rd

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
480-222771-1	SB-1W	Water	08/21/24 14:30	08/23/24 09:15
480-222771-2	SB-2W	Water	08/21/24 14:00	08/23/24 09:15
480-222771-3	SB-3W	Water	08/21/24 13:30	08/23/24 09:15
480-222771-4	SB-5W	Water	08/21/24 13:00	08/23/24 09:15

Chain of Custody Record 599531

eurofins | Environment Testing TestAmerica

TAL-8210

Address: _____

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager:	Site Contact:	Date: 8/22/24	COC No:
Company Name: River IAC	Tel/Email:	Lab Contact:	Carrier:	of COCs
Address: 2558 Hamburg Turnpike	Analysis Turnaround Time			Sampler:
City/State/Zip: Buffalo NY 14218	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone: 716-713-3433	TAT if different from Below _____			Walk-in Client:
Fax:	☐ 2 weeks ☒ 1 week ☐ 2 days ☐ 1 day			Lab Sampling:
Project Name: 3701 River Road				Job / SDG No.:
Site:				
PO # 4369.0005 B000				

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	TCL Target List Metals	Sample Specific Notes:
SB-1W	8/22/24	1430	G	AQ	3			X	
SB-2W		1400						X	
SB-3W		1330						X	
SB-5W		1300						X	

480-222771 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

'5.5 #1 Ice

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:	Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____		
Relinquished by:	Company: River	Date/Time: 8/22/24 16:15	Received by:	Company: EET	Date/Time: 8/22/24 1718
Relinquished by:	Company: ~~EJ~~ EET	Date/Time: 8/22/24 1725	Received by:	Company:	Date/Time: 8/23/24 915
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Login Sample Receipt Checklist

Client: Roux Environmental Engineering and Geology DPC

Job Number: 480-222771-1

Login Number: 222771
List Number: 1
Creator: Stapleton, Kaitlyn

List Source: Eurofins Buffalo

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time (Excluding tests with immediate HTs)..	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Sampling Company provided.	True	Roux Environmental
Samples received within 48 hours of sampling.	True	
Samples requiring field filtration have been filtered in the field.	True	
Chlorine Residual checked.	N/A	

ChemQuants™
ENVIRONMENTAL FORENSICS

Client: Newman Properties, Inc.

ATTN: Tim Boyle, Mike Lesakowski

Project#: 0369

Project name: 3701 River Road

Laboratory#: L2500497

Interpreter

April 3, 2025

Tim Boyle, Mike Lesakowski
Newman Properties, Inc.
2101 St Ritas Lane
Williamsville, NY 14221

CQ Project# 0369
Project Name: 3701 River Rd

Introduction

I am the principal at ChemQuants, LLC, an environmental forensics firm founded in Santa Barbara, and currently operating in Austin, Texas. I received a bachelor's degree in Chemistry, a second bachelor's degree in Environmental Science, and a Master's degree in Analytical Chemistry from Florida International University. My professional experience has focused on fossil fuel, emerging and legacy contamination environmental forensics. Specialties include petroleum release investigations on coastal waterways, subsurface environments at petroleum terminals and fueling stations, as well as "big environmental data" chemometrics and data visualization on all major chemical classes of environmental contaminants. Besides being chair at a scientific conference, I have authored numerous publications and presentations to my peers.

ChemQuants, LLC is gratified to provide you with this report that focuses on the chemical fingerprinting results conducted recently on behalf of Newman Properties. The chemical fingerprinting analysis was carried out on three samples. The client started the study to understand the chemical source nature of the chemical signature(s) exhibited in three soil samples at 3701 River Rd (TP-4 PIANO, TP-5 PIANO, and TP-10 PIANO) (Figure 1).

Site Characteristics and History (per communications by client)

- The 3.2-acre Site is currently developed with one vacant commercial building
- The eastern portion of the Site is currently used as a landscape supply company
- The Site is in an industrial area that uses the public water system for its potable drinking water supply
- Prior to current operations, the Site was used as a portion of a greater oil refinery. See Timeline section of this report and Figure 11 for a detailed discussion and timeline of parcel ownership transfers. The timeline in Figure 11 was constructed from the historical documents contained in Appendix A
- Appendix A contains site history documents that were shared by the client and retrieved from online literature search

Client ID	Lab ID	Date Collected	Date Received	Matrix	Alkylated PAHs 8270D (Mod.)	VOC PIANO 8260D (Mod.)	TEL & TML in Soils
TP-4 PIANO	L2500497-01	1/6/2025	1/6/2025	Soil	X	X	X
TP-5 PIANO	L2500497-02	1/6/2025	1/6/2025	Soil	X	X	X
TP-10 PIANO	L2500497-03	1/6/2025	1/6/2025	Soil	X	X	X

The three samples were delivered to 1) Alpha Pace (Mansfield, MA) and analyzed with the following analytical methods[1]:

1) Alkylated PAHs by GC/MS (SIM) / EPA 8270D (Mod.)
2) VOC PIANO by GC/MS EPA 8260D (Mod.)
3) TEL and TML in Soils (Subcontracted)

Investigative method

The forensics quality chemical data employed data analysis techniques typically used in a hydrocarbons forensics investigation. Petroleum hydrocarbons lines of evidence ("LOEs") were applied and based on Well-established petroleum fingerprinting methodologies were relied on to examine bulk chemical and molecular signatures for source characterization and evaluate their potential differentiations[2]. The characterization of contaminants sampled from the Site relied on the diagnosis of petroleum (petrogenic) signatures and potential contributions of pyrolytic (pyrogenic) signatures. Multiple lines of evidence ("MLE") were developed from a) review of GC/FID chromatograms, b) review of GC/MS total ion chromatograms (TIC), c) review of saturate hydrocarbons data, d) review of parent and alkylated PAHs – including relevant diagnostic ratios and bar graph presentations, e) review of petroleum biomarkers – including appropriate diagnostic ratios and bar graph presentations.

A collection of pyrogenic source samples were procured from the ChemQuants data archive to provide general context and reference data points only (Figures 3, 4). Also for context only, the report was bolstered with a reference set of over 30 middle distillate fuels ("MD") that included #2 diesel, #2 fuel oils & heating oils (Figure 2). The characterization effort in this report applied key principles of hydrocarbon source recognition practices for differentiating petroleum "petrogenic" features and hydrocarbon signatures derived from exposure to thermolytic processes "heat stress" (pyrogenic signatures) from processing for the petroleum economy, industrial operation processes involving practical use of petroleum oils, and hydrocarbons exposed to higher temperature combustion processes in general. In the context of this report the source characteristics under scrutiny are chemical signatures related to 1) petrogenic characteristics, and 2) pyrogenic character that may be derived from a myriad of combustion derived sources and processes.

Three themes emerged from the chemical data, which afforded a defensible characterization of the saturated and aromatic hydrocarbon features in the project samples - TP-4 PIANO, TP-5 PIANO, and TP-10 PIANO. Theme 1 considered dominating fingerprint characteristics of middle distillate range petrogenic hydrocarbon characteristics (i.e., related to #2 diesel fuel, #2 fuel oil,

[1] Douglas, G.D., Emsbo-Mattingly, S.D., Stout, S.A., Uhler, A.D., and McCarthy, K.J. (2007) Chemical fingerprinting of hydrocarbons and polychlorinated biphenyls. In: *Introduction to Environmental Forensics, 2nd Ed.*, B. Murphy and R. Morrison, Eds., Academic Press, New York, pp. 317-459.
[2] Stout, Scott A., Allen D. Uhler, and Paul D. Boehm. "Recognition of and allocation among multiple sources of PAH in urban sediments." *Environmental Claims Journal* 13.4 (2001): 141-158.

heating oil) in the samples[3]. Theme 2 considered petrogenic character that included significant enrichment of naphtha range to kerosene range aviation fuel contribution to the overall fingerprint[6]. Theme 3 considered review of 4-6 ring PAH or high molecular weight "HMW-PAHs" distributions, specifically related to Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Indeno (1,2,3-cd) pyrene, and Benzo (g,h,i) perylene, to explore their potential exposure to thermal or pyrolytic regimes[4]. Diagnostic ratio's derived from HMW-PAH (Specifically the ratio used in the investigation) were applied in this study for source tracking in the environment due to their high stability across a wide range of weathering and concentration[5].

Themes 1 & 2 (Petrogenicity) – Petrogenicity means being related to oil and include uncombusted petroleum, coal, coke, and refined oils such as distillate fuel oils and lubricants. Petrogenic oils typically consists of thousands of hydrocarbons and heteroatomic compounds that consists of resolved chemistry – individual hydrocarbons that can be separated and measured (e.g., n-paraffins, isoparrafins, PAHs, etc.), and unresolved chemistry ("UCM") that consists of branched and cyclic hydrocarbons that are too numerous to be separated and measured (Figures 3, 5). Molecular boiling range & character are important gross factor for differentiating crude oils among themselves and from refined petroleum oils.

Crude oils are typified by high concentrations and enhanced proportions of n-paraffins, which in most high to moderate API crude oils span the lighter volatile organic carbon range ~nC3 to ~nC12 ("VOC") to the semi-volatile carbon range ~nC8 to ~nC42 ("SVOC"). On the other hand, refined petroleum oils are engineered fractions and reacted products of crude oils that are derived from a variety of processes that alter the composition of feedstock crude oils[6]. For example, distillation fractionates the crude oil into desirable molecular boiling range "cuts," and catalytic cracking subjects' larger molecules to reactions that splits them into valuable smaller molecule fractions for gasoline, kerosene, and industrial fuels. For instance, the effect of distillation on a crude oil is readily clear in a GC/FID fingerprint as narrower molecular boiling range distributions that span the heavy naphtha range to lubricating distillate range[6]. Also, the effects of "splitting" (and other thermal stress inducing refinery processes) are more complex, yet still calculable with skilled forensic source recognition practices, and will be the primary subject of theme 3.

Aside from certain fuel formulations that are more complex and wide spanning arrangement of refinery products, e.g., heavy fuel oils ("HFOs") and intermediate fuel oils ("IFOs), an important gross characteristic of a refined petroleum material is its narrower boiling range specifications that are typically mixtures of refinery intermediate products, and resultant fingerprint expression in a GC/FID chromatogram. For instance, aviation gasoline, and aviation fuels are produced from a combination of processes that lead to a significant variability in its composition across VOC to light SVOC range (~nC8 to ~nC16)[6]. For instance, aviation gasoline is composed of paraffins and

[3] Douglas, G.S., Stout, S.A., Uhler, A.D., McCarthy, K.J., Emsbo-Mattingly, S.D. 2007. Advantages of Quantitative Chemical Fingerprinting in Oil Spill Source Identification. In: "Oil Spill Environmental Forensics. Fingerprinting and Source Identification" Ed. By Zhendi Wang and Scott A. Stout, Academic Press, 257-292

[4] Yunker, Mark B., et al. "PAHs in the Fraser River basin: a critical appraisal of PAH ratios as indicators of PAH source and composition." Organic geochemistry 33.4 (2002): 489-515.

[5] Uhler, A. D., and S. D. Emsbo-Mattingly. "Environmental stability of PAH source indices in pyrogenic tars." *Bulletin of Environmental Contamination & Toxicology* 76.4 (2006).

[6] Speight, James G. *The Chemistry and Technology of Petroleum*. CRC Press, 1991.

iso-paraffins (~50%-60%), moderate amounts of naphthene's from the straight run gasoline intermediate (~20%-30%), lesser amounts of aromatics (~10%), and usually no olefins[6]. Thus, aviation gasoline exhibits lower boiling fingerprint aspects that are manufactured from straight run naphtha aviation base stock, higher boiling iso-paraffins from alkylate blend stock, and C2 to C4 monoaromatics from catalytic reforming or similar source[6]. Aviation fuels comprises both gasoline range and kerosene range products meeting different specifications for use in aviation turbine power units[6]. In addition to more nuanced features of petroleum, themes 1 and 2 consider insights from boiling range qualities and refinery process diagnostics for source type characterization.

Theme 3 (Pyrogenicity) – Pyrogenicity is derived from the combustion processes of petroleum fuels, hydrocarbons in general, and thermal stress's that may be related to a myriad of refinery control and production residues, industrial process artifacts, and the urban environment and its runoff[6]. Figures 3 and 4 present the three project samples overlayed to a variety of reference samples from the peer reviewed literature and ChemQuants data archive. The list of samples shows a range of chemical sources that expose hydrocarbons to thermolytic stress, which lead to the production of pyrogenic hydrocarbon chemistry.

Figures 3 and 4 presents a panel of scatter plots of diagnostic HMW-PAH ratios. The figures overlay the project samples TP-4 PIANO, TP-5 PIANO, and TP-10 PIANO to an array of reference source samples. Elevated HMW-PAH ratios and their respective chemical abundances emphasize pyrogenicity and are effective for diagnosing hydrocarbon exposure to thermal stresses. Abundances of HMW-PAHs, specifically those with five membered rings increases with exposure to higher temperatures, which show the following trend[6]:

~Fossil Fuel: $0 \leq FL0/(FL0+PY0) < 0.33$; Low BA0/(BA0+C0); Low IND/(IND+GHI)

~Low Temperature Process: $0.33 < FL0/(FL0+PY0) \leq 0.5$

~High Temperature Process: $0.5 < FL0/(FL0+PY0)$; High BA0/(BA0+C0); High IND/(IND+GHI)

Theme 3 LOEs focus on characterizing the project samples with respect to their potential exposure to thermal stress regimes.

Results and Discussion

Chemical Data Investigation

Objective for this investigation was to evaluate the chemical data related to the project soil samples TP-4 PIANO, TP-5 PIANO, and TP-10 PIANO with defensible techniques and methodologies. The three themes in this investigation summarize a systematic method conducted for the source characterization of the project soil samples collected from various locations and depths, while each theme corresponded to distinct discriminating attributes of the chemical signatures.

Themes 1 & 2 (Petrogenicity) – TP-4 PIANO, TP-5 PIANO exhibited petrogenic chemical signatures described by VOC to SVOC molecular boiling ranges as shown in the GC/MS (FS/TIC) chromatograms (Figures 5 and 7). In both samples the VOC range signature showed low expressions of paraffinic and isoparaffinic compounds as showed as blue bars and red bars respectively in the VOC PIANO bar graphs of Figures 5 and 7. In both project samples C3 to C4 monoaromatic hydrocarbons (green bars) are significantly more abundant than isoparrafins, and cyclic hydrocarbons called naphthene's in purple are prominent - methylcyclopentane (MCYP), cyclohexane (CYHX), and methylcyclohexane (MCYHX) (Figures 5, 7). Heavy naphtha range hydrocarbon chemistry is also exhibited in the very lightest segment of the SVOC range, and the gross presence of the hydrocarbons are evident in the clustering of chemical "peaks" that elute toward the "light-end" (left side) of the chemical chromatograms (Figures 5 and 7 – top).

Heavy Naphtha Range Signature in TP-4 PIANO - More specifically in the lighter end of the SVOC range, heavy naphtha range chemistry is more pronounced in TP-4 PIANO as enrichments of more biodegradation resistant nC8 to nC13 hydrocarbons (Figure 5), relative to depleted expressions of less biodegradation resistant n-paraffins (Figure 5). The severely depleted, i.e., biodegraded quality of the heavy naphtha range petroleum signature is expressed in a) ethylbenzene dominant C2 monoaromatics "BTEX" complex, whereas benzene toluene, and xylenes were removed from biodegradation (Figure 5), complete removal of nC8 to nC13 n-paraffins in the VOC range signature (Figure 5), and relative enrichments of branched hydrocarbons > biodegraded normal alkanes (Figure 5). Heavy naphtha range distributions of more biodegradation resistant and source diagnostic hydrocarbons are exhibited as: CH-2 to CH-4 alkylcyclohexanes (83 m/z) (Figure 6); significant enrichments of heavy naphtha range i-9 to i-14 isoparaffins; and relative enhancements of C1 > C2 alkylnaphthalenes & C4 monoaromatics > C1 alkylnaphthalenes (Figures 5).

Middle Distillate Range Fuel Signatures in TP-4 PIANO & TP-5 PIANO - The SVOC range signatures of the TP-4 PIANO, TP-5 PIANO chromatograms also showed prominence of middle distillate range hydrocarbon chemistry as showed by the UCM and n-paraffins spanning ~nC13 to nC22 (Figures 5, 7). TP-4 PIANO was significantly and preferentially more enriched with heavy naphtha range hydrocarbons (Figures 5), while TP-5 PIANO exhibited prominence of nC13 to nC22 middle distillate range hydrocarbons (Figures 7). A broad range of alkylated PAHs that extended beyond two to four ring alkylated PAHs and SPAHs (sulfur heterocyclics) that are representative for middle distillate range petroleum, occurred in TP-4 PIANO, TP-5 PIANO. For instance, TP-4 PIANO, TP-5 PIANO were enriched with lower amounts of three to four ringed alkylated PAHs and SPAHs, and five to six ring heavy molecular weight PAHs ("HMW-PAHs") (Figures 5, 7 – Y-axis Inset). In accordance with enrichments of higher ringed PAHs in the two samples the UCM signatures of the petroleum extended beyond the middle distillate range to the residual range (Figures 5, 7).

Hydrocarbon boiling range extension to the heavier residual range was greater in TP-5 PIANO as evident in the pronounced bi-modal UCM characteristic and significant enrichments of residual range petroleum biomarkers e.g., terpanes 191 m/z (Figures 6, 8). Along with general petrogenic source divergences between TP-4 PIANO and TP-5 PIANO, a detailed investigation of "specific chemical fingerprints" showed that the feedstock source properties of the petroleum were also

distinct. For example, a) the relative differences of bulk properties like UCM, the relative differences of alkylated phenanthrene PAHs and alkylated chrysenes, (Figures 5, 7) and the relative differences of middle distillate range biomarker fingerprints like bicyclanes were distinct (123 m/z) (Figures 6, 8). Forensic fingerprint analysis revealed that although the period of residence time in the subsurface were not significantly different, the middle distillate fuels expressed in TP-4 PIANO and TP-5 PIANO were from dissimilar sources and fugitive releases.

Unleaded Gasoline in TP-4 PIANO & TP-5 PIANO & Heavier Petroleum Signature in TP-5 PIANO

A more focused analysis of the less obvious chemical attributes of TP-5 PIANO, which included residual range chemistry, showed that the heavier component was an admixture from a completely different source. Also, minor admixture contributions of unleaded gasoline were evident in TP-4 PIANO and TP-5 PIANO as enrichments of alkylate feedstock derived attributes (Table 1 - #1), and occurrence of tert-amyl methyl ether ("TAME") in TP-5 PIANO. This data driven opinion of the heavier admixtures in TP-5 PIANO stemmed from shared diagnostic attributes that were conclusively derived from the Theme 3 study in the following section of TP-10 PIANO. For instance, a) similar heavier tail profiles of terpanes (191 m/z) were evident (Figures 6, 8), b) TP-5 PIANO and TP-10 PIANO were enriched with Retene - a biogenic PAH derived from conifer trees[7], and c) TP-5 PIANO presented HMW-PAH ratios that were more expressive than TP-4 PIANO of exposure to higher temperature pyrogenic processes. For instance, HMW-PAH ratios of TP-5 PIANO presented exposure to higher temperature processes in line with 1) a reference mixture of petroleum and tar from a carbureted water gas ("CWG") process, 2) and a reference sample from a petroleum handling facility (Figure 4).

Source candidates and time of release estimations

Aviation Fuel in TP-4 PIANO - Refined petroleum products are the dominant characteristic for TP-4 PIANO and TP-5 PIANO samples. The detailed review of the fingerprint features of TP-4 PIANO showed that TP-4 was dominated by heavy naphtha range chemistry > middle distillate range chemistry, which leads to the two questions about the heavy naphtha range signature: 1) what type of fuel is it? 2) When was the fuel released? Multiple lines of evidence provided in the detailed discussion above and reconnaissance of historical documents in Appendix A (visually summarized in Figure 11) provided data driven support to address the first question. The detailed investigation of the hydrocarbon chemistry in TP-4 PIANO concluded that that the soil samples was enriched with a severely biodegraded heavy naphtha range source as expressed in the near complete removal of n-paraffins and C2-monoaromatics.

It was discussed that heavy straight run gasoline i.e., heavy naphtha is a dominant refinery intermediate product blended to manufacture some varieties of aviation fuels. In addition, reconnaissance of historical Site documents provided conclusive evidence that aviation fuels were stored in multiple tanks on parcel O with piping networks that extended to the adjacent parcel N of 3701 River Road where the soil samples were collected for this forensic investigation (Figure 1;

[7] *Wakeham, Stuart G., Christian Schaffner, and Walter Giger. "Poly cyclic aromatic hydrocarbons in Recent lake sediments—II. Compounds derived from biogenic precursors during early diagenesis." Geochimica et Cosmochimica Acta 44.3 (1980): 415-429.*

Appendix A - Exhibit 1, 16, and 21). The 1979 survey of Exhibit 16 shows that aviation fuel was stored in parcel O since at least 1979. Addressing the first characterization question, multiple lines of evidence revealed that the heavy naphtha component in TP-4 PIANO was an aviation fuel. Regarding the second question of residence time in the subsurface, multiple lines of evidence were applied to estimate the time of release of the aviation fuel in TP-4 PIANO sample. The lines of evidence included a biodegradation model calibrated by subsurface weathering potential regimes that are functions of subsurface soil characteristics like depth to groundwater, overlying soil cover, lithology and texture of geology, and geochemical conditions of the soil[8]. Soil characteristics prevalent in the Site proximity are as stated by the client as having a deep-water table ranging from 12 to 24 feet and a clay dominant lithology.

Also, it is known that soils in Tonawanda near 3701 River Road[9] are poorly drained soils with pH ranges from strongly to moderately acidic in the surface to subsoil layer. TP-4 PIANO was collected 3 feet below ground surface, which was well above the water table range. These conditions supported a charachterization of the potential subsurface weathering regime as being weak. The classification of a weak weathering potential regime in the subsurface was based on subdued and limited biological activity due to a) significant overlying soil cover, b) soil sample collected from above the deep-water table, and c) soils with clay and silty lithology and texture. As discussed above the hydrocarbon profiles of TP-4 PIANO were near to completely depleted of n-paraffins from nC8 to nC13 and C2 monoaromatics "BTEX".

Also, the more recalcitrant and biodegradation resistant CH2 to CH4 alkylcyclohexanes biomarkers were microbially altered to a significant extent. This heavy to severe stage of biodegradation attribution in the context of the weak weathering potential regime provided evidence that the aviation fuel experienced a residence time in the subsurface ranging of at least 40 years. The geochemically derived lower boundary time of release estimate was calibrated to a time range that was informed by two historical markers, a) the date of tank removal as shown in Exhibit 17 & 20 - 1987, and b) the dated survey indicating that aviation fuels and heating oils were stored on Parcels N and O from earlier than the survey's time stamp of 1979 in Exhibit 16. These historically weighted lines of evidence show that aviation fuel impacted the subsurface at least 40 years ago. Understandably, an upper time of release boundary can be further elucidated with additional historical and chemical lines of evidence extending to the mid-century when the tank infrastructure was first erected on Parcels N and O.

Heating Oils in TP-4 PIANO & TP-5 PIANO – As discussed in the last section of this report, the detailed review of the fingerprint features of TP-4 PIANO and TP-5 PIANO soil samples showed that 1) TP-4 PIANO, although dominated by the aviation fuel source component, exhibited significant enrichment of middle distillate range fuel chemistry, and 2) TP-5 PIANO exhibited a petroleum signature that was dominated by middle distillate range fuel chemistry. Furthermore, it was defensibly concluded in the last section that the middle distillate fuel in TP-4 PIANO originated from a different middle distillate fuel feedstock and thus a different fugitive release. As

[8] *Oudijk, Gil. "Age dating heating-oil releases, Part 2: Assessing weathering and release time frames through chemistry, geology and site history." Environmental Forensics 10.2 (2009): 120-131.*
[9] *Official Series Description - TONAWANDA Series (USDA soilseries.sc.egov.usda.gov*

with the aviation gasoline source that dominated TP-4 PIANO soil sample, these significant petroleum enrichments in the soil samples lead to two questions about the middle distillate range signatures: 1) what type of middle distillate fuel is it? 2) and when were the fuels released?

Multiple lines of evidence provided in the detailed discussion above and reconnaissance of historical documents in Appendix A (visually summarized in Figure 11) provided data driven support to address the first and second questions. The detailed investigation of the hydrocarbon chemistry in TP-4 PIANO & TP-5 PIANO in the previous section concluded that that the soil samples were conclusively characterized as middle distillate range fuel products. Regarding the types of middle distillate fuel in the soil samples, organic sulfur diagnostics and historical site reconnaissance were concurrently applied. Organic sulfur diagnostics yielded insights to the formulation era of the middle distillate range fuel.

Different refinery eras in the U.S. are differentiated by sulfur reduction efforts that over the last 20+ years have been achieved through hydrodesulfurization (HDS)[6], with effects of HDS reactions reflected in the hydrocarbons chemistry[11]. As a consequence, different manufacturing eras of middle distillate range fuels are generally reflected in a) relationships of sulfur-containing alkylated dibenzothiophenes (green bars in Figures 5, 7) to alkylated phenanthrene PAH moieties (Table 1, Figure 2, and Figures 5, 7), b) changes to certain dibenzothiophenes (DBTs) isomers over others (in main data package), and c) abundance of alkylated decalins (blue bars in Figures 5, 7) relative to alkylated dibenzothiophenes.

Review of these critical organic sulfur diagnostics revealed that the middle distillate fuels in both soil samples TP-4 PIANO & TP-5 PIANO clustered with the highest sulfur enriched populations of middle distillate fuel oils and heating oils from ChemQuants data archive and peer reviewed literature (Figure 2). Based on the Figure 2 diagnostic ratios, this population of middle distillate range fuels exhibited diagnostic ratios and total sulfur attributes that exceeded non-road, locomotive, and certainly on-road U.S. regulatory diesel limits of 1993. In addition, the low abundances of alkylated decalins relative to alkylated dibenzothiophenes bolsters a defensible conclusion that the middle distillate range fuels in TP-4 PIANO & TP-5 PIANO were high sulfur fuels that were not subject to extensive desulfurization reactions at the refinery.

A more specific charachterization of the high sulfur fuel was bolstered with additional lines of evidence from reconnaissance of historical Site documents. These historical lines of evidence concluded that heating oil was stored in a large tank in parcel N of 3701 River Road where the soil samples were collected for this forensic investigation (Figure 1; Appendix A - Exhibit 1, 16, and 22). The 1979 survey of Exhibit 16 shows that heating oil was stored in parcel N since at least 1979. Because of multiple lines of chemical and historical evidence, it is defensibly stated that the high-sulfur middle distillate fuels expressed in TP-4 PIANO & TP-4 PIANO soil samples were of the non-road heating oil variety.

Addressing the first characterization question, multiple lines of evidence revealed that the middle distillate fuels in TP-4 PIANO & TP-5 PIANO were heating oils from different feedstock sources. Regarding the second question of residence time in the subsurface, multiple lines of evidence were applied to estimate the time of release of the heating oils in TP-4 PIANO & TP-5 PIANO soil

samples. The lines of evidence included the organic sulfur diagnostics discussed in the last paragraph, and the biodegradation model calibrated by subsurface weathering potential regimes that was characterized as being weak[8]. As discussed in the previous section the time of release model considers biodegradation dynamics of a wide range of hydrocarbons, in addition to a biodegradation index based on the relationship between nC17 and Pristane[8,10,11].

A biodegradation-based index was used as an additional line of evidence to assess the middle distillate range fuels approximate age in both TP-4 PIANO and TP-5 PIANO samples. The well documented time-based model is a biodegradation index based on the relationship between nC17 and Pristane. The approximate nC17/Pristane ratio value of ~0.8 (TP-4 PIANO) / ~0.72 (TP-4 PIANO) indicates that the petroleum in both samples were appreciably depleted of n-paraffins (~>80%), thus heavily biodegraded. These historically weighted line of evidence show that aviation fuel impacted the subsurface at least 40 years ago.

The geochemically derived lower boundary time of release estimate was calibrated to a time range that was informed by two historical markers, a) the date of tank removal as shown in Exhibit 20 - 1987, and b) the dated survey indicating that aviation fuels and heating oils were stored on Parcels N and O from earlier than the survey's time stamp of 1979 in Exhibit 16. These historically weighted lines of evidence show that aviation fuel impacted the subsurface at least 40 years ago. Understandably, an upper time of release boundary can be further elucidated with additional historical and chemical lines of evidence extending to the mid-century when the tank infrastructure was first erected on Parcels N and O.

Theme 3 (Pyrogenicity) – As communicated in the last section, TP-10 PIANO (and to a minor extent in admixture TP-5 PIANO) showed lower concentration expressions of pyrogenicity. The primary question of this section explores the characteristics of pyrogenicity – what process(s) caused the pyrolysis of hydrocarbons in the TP-10 PIANO sample? And can time of release be estimated from the chemistry and preponderance of evidence? In this report pyrogenicity is evaluated with PAH fingerprint reviews and diagnostics of HMW-PAH abundances and ratio characteristics. Three diagnostic ratios derived from HMW-PAH were applied in this study for source characterizations of TP-10 PIANO due to their high stability across a wide range of weathering and concentration[5]. Furthermore, the HMW-PAH ratios were explored in a comparative fashion among a diverse population of candidate source samples assembled from the peer-reviewed literature and ChemQuants data archive (Figures 3, 4; Table 1).

HMW-PAH ratio values for TP-10 PIANO plotted on the top right quadrant of each scatter plot in Figures 3, 4, which are values associated to hydrocarbons that were exposed to significant pyrolysis. TP-10 PIANO expressed ratio values consistent with higher temperature pyrolysis characteristics since FL/(FL+PY) > 0.5, and values of BA0/(BA0+C0) and IND/(IND+GHI) were high. The HMW-PAHs of TP-10 PIANO. Among the reference candidate samples the strongest ratio

[10] Schade, Thomas, Benedikte Roberz, and Jan T. Andersson. "Polycyclic aromatic sulfur heterocycles in desulfurized diesel fuels and their separation on a novel palladium (II)-complex stationary phase." Polycyclic Aromatic Compounds 22.3-4 (2002): 311-320.
[11] Wade, Michael J. "Age-dating diesel fuel spills: Using the European empirical time-based model in the USA." Environmental Forensics 2.4 (2001): 347-358.

correspondence was to a sample that was characterized as coke/clinker w/ trace of refined petroleum (Figures 3, 4). The next ranking candidate source were related to a set of tars from MGP sites (Figures 3, 4). Significant pyrogenicity was evident upon inspection of TP-10 PIANO parent and alkylated PAH bar graph. At first pass one may interpret this signature as a weathered MGP tar (Figure 9).

However, preponderance of evidence from HMW-PAH ratios in addition to the following factors indicate that the pyrogenicity expressed in TP-10 PIANO was not a weathered MGP tar: a) The chemical chromatogram of TP-10 PIANO exhibited a significant residual range UCM aspect without concomitant dominance of a resolved parent and alkylated pyrogenic PAH profile (Figure 9), b) The PAH bar graph of Figure 9 exhibits that TP-10 PIANO contains prominence of higher molecular weight and higher alkylated series of PAHs and SPAHs, c) furthermore the ion trace of n-paraffins (85 m/z) in TP-10 PIANO indicates the prominence of an odd to even pattern extending to nC35. In concert, these aspects provide robust evidence that the pyrogenicity of TP-10 PIANO is more likely consistent with carbonized coal ("Coke") and admixtures of uncombusted or uncarbonized particulate coal[12,13]. In addition to the pyrogenic aspects TP-10 PIANO contained traces of alkylate gasoline feedstock derived attributes (Figure 9, Table 1 - #1), and leaded gasoline formulations (Figure 9, Table 1 - #3, 4).

Timeline of 3701 River Road with Detailed Ownership Transfers of Parcels

The timeline diagram meticulously tracks the ownership history of 3701 River Road parcels, with particular emphasis on the complex transfers between companies and the forensic evidence period related to subsurface contamination (Figure 1; Figure 11; Appendix A).

Detailed Ownership Transfer History of 3701 River Road Parcels

The diagram in Figure 11 presents a comprehensive visualization of the complex ownership transfers for 3701 River Road parcels, tracking each parcel's history separately before they were unified under common ownership

Parcels N & O Ownership Path

The ownership journey of parcels N and O began in 1927 when they were acquired from Wonalancet Company by Beacon Oil Company, which immediately developed petroleum infrastructure on the site:

1927: Beacon Oil Company Acquisition and Development

- Beacon Oil Company purchased Parcels N and O from Wonalancet Company

[12] *Emsbo-Mattingly, S. D., and S. A. Stout. "Semivolatile hydrocarbon residues of coal and coal tar." Coal and peat fires: A global perspective 1 (2011): 173-208.*
[13] *Stout, Scott A., and Andrew P. Brey. "Appraisal of coal-and coke-derived wastes in soils near a former manufactured gas plant, Jacksonville, Florida." International Journal of Coal Geology 213 (2019): 103265.*

- Erected a pump house on these parcels
- Installed 5-10,000-gallon oil storage tanks, pipelines, and dikes

1928: Corporate Merger

- Beacon Oil Company merged with Colonial Oil Company to form Colonial Beacon Oil Company
- Despite the merger, the petroleum infrastructure continued to operate on these parcels
- Additional improvements were made including tankage, pipelines, and sidetrack

1929: Change in Corporate Control

- Standard Oil of New Jersey acquired a controlling interest in Colonial Beacon Oil Company
- Despite this acquisition, Colonial Beacon Oil Company maintained its brand identity for marketing purposes in New England and New York
- Operational control of the parcels remained with Colonial Beacon Oil Company while Standard Oil of New Jersey influenced strategic decisions

1945-1947: Company N Ownership Period

- During this brief period, Colonial Beacon Oil Company owned all four parcels (N, O, P, and Q)
- This represented the first time all parcels were unified under a single entity

1947: Formal Takeover by Standard Oil of New Jersey

- Standard Oil of New Jersey, which had held controlling interest since 1929, formally took over the business
- All assets of Colonial Beacon Oil Company, including Parcels N and O, were transferred to Standard Oil of New Jersey
- This completed the corporate absorption that had begun almost two decades earlier

Shell Eastern Petroleum Products Incorporated & Shell Union Oil Corporation Ownership Path

The ownership history of Parcels P and Q followed a different and more complex path:

1930: Initial Acquisition by Shell Eastern Petroleum Products Incorporated

- Shell Eastern Petroleum Products Incorporated acquired Parcels P and Q from Wonalancet Company
- Unlike Parcels N and O, aerial imagery from 1938 showed no to minimal petroleum infrastructure erected on these parcels at that time

1936: Transfer to Shell Union Oil Corporation

- Shell Eastern Petroleum Products transferred Parcels P and Q to Shell Union Oil Corporation
- Still no significant petroleum infrastructure development based on 1938 aerial images

1938: Split Ownership Period

- Shell Union Oil Corporation transferred Parcel P to Shell Oil Company
- Parcel Q remained under Shell Union Oil Corporation ownership
- This created a period of split ownership between these adjacent parcels

1945: Reunification under Colonial Beacon Oil Company

- Shell Oil Company transferred Parcels P and Q to Colonial Beacon Oil Company
- This brought all four parcels (N, O, P, and Q) under Colonial Beacon Oil Company ownership
- The consolidation of ownership facilitated integrated operations across the 3701 River Road property

1947: Transfer to Standard Oil of New Jersey

- Parcels P and Q were transferred to Standard Oil of New Jersey
- This completed the unification of all parcels under Standard Oil of New Jersey

Unified Ownership Period (1947-1987)

After 1947, all parcels of 3701 River Road followed a common ownership trajectory:

1947: Complete Unification

- All parcels (N, O, P, and Q) were unified under Standard Oil of New Jersey ownership
- This allowed for integrated petroleum storage operations across the 3701 River Road property

1948: Corporate Rebranding

- Standard Oil of New Jersey changed its name to ESSO Standard Oil Company
- Ownership of the parcels remained unchanged; this was purely a corporate identity change

1951: Infrastructure Expansion

- Aerial imagery from this period revealed additional petroleum infrastructure had been erected between 1938 and 1951
- New facilities were developed across Parcels N, O, and P
- This expansion reflected growing demand for petroleum storage in the post-WWII period

1960: Corporate Merger

- ESSO Standard Oil Company merged with Carter Oil Company to form Humble Oil & Refining Company
- 3701 River Road continued to operate as a petroleum storage facility through this transition

1972: Acquisition by EXXON Corporation

- Humble Oil & Refining Company merged into Exxon Corporation
- EXXON Corporation maintained the petroleum storage operations at 3701 River Road
- As notable in the 1979 survey details - parcels N and O were used as a fuel storage terminal that stored "aviation fuel", "unleaded gasoline", and "heating oil" (middle distillate range fuel) since at least 1979. Also notable in the 1979 survey details was the pipeline network associated to the loading rack of parcel N
- This ownership period coincides with the lower end of the release period range of at least 1979 to 1987

1979: Sale to Ashland Oil, Inc.

- EXXON Corporation transferred all parcels to Ashland Oil, Inc.
- Ashland Oil, Inc. operated the site from 1979 to 1987
- As notable in the 1979 survey details - parcels N and O were used as a fuel storage terminal that stored "aviation fuel", "unleaded gasoline", and "heating oil" (middle distillate range fuel) since at least 1979. Also notable in the 1979 survey details was the pipeline network associated to the loading rack of parcel N
- This ownership period coincides with the lower end of the release period range of at least 1979 to 1987

1987: Final Transfer and Tank Removal

- Ashland Oil, Inc. transferred all parcels to NOCO Energy Corporation
- Within six months of acquisition, NOCO Energy Corporation removed all storage tanks (10-million-gallon capacity) that were labeled in the 1979 survey details and NOCO related aerial map document as containing "aviation fuel", "unleaded gasoline", and "heating oil" (middle distillate range fuel)
- This tank removal event of 1987 informed and calibrated the forensic investigation

Forensic Evidence and Ownership Timeline Correlation

The petroleum forensics investigation conducted on Parcel N of 3701 River Road revealed critical contamination evidence:

Contamination Characteristics

- TP-4 PIANO (L2500497-01): Mixture of aviation fuel and heating oil, with minor aspect of unleaded gasoline
- TP-5 PIANO (L2500497-02): Heating oil mixed with pyrogenic coke-related particles, with minor aspect of unleaded gasoline
- TP-10 PIANO (L2500497-03): Significantly lower concentration pyrogenic aspect in soil characterized as coke-like, with minor aspect of leaded gasoline

Time of Petroleum Release Analysis

The geochemically derived lower boundary time of release estimate was calibrated to a time range that was informed by two historical markers, a) the date of tank removal as shown in Exhibit 20 - 1987, and b) the dated survey indicating that aviation fuels and heating oils were stored on Parcels N and O from earlier than the survey's time stamp of 1979 in Exhibit 16. These historically weighted lines of evidence show that aviation fuel impacted the subsurface at least 40 years ago. Understandably, an upper boundary time of release estimate can be further elucidated with additional historical and chemical lines of evidence extending to the mid-century when the tank infrastructure was first erected on Parcels N and O.

- This lower boundary time range specifically overlaps with:
    - EXXON Corporation (1972 -1979)
    - The end of Ashland Oil, Inc. ownership (1979-1987)
    - The beginning of NOCO Energy Corporation ownership (1987 onward)

Significance of the Ownership-Contamination Correlation

The refined timeline offers crucial insights into potential responsibility for the contamination:

Critical Periods (pre-1979), (1980-1987) & (1987-1990)

- This period timeframe more appropriately captures the period of Exxon's ownership, Ashland's ownership, and NOCO tank removal.

Contamination Sources

- The heating oil, unleaded gasoline, and aviation fuel components in TP-4 PIANO (L2500497-01) and TP-5 PIANO (L2500497-02) originated from 3701 River Road petroleum storage operations

Conclusions

This investigation resulted in data driven opinions from applications of environmental forensic techniques and principles that included chemical analysis and reconnaissance of historical documents of the Site environs. The primary objective of this investigation was to assess the characteristics and subsurface residence time of the hydrocarbon's signatures enriched in three soil samples collected from parcel N of 3701 River Road. Review of multiple lines of evidence concluded the following dominant chemical source attributes of hydrocarbons in the soil samples: TP-4 PIANO soil sample was enriched with a mixture of aviation fuel and heating oil, TP-5 PIANO soil sample was enriched with a mixture of heating oil and relatively lower level of coke-like pyrogenic aspect, TP-10 PIANO soil sample exhibited a low concentration coke-like pyrogenic aspect. The combination of chemical analysis, review of subsurface conditions, and review of historical Site related documents showed that: the aviation fuel enriched in TP-4 PIANO soil sample, and heating oils enriched in TP-4 PIANO and TP-5 PIANO were released at least 40 years ago from historical tank(s) or pipeline network associated to heating oil handling on parcel N. An upper boundary time of release estimate can be further elucidated with additional historical and chemical lines of evidence extending to the mid-century when the tank infrastructure was first erected on Parcels N and O.

Upon receipt of additional information, I reserve the right to modify and supplement my opinions outlined in this report.

You may email any questions or concerns to markcejas@chemquants.com
regarding chemistry data or interpretation.

Respectfully submitted,

Mark Jonathan Cejas



Principal

	ChemQuants project ID	369	369	369
	Project Name	3701 River Rd	3701 River Rd	3701 River Rd
	Sample ID	TP-4 PIANO	TP-5 PIANO	TP-10 PIANO
	Laboratory ID	L2500497-01	L2500497-02	L2500497-03
	Sample Type	SOIL	SOIL	SOIL
	Diagnostic SVOC Ratio (Biodegradation Properties)			
1)	nC17/Pristane	0.81	0.71	
	Diagnostic VOC Ratios (Refining Properties)			
2)	2,2,4-Trimethylpentane / (2,2,4-Trimethylpentane+Methylcyclohexane)	0.71	0.07	NR
	Oxygenates & Other (ug/kg)			
3)	Tert-amyl methyl ether (TAME)		49.5	
	Lead Scavengers (ug/kg)			
4)	1,2-Dichloroethane (EDC)			22.7
	Organic Lead Isomers (ug/kg)			
5)	Tetraethyl Lead (%)			360
	Total PAH Parameters (ug/kg)			
6)	TPAH(50) (Parent, Alkylated, & HMW PAHs)	142469	24149	13086
7)	TPAH(16) (Parent PAHs and HMW PAHs)	19955	1208	7571
	Fraction of Pyrogenic PAHs			
8)	(FL + Py) / (C2 + C3 + C4 P/As)	0.10	0.09	8.29
9)	Σ 4-6 Ring PAHs / Σ PAHs	0.01	0.02	0.83
	Pyrogenic & Petrogenic Ratios			
10)	IND / (IND + GHI)	0.44	0.38	0.48
11)	BA0 / (BA0+C0)	0.45	0.35	0.52
12)	(BBF+BJKF) / (BBF+BJKF+BAP)	0.70	0.75	0.64
13)	BAP / (BAP + BEP)	0.48	0.42	0.59
14)	C3 DBT / (C3 DBT + C3 BC)	0.93	0.88	0.10
15)	C2 DBT / (C2 DBT + C2 BC)	0.98	0.95	0.15
16)	C3 DBT / C3 P/A	0.70	0.86	0.51
17)	C2 DBT / C2 P/A	0.62	0.67	0.29

Note: If field is "NR" a ratio was not calculable.
FL=Fluoranthene
Py=Pyrene
C=Chryenes
P=Phenanthrene/Anthracenes
DBT = Dibenzothiophenes
BC = Benzanthracenes / Chrysenes
BA0 = Benzo(a)anthracene
C0 - Chrysene
BBF = Benzo(b)fluoranthene
BJKF = Benzo(j)+(k)fluoranthene
BAP = Benzo(a)pyrene
IND - Indeno(1,2,3,-cd)Pyrene
GHI - Benzo(g,h,i)Perylene

Table 1. Diagnostic Properties for the Project Samples.

Abbreviation	SVOC Compound	Abbreviation	SVOC Compound
D0	cis/trans-Decalin	NBT1	C1-Naphthobenzothiophenes
D1	C1-Decalins	NBT2	C2-Naphthobenzothiophenes
D2	C2-Decalins	NBT3	C3-Naphthobenzothiophenes
D3	C3-Decalins	NBT4	C4-Naphthobenzothiophenes
D4	C4-Decalins	BA0	Benz(a)anthracene
N0	Naphthalene	C0	Chrysene/Triphenylene
N1	C1-Naphthalenes	BC1	C1-Chrysenes
N2	C2-Naphthalenes	BC2	C2-Chrysenes BS
N3	C3-Naphthalenes	BC3	C3-Chrysenes
N4	C4-Naphthalenes	BC4	C4-Chrysenes
BT0	Benzothiophene	BBF	Benzo(b)fluoranthene
BT1	C1-Benzo(b)thiophenes	BJKF	Benzo(j)+(k)fluoranthene
BT2	C2-Benzo(b)thiophenes	BAF	Benzo(a)fluoranthene
BT3	C3-Benzo(b)thiophenes	BEP	Benzo(e)pyrene
BT4	C4-Benzo(b)thiophenes	BAP	Benzo(a)pyrene
B	Biphenyl	PER	Perylene
DF	Dibenzofuran	IND	Indeno(1,2,3-cd)pyrene
ACY	Acenaphthylene	DA	Dibenz(a,h)+(a,c)anthracene
ACE	Acenaphthene	GHI	Benzo(g,h,i)perylene
F0	Fluorene	2MN	2-Methylnaphthalene
F1	C1-Fluorenes	1MN	1-Methylnaphthalene
F2	C2-Fluorenes	26DMN	2,6-Dimethylnaphthalene
F3	C3-Fluorenes	235TMN	2,3,5-Trimethylnaphthalene
DBT0	Dibenzothiophene	4MDT	4-Methyldibenzothiophene(4MDT)
DBT1	C1-Dibenzothiophenes BS	2MDT	2/3-Methyldibenzothiophene(2MDT)
DBT2	C2-Dibenzothiophenes	1MDT	1-Methyldibenzothiophene(1MDT)
DBT3	C3-Dibenzothiophenes	3MP	3-Methylphenanthrene (3MP)
DBT4	C4-Dibenzothiophenes	2MP	2-Methylphenanthrene (2MP)
P0	Phenanthrene	2MA	2-Methylanthracene (2MA)
P1	C1-Phenanthrenes/Anthracenes	9MP	9/4-Methylphenanthrene (9MP)
P2	C2-Phenanthrenes/Anthr BS	1MP	1-Methylphenanthrene (1MP)
P3	C3-Phenanthrenes/Anthracenes	BbFl	Benzo(b)fluorene
P4	C4-Phenanthrenes/Anthracenes	BcFl	7H-Benzo(c)fluorene
A0	Anthracene	2MPy	2-Methylpyrene
CAR	Carbazole	4MPy	4-Methylpyrene
FL0	Fluoranthene	1MPy	1-Methylpyrene
PY0	Pyrene	R	Retene
FP1	C1-Fluoranthenes/Pyrenes		
FP2	C2-Fluoranthenes/Pyrenes		
FP3	C3-Fluoranthenes/Pyrenes		
FP4	C4-Fluoranthenes/Pyrenes		
NBT0	Naphthobenzothiophenes		

Table 2. Chemical Abbreviations for PAHs.

ChemQuants, LLC
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Cedar Park, TX 78613
www.ChemQuants.com

Interpreter

Abbreviation	VOC Compound
3M1B	3-Methyl-1-butene
ISOP	Isopentane
1P	1-Pentene
2M1B	2-Methyl-1-Butene
C5	Pentane
T2P	trans-2-Pentene
IPE	Isoprene
C2P	cis-2-Pentene
TBA	Tertiary Butanol
22DMB	2,2-Dimethylbutane
4M1P	4-Methyl-1-pentene
CYP	Cyclopentane
23DMB	2,3-Dimethylbutane
2MP	2-Methylpentane
MTBE	Methyl tert butyl ether
3MP	3-Methylpentane
1H	1-Hexene
C6	n-Hexane
IPROE	Isopropyl Ether
T2H	trans-2-Hexene
2M2P	2-Methyl-2-pentene
C2H	cis-2-Hexene
ETBE	Ethyl-Tert-Butyl-Ether
22DMP	2,2-Dimethylpentane
MCYP	Methylcyclopentane
24DMP	2,4-Dimethylpentane
223TMP	2,2,3-Trimethylbutane
EDC	1,2-Dichloroethane
33DMP	3,3-Dimethylpentane
CYHX	Cyclohexane
2MHX	2-Methylhexane
B	Benzene
23DMP	2,3-Dimethylpentane
THIO	Thiophene
11DMCYP	1,1-Dimethylcyclopentane
3MHX	3-Methylhexane
TAME	Tertiary-Amyl Methyl Ether
C13DMCYP	1,3-Dimethylcyclopentane (cis)
3EP	3-Ethylpentane
T13DMCYP/2M1HX	1,3-DMCP (trans)/2-Methyl-1-hexene
1HP/T12DMCYP	1-Heptene/1,2-DMCP (trans)
224TMP	Isooctane
T3H	trans-3-Heptene
C7	Heptane
T2H	trans-2-Heptene
C2H	cis-2-Heptene
22DMHX	2,2-Dimethylhexane
MCYHX	Methylcyclohexane
25DMHX	2,5-Dimethylhexane
24DMHX	2,4-Dimethylhexane

Abbreviation	VOC Compound
ECYP	Ethylcyclopentane
223TMP	2,2,3-Trimethylpentane
234TMP	2,3,4-Trimethylpentane
233TMP	2,3,3-Trimethylpentane
23DMHX	2,3-Dimethylhexane
2MHP	2-Methylheptane
4MHP	4-Methylheptane
3MHP	3-Methylheptane
3EHX	3-Ethylhexane
T	Toluene
2MTHIO	2-Methylthiophene
T14DMCYHX	1,4-Dimethylcyclohexane (trans)
3MTHIO	3-Methylthiophene
1O	1-Octene
C8	Octane
T12DMCYHX	1,2-Dimethylcyclohexane (trans)
EDB	1,2-Dibromoethane
C2O	cis-2-Octene
IPCYP	Isopropylcyclopentane
12DMCYHX	1,2-Dimethylcyclohexane (cis)
25DMHP	2,5-Dimethylheptane
35DMHP	3,5-Dimethylheptane
33DMHP	3,3-Dimethylheptane
114TMCYHX	1,1,4-Trimethylcyclohexane
23DMHP	2,3-Dimethylheptane
34DMHP	3,4-Dimethylheptane
4MO	4-Methyloctane
2MO	2-Methyloctane
EB	Ethylbenzene
2ETHIO	2-Ethylthiophene
3MO	3-Methyloctane
33DEP	3,3-Diethylpentane
PMX	p/m-Xylene
1N	1-Nonene
T3N	trans-3-Nonene
C3NE	cis-3-Nonene
C9	Nonane (C9)
STRE	Styrene
OX	o-Xylene
2N	2-Nonene
IPROCYHX	Isopropylcyclohexane
IPROPB	Isopropylbenzene
33DMO	3,3-Dimethyloctane
NPRPPB	n-Propylbenzene
2MNON	2-Methylnonane
3MNON	3-Methylnonane
1M3EB	1-Methyl-3-Ethylbenzene
1M4EB	1-Methyl-4-Ethylbenzene
135TMB	1,3,5-Trimethylbenzene
1D	1-Decene

Abbreviation	VOC Compound
IBCYHX	Isobutylcyclohexane
1M2EB	1-Methyl-2-Ethylbenzene
C10	Decane (C10)
TBUTB	tert-Butylbenzene
124TMB	1,2,4-Trimethylbenzene
IBUTB	Isobutylbenzene
SBUB	sec-Butylbenzene
1M3IPROPB	1-Methyl-3-Isopropylbenzene
1M4IPROPB	1-Methyl-4-Isopropylbenzene
123TMB	1,2,3-Trimethylbenzene
1M2IPROPB	1-Methyl-2-Isopropylbenzene
IA	Indane
13DEB	1,3-Diethylbenzene
1M3PROPB	1-Methyl-3-N-Propylbenzene
IE	Indene
1M4PROPB	1-Methyl-4-N-Propylbenzene
NBUB	n-Butylbenzene
12DM4EB	1,2-Dimethyl-4-Ethylbenzene
12DEB	1,2-Diethylbenzene
1M2PROPB	1-Methyl-2-N-Propylbenzene
14DM2EB	1,4-Dimethyl-2-Ethylbenzene
C11	Undecane
13DM4EB	1,3-Dimethyl-4-Ethylbenzene
13DM5EB	1,3-Dimethyl-5-Ethylbenzene
13DM2EB	1,3-Dimethyl-2-Ethylbenzene
12DM3EB	1,2-Dimethyl-3-Ethylbenzene
1245TMB	1,2,4,5-Tetramethylbenzene
1235TMB	1,2,3,5-Tetramethylbenzene
NPYB	N-Pentylbenzene
1234TMB	1,2,3,4-Tetramethylbenzene
13DM5TBUB	1,3-Dimethyl-5-tert-Butylbenzene
C12	Dodecane (C12)
135TEB	1,3,5-Triethylbenzene
N	Naphthalene
BTHIO	Benzothiophene
124TEB	1,2,4-Triethylbenzene
HYB	Hexylbenzene
MMT	MMT
C13	Tridecane
2MN	2-Methylnaphthalene
1MN	1-Methylnaphthalene
C14	Tetradecane (C14)
C15	Pentadecane

Table 3. Chemical Abbreviations for VOC PIANO.

ChemQuants, LLC
1320 Arrow Point Drive Ste. 501 #65
Cedar Park, TX 78613
www.ChemQuants.com

Interpreter

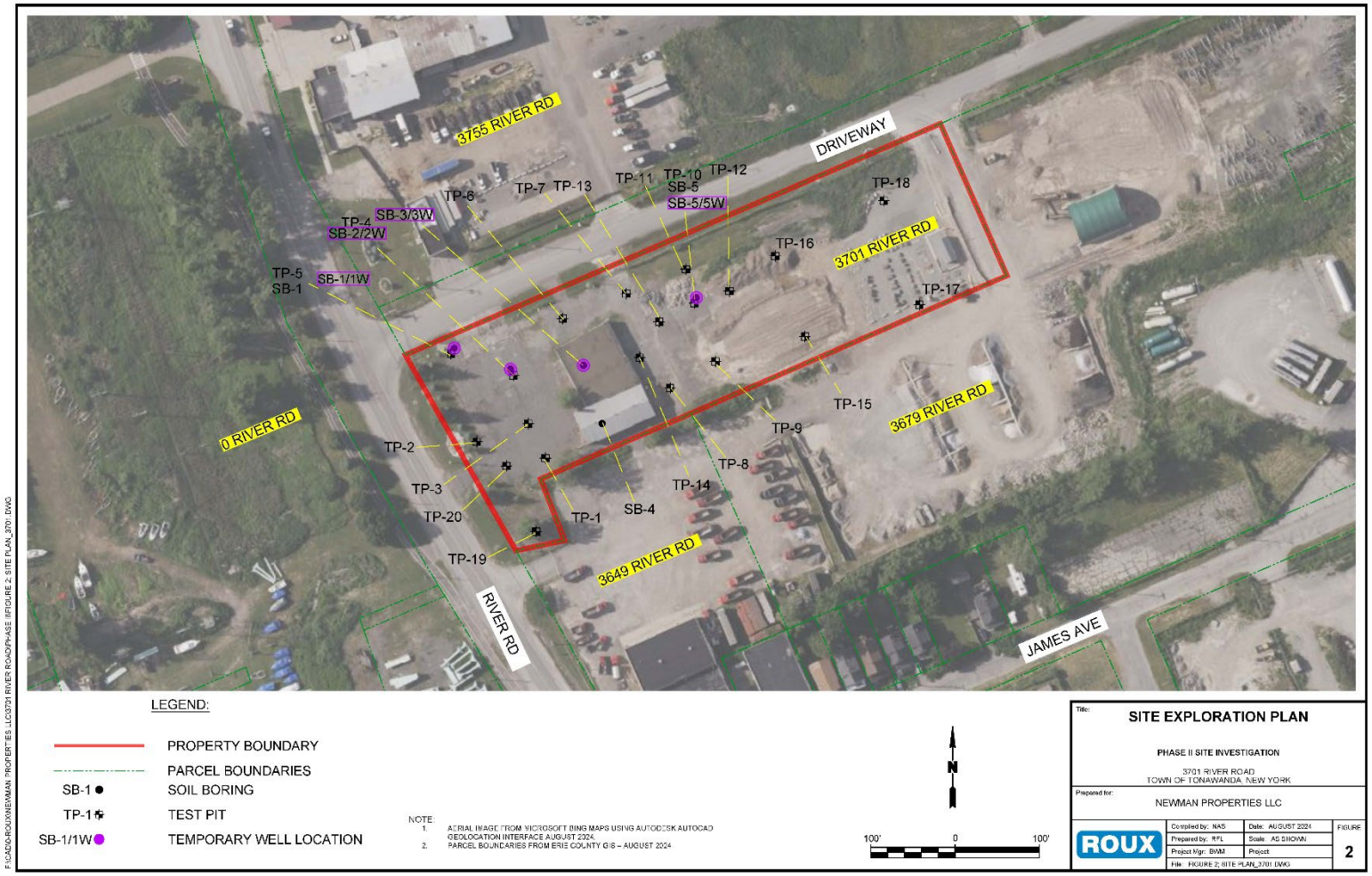


Figure 1. Site Plan.

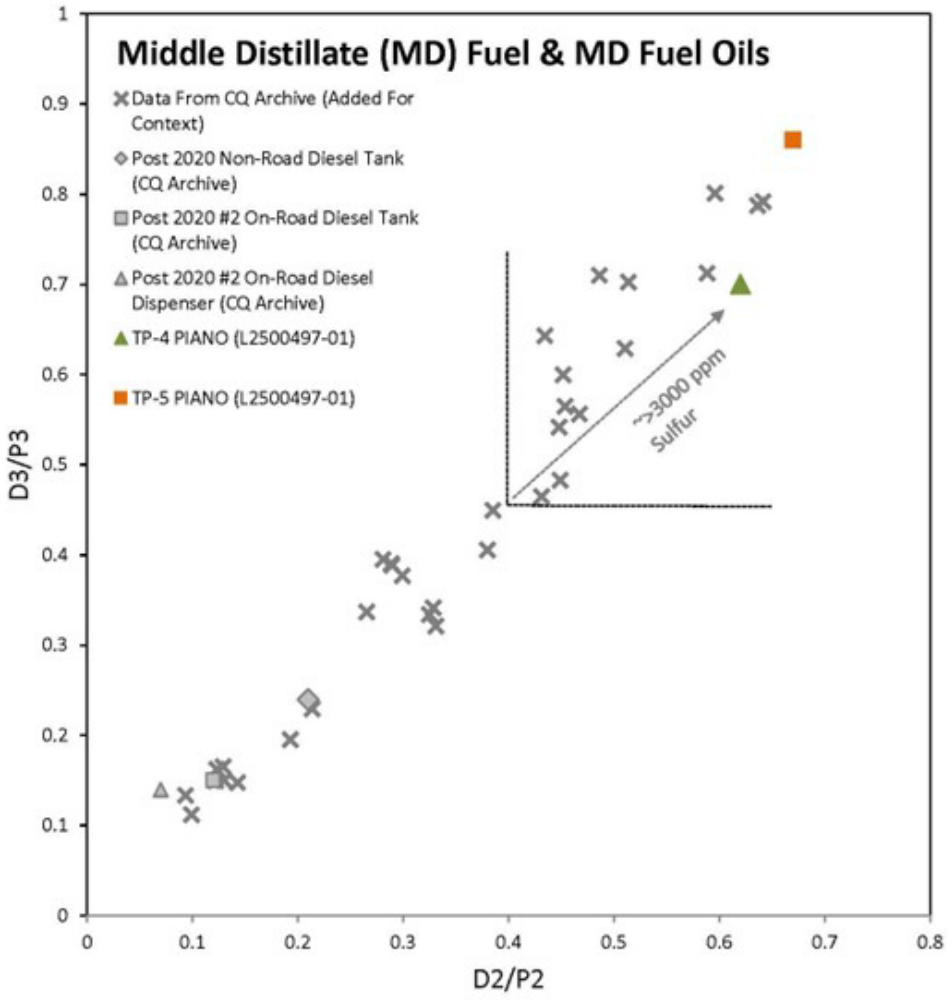


Figure 2. Diagostic Ratios of Middle Distillate Fuels.

ChemQuants, LLC
1320 Arrow Point Drive Ste. 501 #65
Cedar Park, TX 78613
www.ChemQuants.com

Interpreter

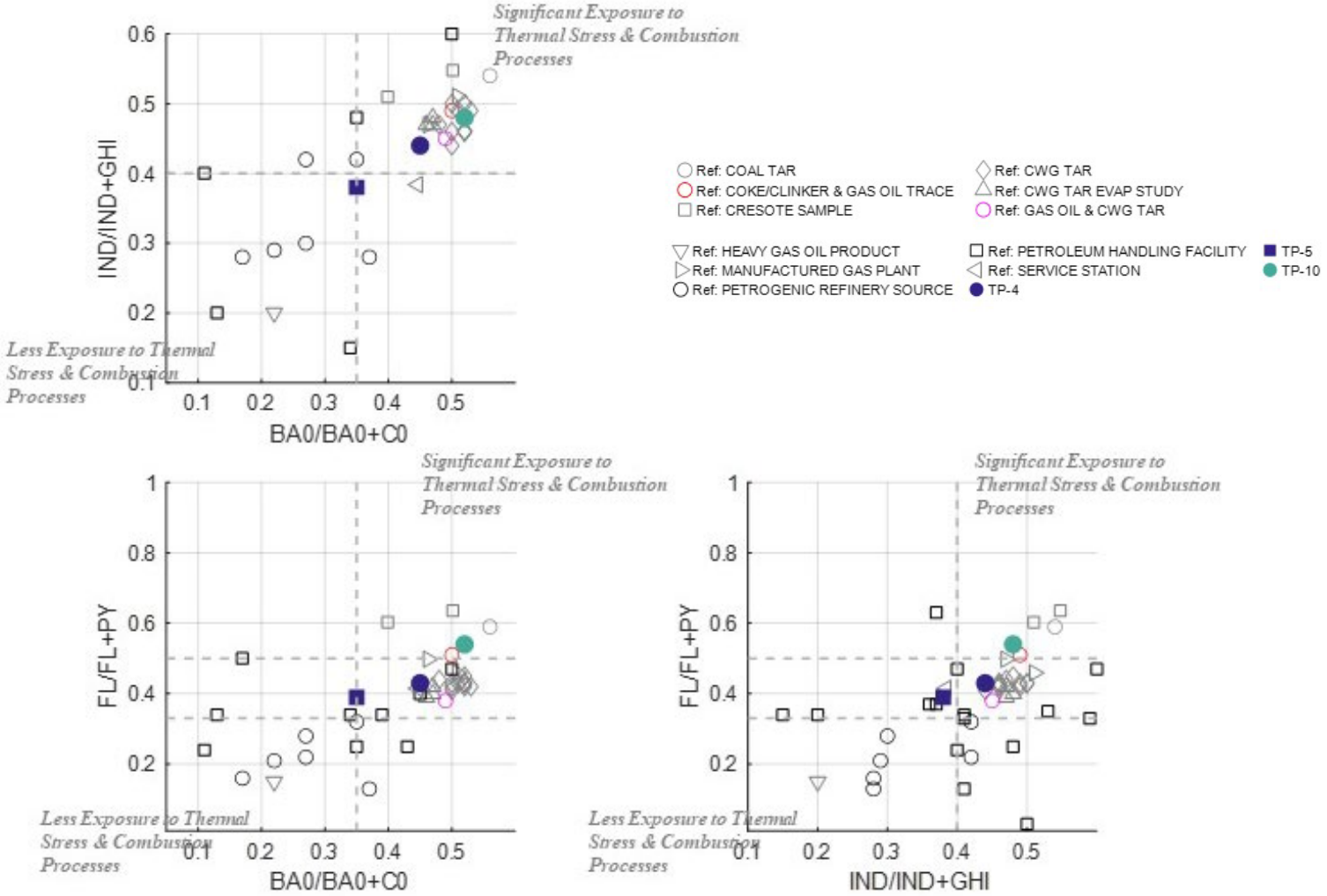


Figure 3. Diagnostic Ratio Plots of High Molecular Weight PAHs - Contextualized with Reference Samples from the Peer-reviewed Literature & CQ Data Archive.

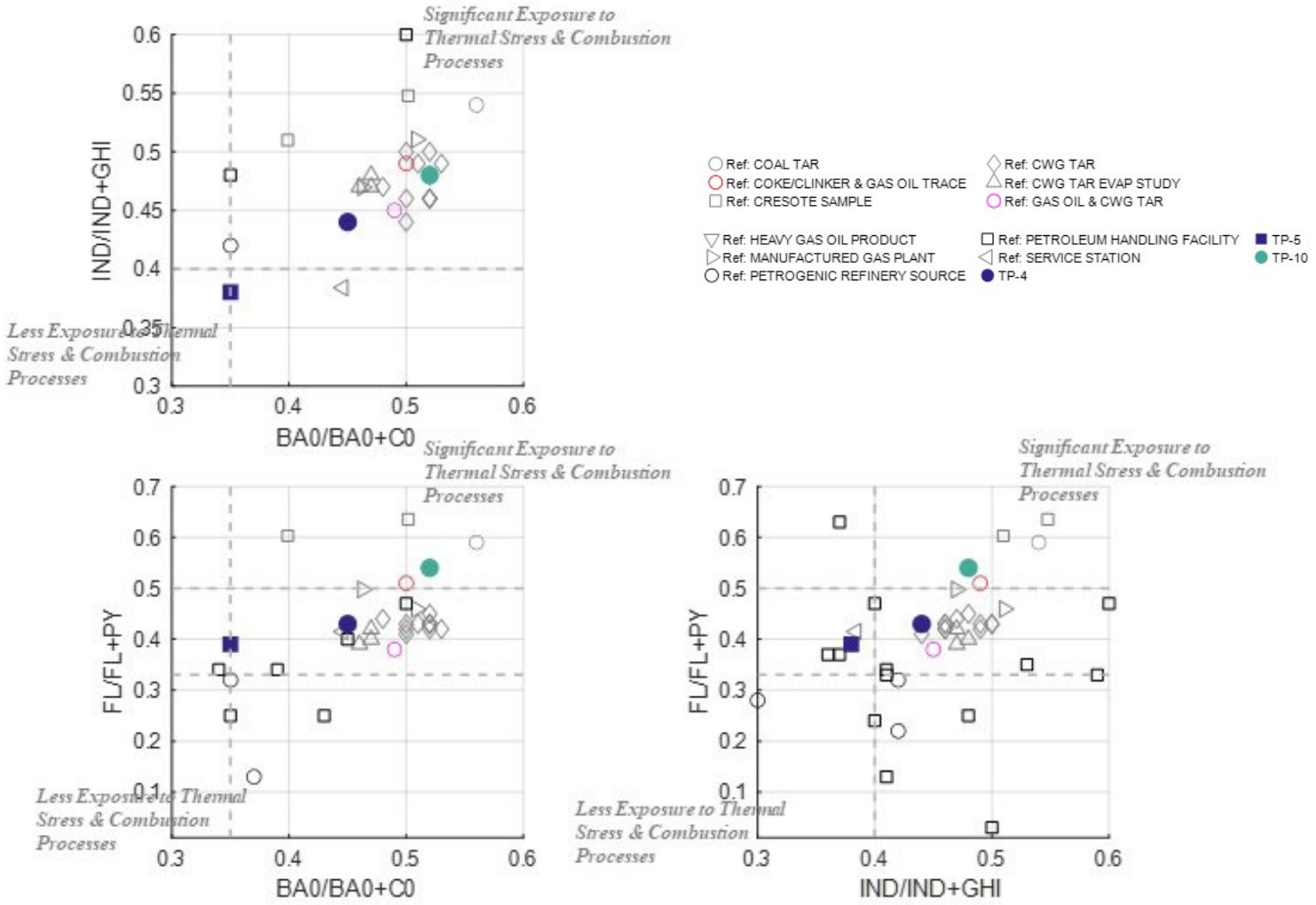


Figure 4. Diagnostic Ratio Plots of High Molecular Weight PAHs (Zoomed) - Contextualized with Reference Samples from the Peer-reviewed Literature & CQ Data Archive.

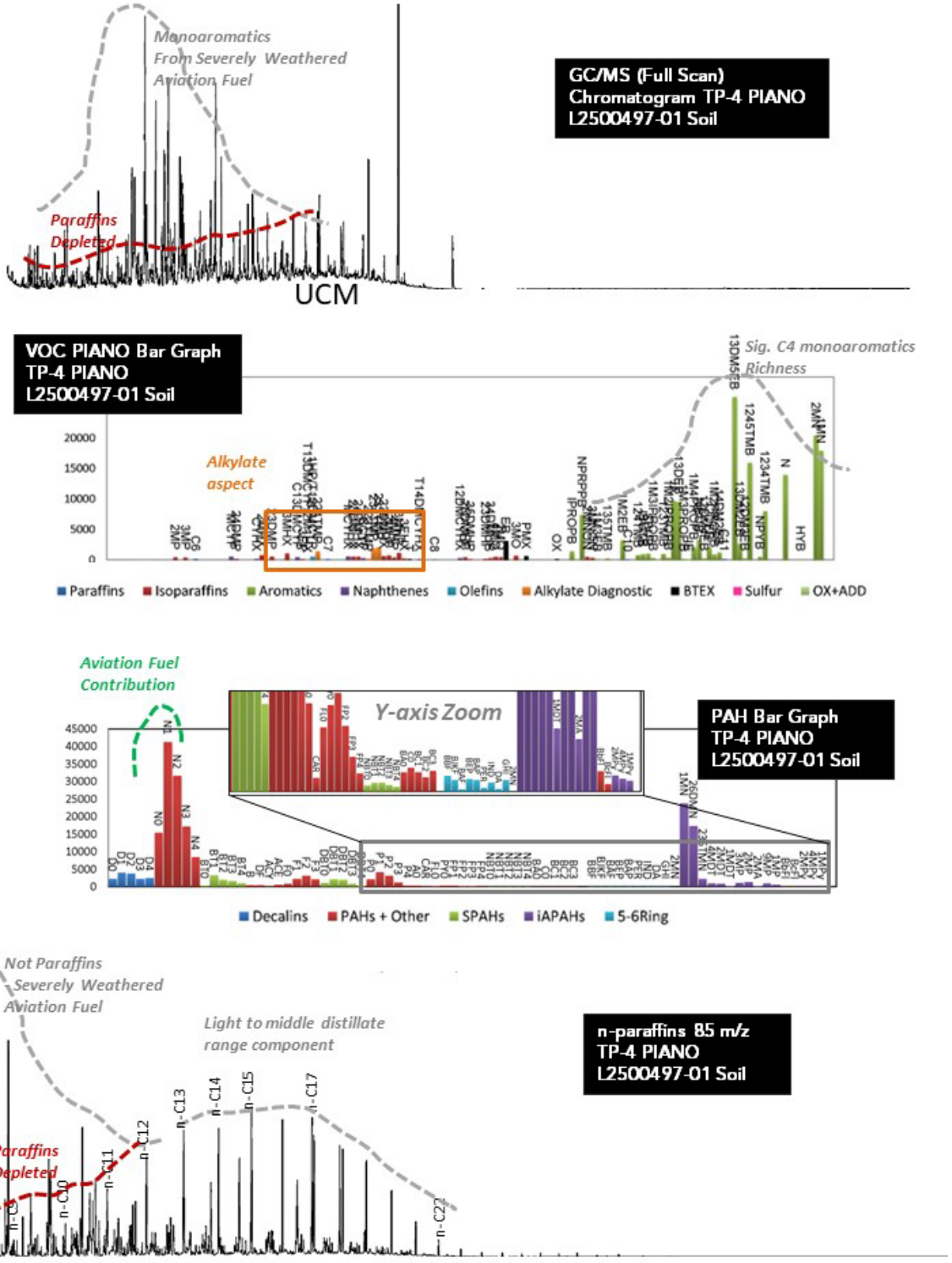


Figure 5. Fingerprint Mosaics – TP-4 PIANO L2500497-01.

ChemQuants, LLC
1320 Arrow Point Drive Ste. 501 #65
Cedar Park, TX 78613
www.ChemQuants.com

Interpreter

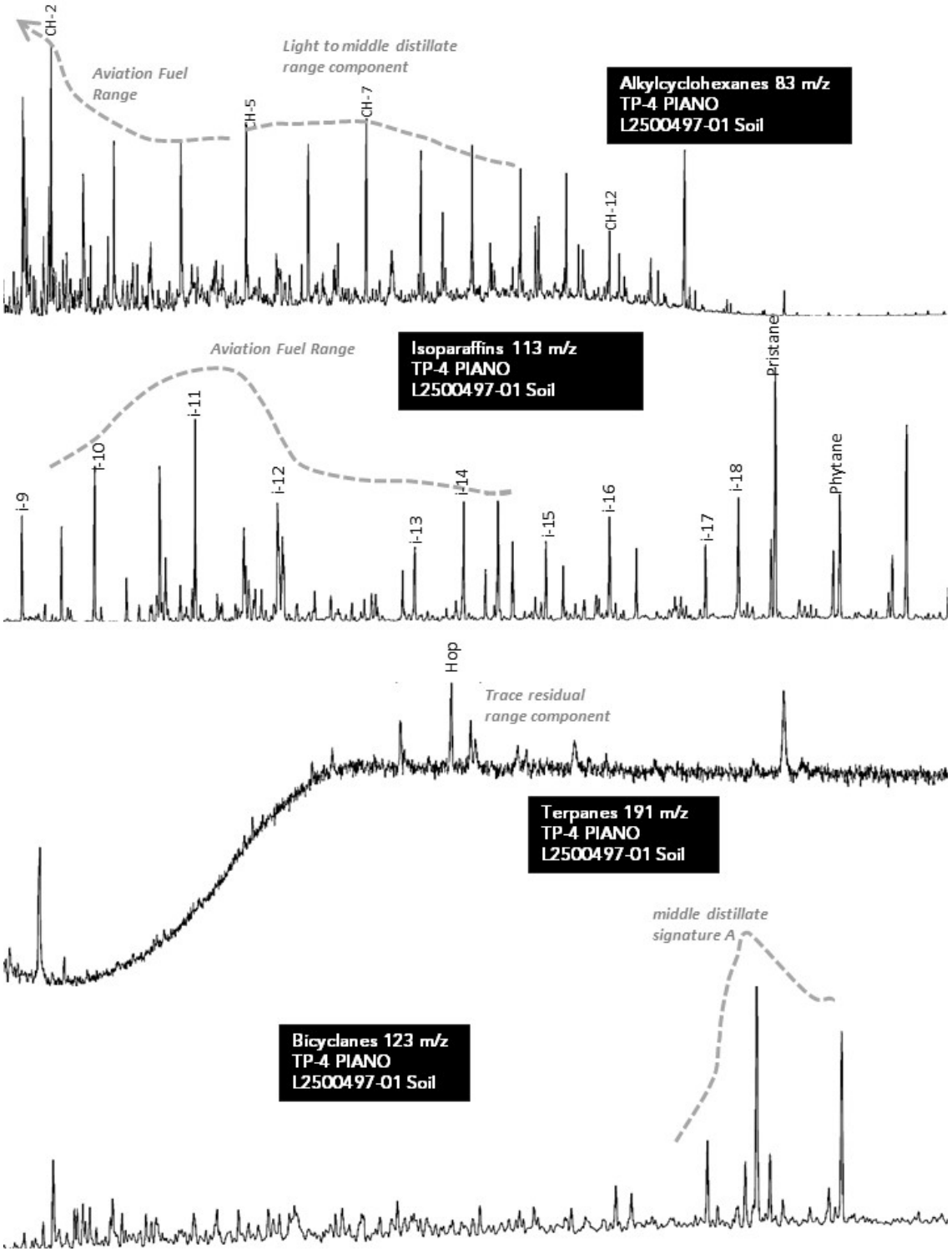


Figure 6. Fingerprint Mosaics – TP-4 PIANO L2500497-01.

ChemQuants, LLC
1320 Arrow Point Drive Ste. 501 #65
Cedar Park, TX 78613
www.ChemQuants.com

Interpreter

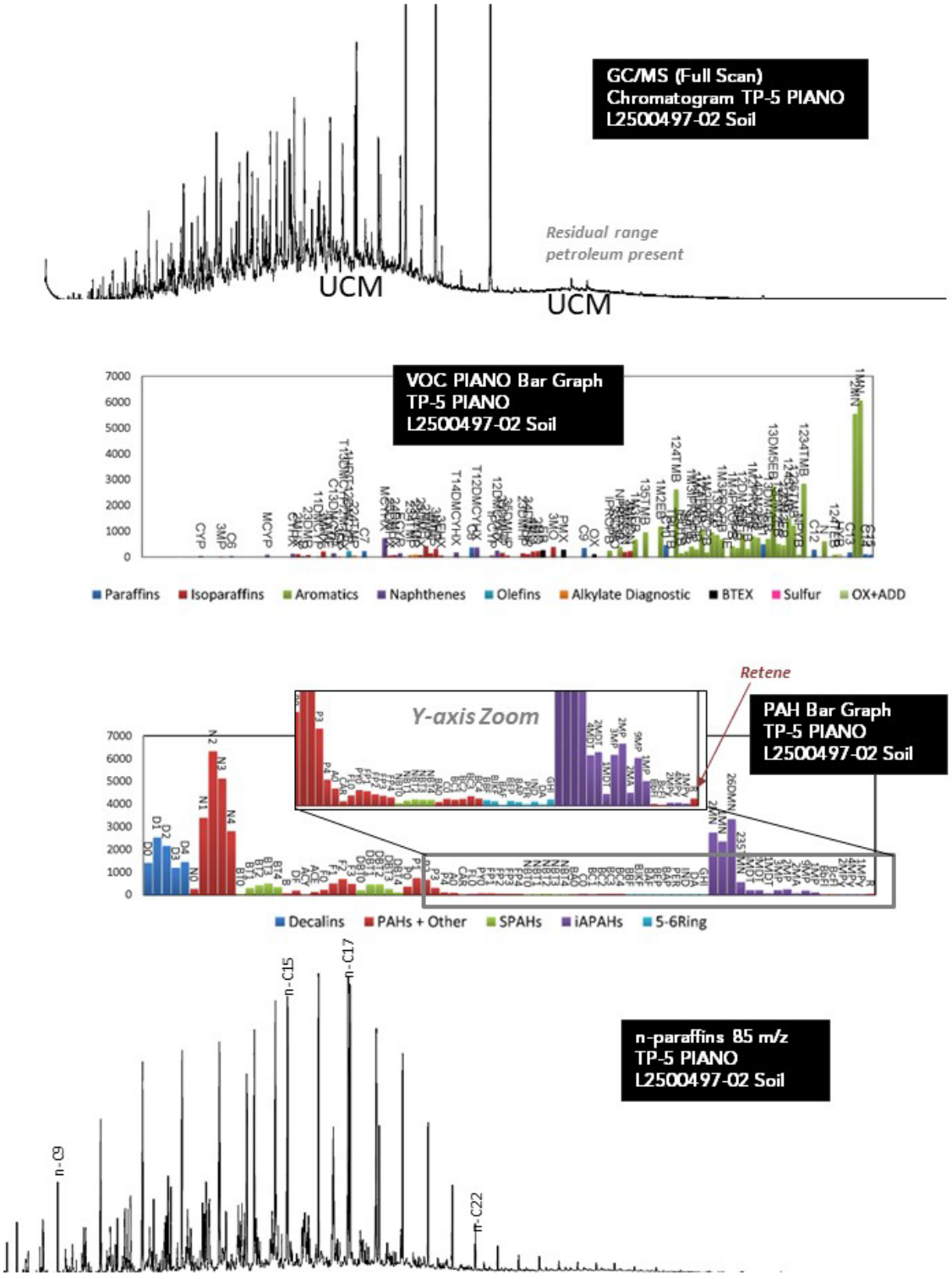


Figure 7. Fingerprint Mosaics – TP-5 PIANO L2500497-02.

ChemQuants, LLC
1320 Arrow Point Drive Ste. 501 #65
Cedar Park, TX 78613
www.ChemQuants.com

Interpreter

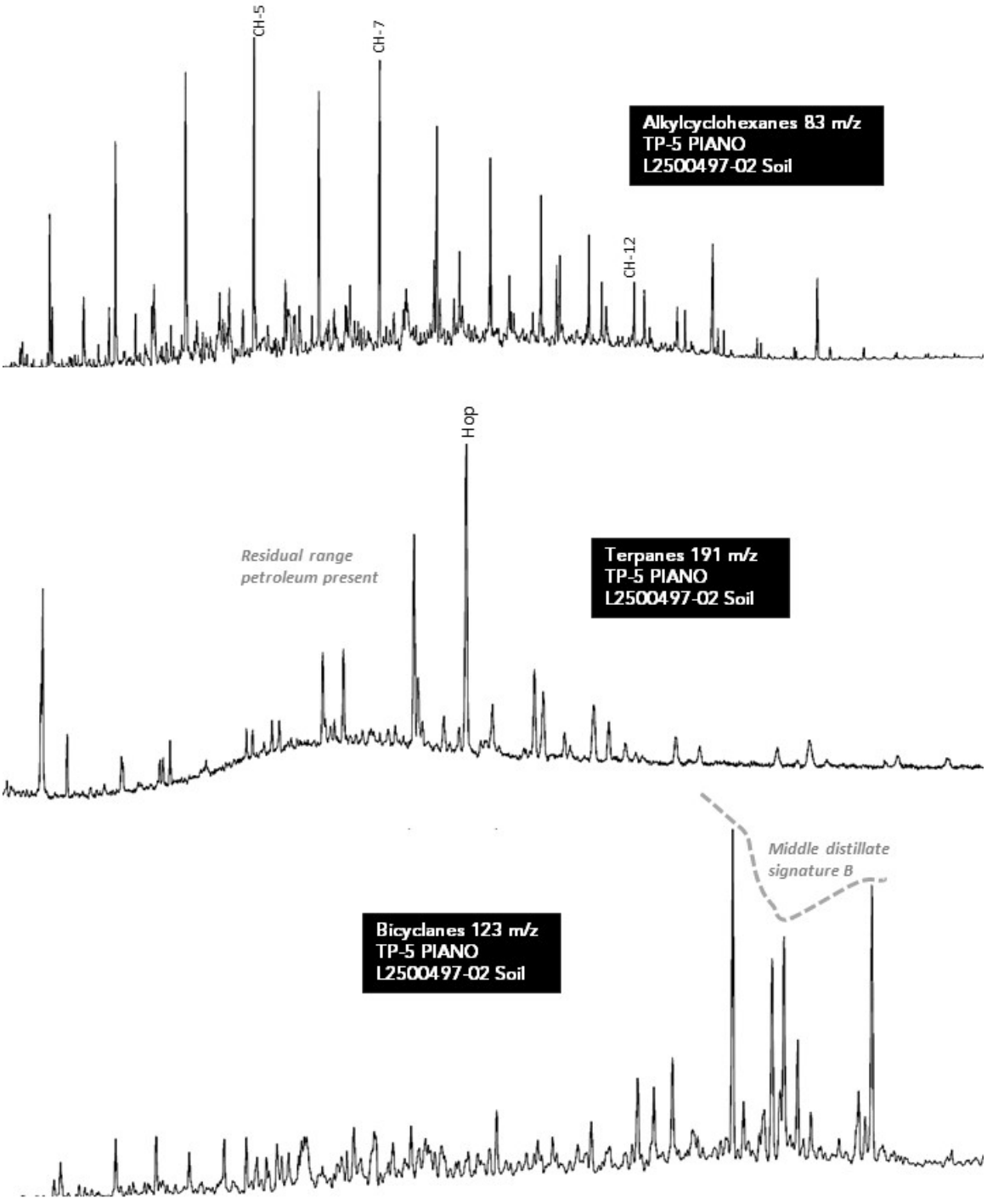


Figure 8. Fingerprint Mosaics – TP-5 PIANO L2500497-02.

ChemQuants, LLC
1320 Arrow Point Drive Ste. 501 #65
Cedar Park, TX 78613
www.ChemQuants.com

Interpreter

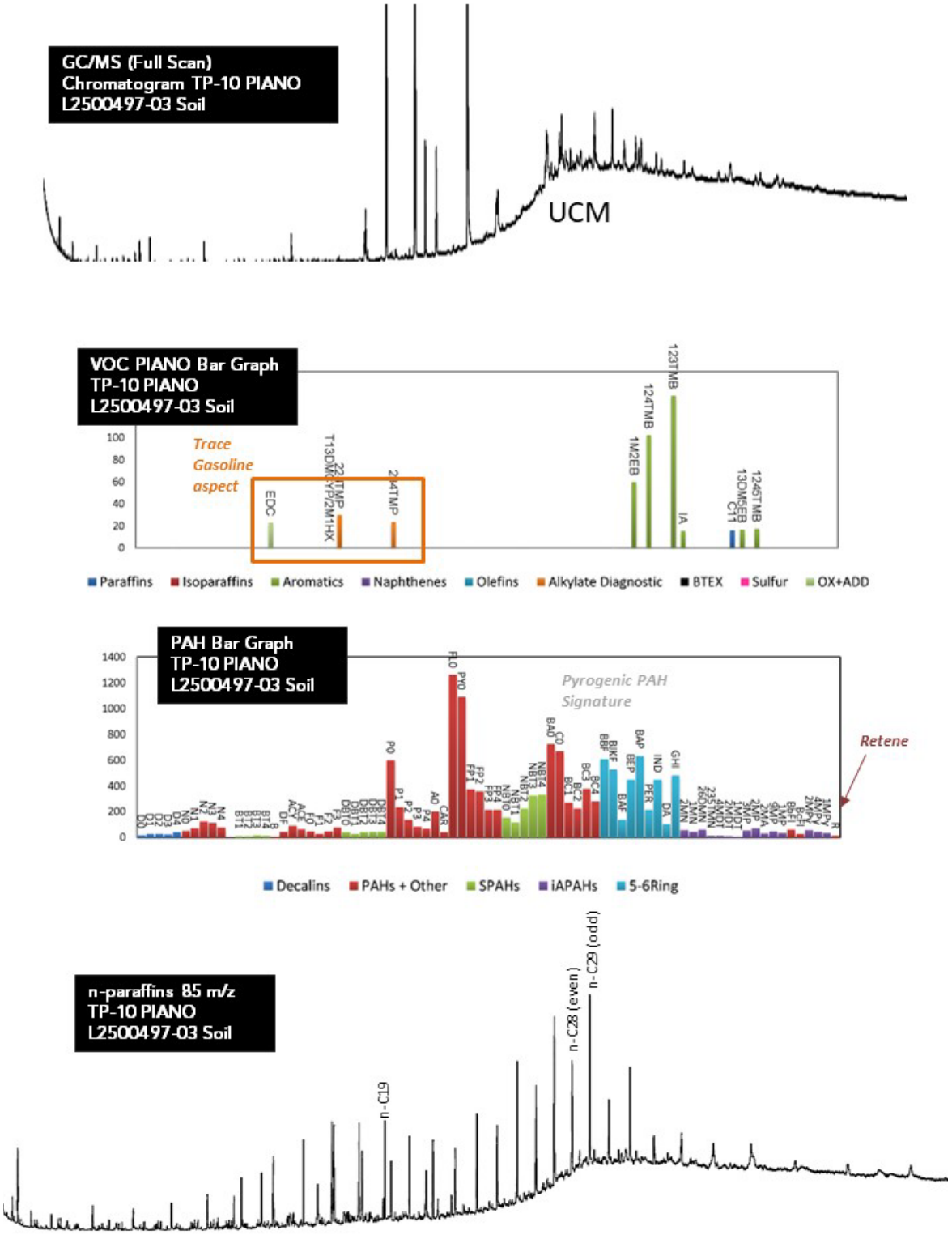


Figure 9. Fingerprint Mosaics – TP-10 PIANO L2500497-03.

ChemQuants, LLC
1320 Arrow Point Drive Ste. 501 #65
Cedar Park, TX 78613
www.ChemQuants.com

Interpreter

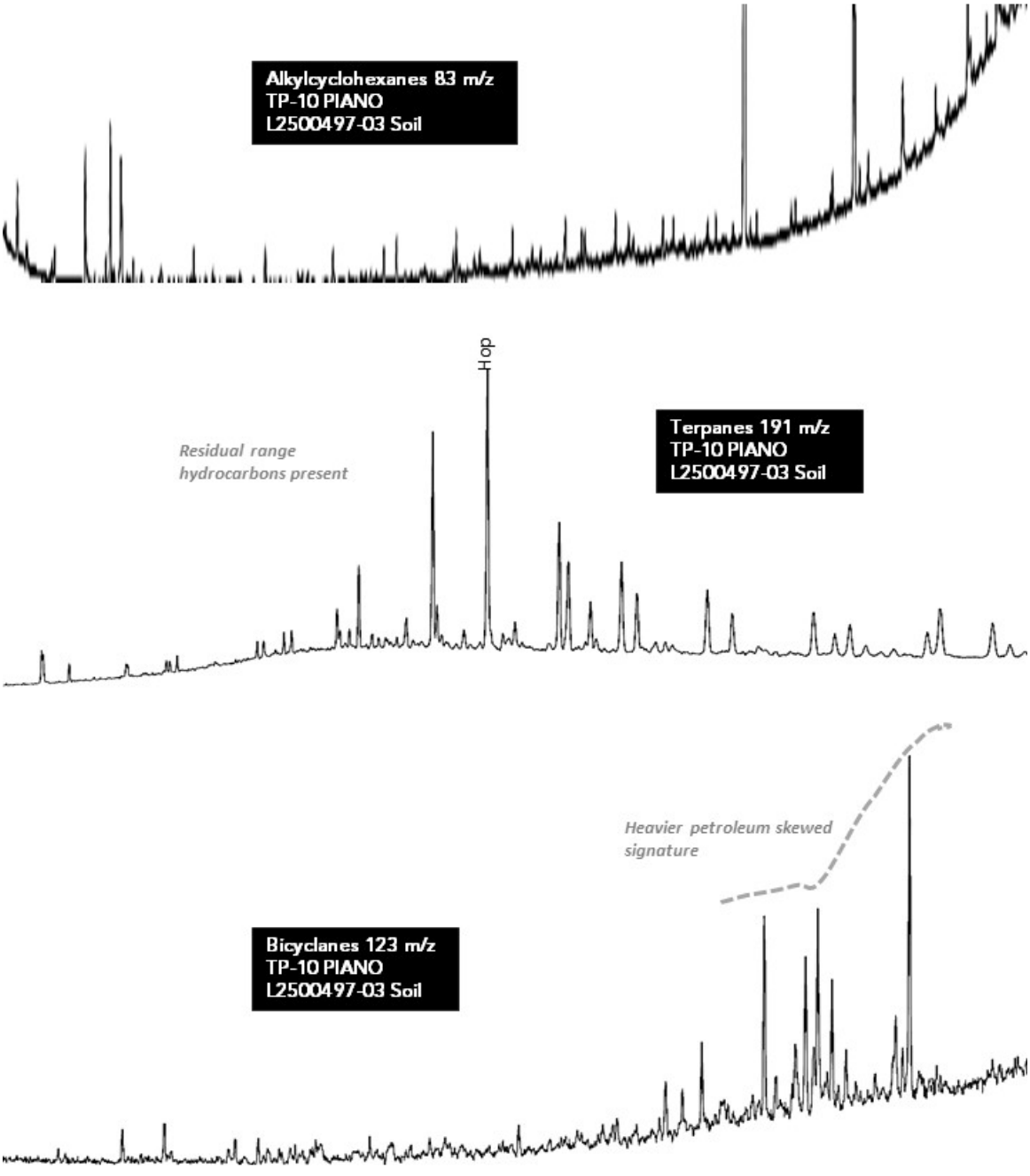


Figure 10. Fingerprint Mosaics – TP-10 PIANO L2500497-03.

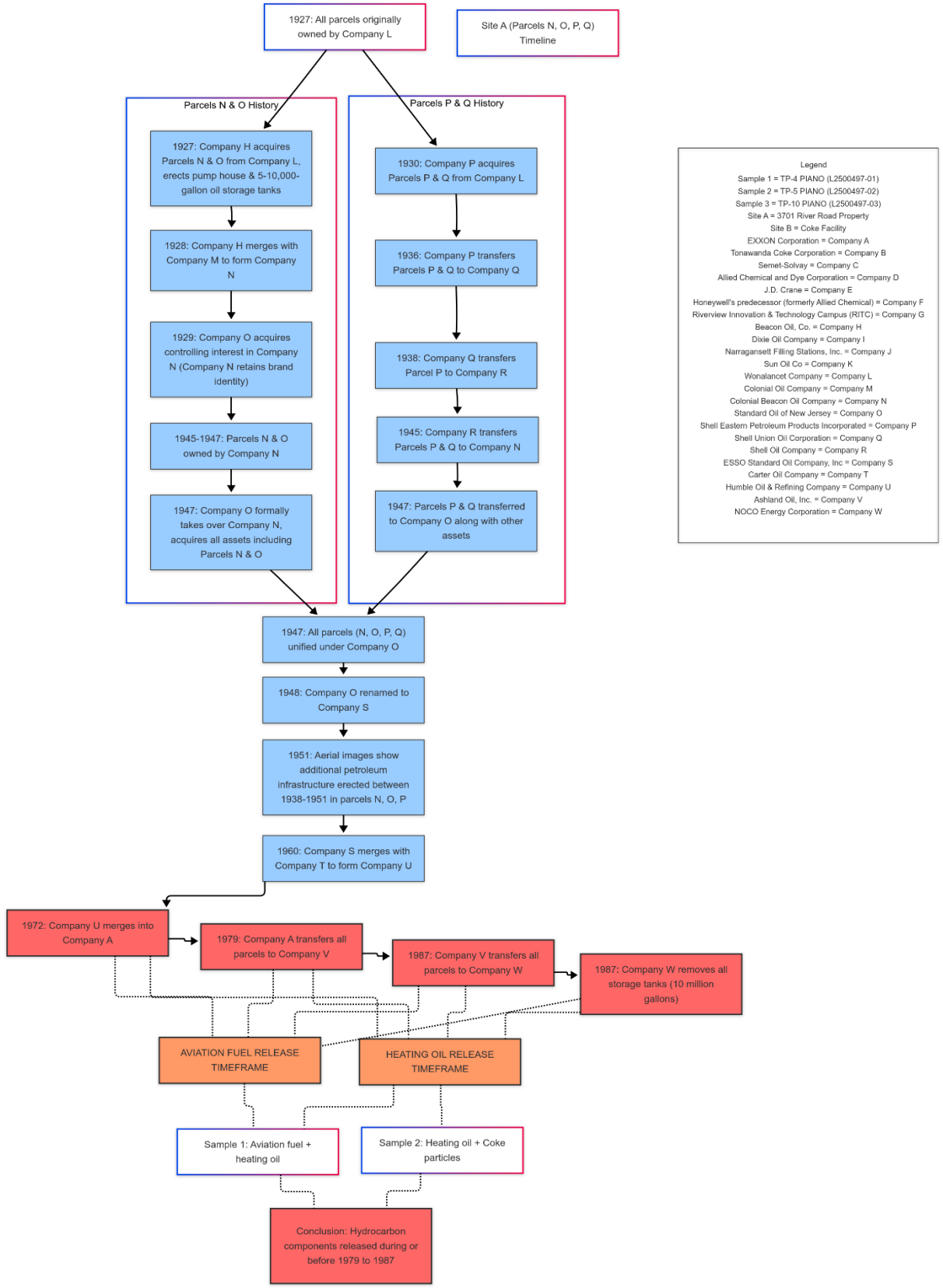


Figure 11. Time line of 3701 River Road and coke facility with forensic evidence analysis.

Appendix A

Historical Site Documents

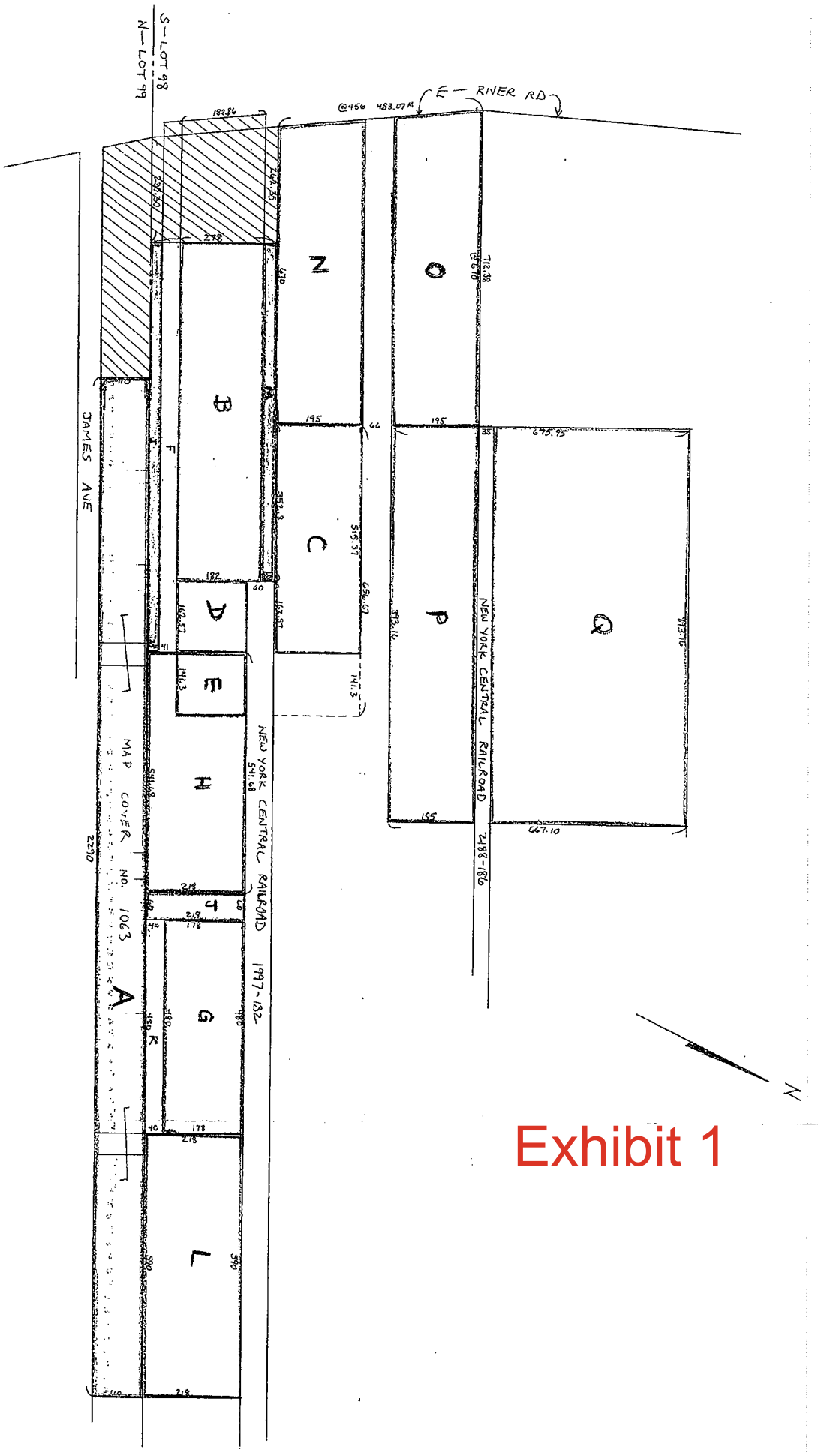

S—LOT 98
N—LOT 99
E—RIVER RD
@450
458.07M
182.86
244.35
238.30
278
N
O
B
C
P
Q
A
E
H
G
L
JAMES AVE
NEW YORK CENTRAL RAILROAD
NEW YORK CENTRAL RAILROAD 1997-132
MAP COVER NO. 1063
712.38
675.95
647.10
2188-186
2290
195
182
162.57
141.3
511.68
218
178
180
590
60
40
N

Exhibit 1

3679 River Road

3679 River Road

Tonawanda, NY 14150

Inquiry Number: 7522356.8

December 15, 2023

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

12/15/23

Site Name:

3679 River Road
3679 River Road
Tonawanda, NY 14150
EDR Inquiry # 7522356.8

Client Name:

Roux Associates Inc.
2558 Hamburg Turnpike Suite 300
Buffalo, NY 14218
Contact: Nick Suraci

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Search Results:

Year	Scale	Details	Source
2019	1"=500'	Flight Year: 2019	USDA/NAIP
2015	1"=500'	Flight Year: 2015	USDA/NAIP
2011	1"=500'	Flight Year: 2011	USDA/NAIP
2008	1"=500'	Flight Year: 2008	USDA/NAIP
1995	1"=500'	Acquisition Date: March 28, 1995	USGS/DOQQ
1985	1"=500'	Flight Date: May 03, 1985	USDA
1983	1"=500'	Flight Date: March 17, 1983	USDA
1978	1"=500'	Flight Date: October 31, 1978	USDA
1970	1"=500'	Flight Date: June 23, 1970	USGS
1966	1"=500'	Flight Date: June 12, 1966	USDA
1962	1"=500'	Flight Date: November 26, 1962	USGS
1959	1"=500'	Flight Date: May 08, 1959	USDA
1951	1"=500'	Flight Date: October 14, 1951	USDA
1938	1"=500'	Flight Date: August 03, 1938	USDA

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Exhibit 2
INQUIRY #: 7522356.8
YEAR: 2019
= 500'
N
EDR



INQUIRY #: 7522356.8

YEAR: 2015

= 500'

N

EDR


Exhibit 4
INQUIRY #: 7522356.8
YEAR: 2011
= 500'
N
EDR


Exhibit 5
INQUIRY #: 7522356.8
YEAR: 2008
= 500'
N
EDR



INQUIRY #: 7522356.8

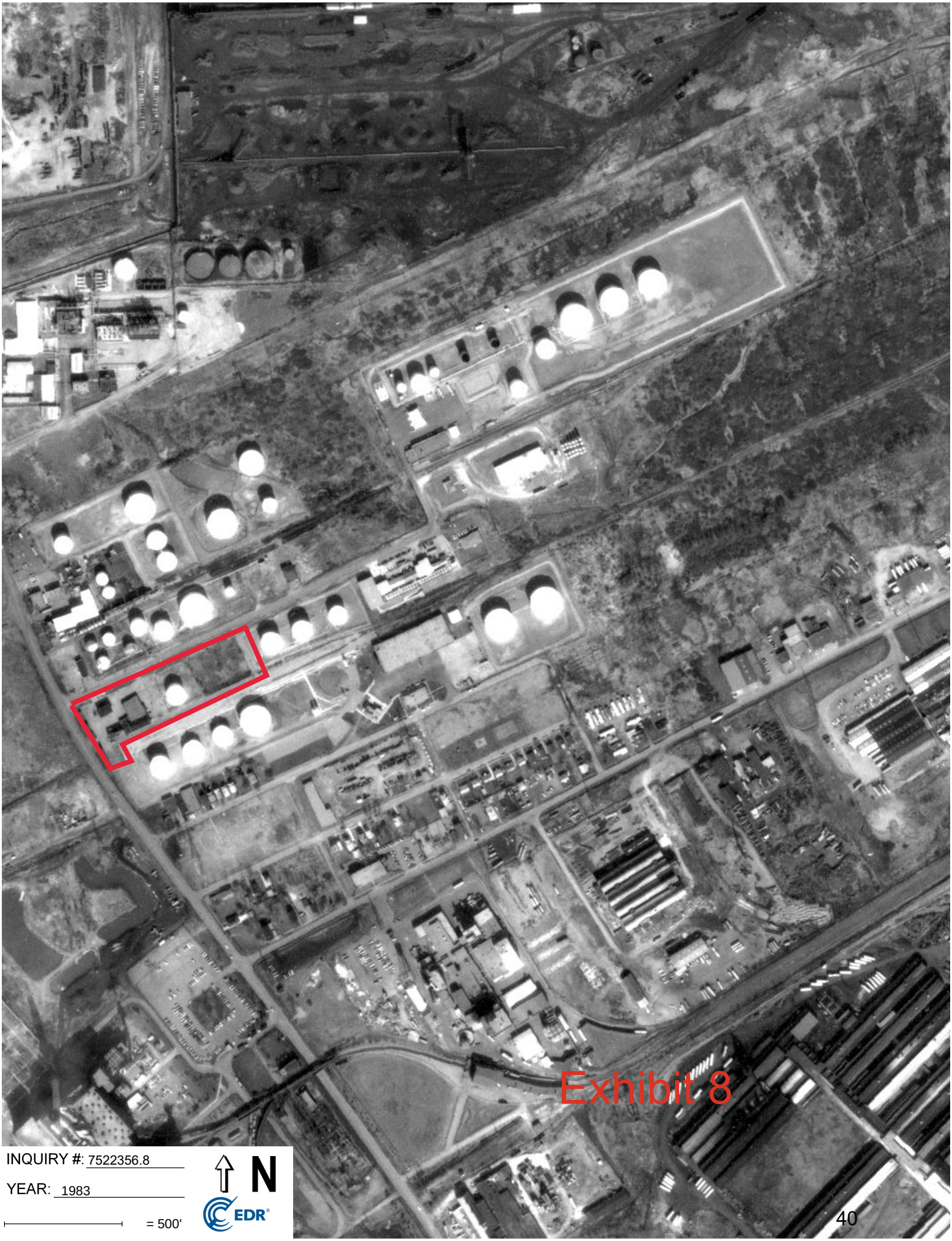
YEAR: 1995

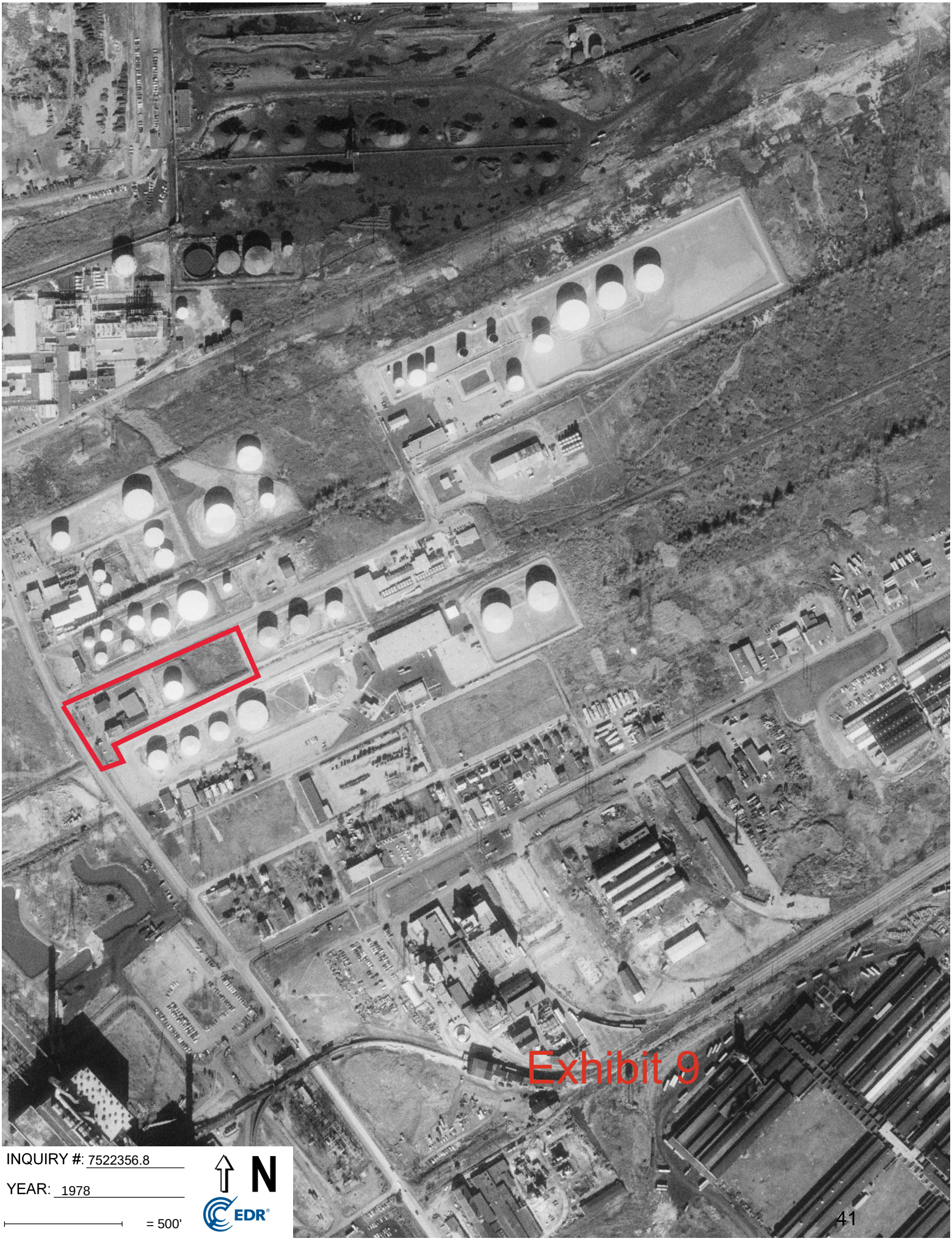
= 500'

N

EDR


Exhibit 7
INQUIRY #: 7522356.8
YEAR: 1985
= 500'
N
EDR


Exhibit 8
INQUIRY #: 7522356.8
YEAR: 1983
= 500'
N
EDR


Exhibit 9
INQUIRY #: 7522356.8
YEAR: 1978
= 500'
N
EDR



INQUIRY #: 7522356.8

YEAR: 1970

= 500'

N

EDR



INQUIRY #: 7522356.8

YEAR: 1966

= 500'

N

EDR



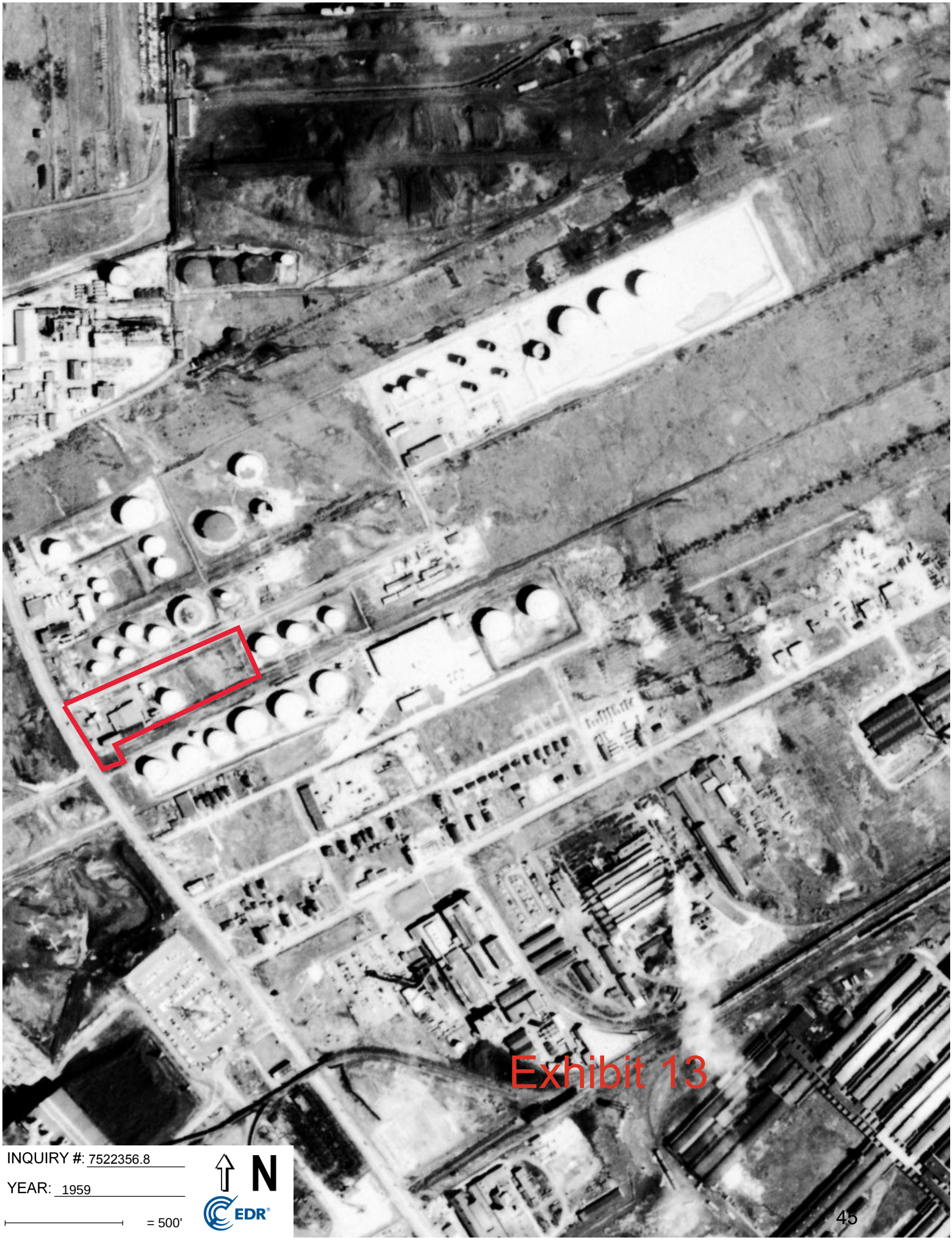
INQUIRY #: 7522356.8

YEAR: 1962

= 500'

N

EDR



INQUIRY #: 7522356.8

YEAR: 1959

= 500'

N

EDR



Exhibit 14

INQUIRY #: 7522356.8

YEAR: 1951

= 500'

N

EDR



INQUIRY #: 7522356.8

YEAR: 1938

= 500'

N

EDR

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NOTE
AGREEMENT FOR DOCKING FACILITIES RECORDED IN LIBER 5592, PAGE 209.

NORTH

ERIE COUNTY WATER AUTHORITY
(REPUTED OWNER)

11 PIPES UNDER COCK

20' WIDE EASEMENT RECORDED UNDER LIBER 2146 PAGE 299

0' WIDE EASEMENT RECORDED UNDER LIBER 2145, PAGE 275

LICENSE IN COMMON WITH OTHERS GRANTED BY NIAGARA MOHAWK POWER CORP FOR ROADWAY PURPOSES BY LETTER OF AGREEMENT DATED MARCH, 6, 1958

EASEMENT IN COMMON WITH OTHERS GRANTED BY THE COUNTY OF ERIE FOR ROADWAY PURPOSES PER AGREEMENT DATED MAY 22, 1958

SOUTHERLY LINE OF LANDS CONVEYED TO ALLIED CHEMICAL & TYE CORPORATION UNDER LIBER 4349, PAGE 146

NORTHERLY LINE OF LANDS CONVEYED UNDER LIBER 5188, PAGE 519, 158.88 DEED & MEAS.

FENCE 5.95 NORTH

FENCE 4.64 NORTH

PARCEL "D"
AREA = 3.693±ACRES

GRAVEL
TOP OF BANK
BOTTOM OF BANK
2-8" PIPES
OVERHEAD WIRES (1)
TOP OF BANK
GRAVEL
DRIVE
937.85 DEED & MEAS.
METAL PIPE CARRIERS (ABANDONED) 498.97

SOUTHERLY LINE OF LANDS CONVEYED UNDER LIBER 5188, PAGE 519

NORTHERLY LINE OF LANDS CONVEYED TO BEACON OIL COMPANY UNDER LIBER 1912, PAGE 464.

15.0' WIDE EASEMENT FOR ELECTRICAL TRANSMISSION LINES, RECORDED UNDER LIBER 2088, PAGE 381.

15.0' WIDE EASEMENT FOR GAS TRANSMISSION LINE RECORDED UNDER LIBER 3304, PAGE 334.

5 ABANDONED PIPES NORTH OF CATWALK
7 METAL CATWALK
4 ABANDONED PIPES SOUTH OF CATWALK
OLD WOODEN DOCKS
6.0' WIDE EASEMENT RECORDED UNDER LIBER 2162, PAGE 375
EDGE OF WATER

PARALLEL WITH THE SOUTH LINE OF LOT 98

MID RIVER MARINA, INC
(REPUTED OWNER)

15' WIDE PARCEL CONVEYED TO COLONIAL BEACON OIL COMPANY UNDER LIBER 2110 PAGE 314 PARCEL "B"

15' WIDE PARCEL CONVEYED TO COLONIAL BEACON OIL COMPANY UNDER LIBER 2110 PAGE 314 PARCEL "A"

NIAGARA RIVER
UNITED STATES HARBOR LINE

WESTERLY LINE OF LANDS CONVEYED TO SUN OIL COMPANY UNDER LIBER 5188, PAGE 519

CENTERLINE OF CHANNEL

LANDS CONVEYED TO THE NIAGARA MOHAWK POWER CORPORATION UNDER LIBER 2146, PAGE 299

LANDS IN CORPORATION (REPUTED OWNER)

NEW YORK STATE BLUE LINE

ELECTRIC CORPORATION

ROAD

FORMER WESTERLY HIGHWAY BOUNDARY AS A 66.0' R.O.W.

10' WIDE EASEMENT RECORDED UNDER LIBER 4862, PAGE 182 PARCEL "E"

SUN REFINING & MARKETING CO.

SOUTHERLY LINE OF LANDS CONVEYED UNDER LIBER 2028, PAGE 590

NORTHERLY LINE OF LANDS CONVEYED UNDER LIBER 1912, PAGE 464

ASPHALT DRIVE

CONC BLDG

TRUCK WASH

46.83 DIAM VAPOR

49.78 DIAM AVIATION FUEL

60' DIAM EXTRA

49.75 DIAM AVIATION FUEL

49.75 DIAM.

73.42 DIAM UNLEADED

120' DIAM EXXON

AREA = 3.153±ACRES

PARCEL "A"

PRIVATE ROAD

CONC ISLANDS CONC PAD

GAS LOADING DOCK

LIGHT POLE

CONC BLK BLDG.

27
73.39 DIAM. HEATING OIL

PARCEL "A"
AREA = 3.045±ACRES

BR & FR BLDG.

PARCEL "B"
AREA = 0.077±ACRES

FENCE ON LINE
LANDS CONVEYED UNDER LIBER 7091, PAGE 13.

PIPE LINE ASEMENT AGREEMENT

FOUND 1" CORNER IRON PIPE

FENCE 1.40 EAST 1.70 NORTH

15.0' WIDE PARCEL CONVEYED UNDER LIBER 1912, PAGE 464

2' WIDE RESERVATION FOR PIPELINE EASEMENT AGREEMENT RECORDED IN LIBER 7098, PAGE 13

NOCO ENERGY CORP
(REPUTED OWNER)

PARALLEL WITH THE SOUTH LINE OF LOT 98

SOUTHERLY LINE OF LANDS CONVEYED UNDER LIBER 1912, PAGE 464.

SOUTHERLY LINE OF LOT 98, OF THE NEW YORK STATE RESERVATION

ERIE COUNTY INDUSTRIAL DEVELOPMENT ASSOCIATION
(REPUTED OWNER)

NORTHEASTERLY CORNER OF LIBER 2028, PAGE 590

PARALLEL WITH & 282' SOUTHERLY FROM THE NORTHERLY LINE OF LOT 98, OF THE NEW YORK STATE RESERVATION.

EASTERLY LINE OF LANDS CONVEYED TO SUN OIL COMPANY UNDER LIBER 2028, PAGE 590

FOUND IRON PIPE
FENCE ON LINE
893.33
FOUND IRON PIPE
FENCE ON LINE 0.65 EAST

30
100' DIAM. KEROSENE

28
118 DIAM. HEATING OIL

29
80' DIAM DIESEL OIL

PARCEL "C"
AREA = 9.017±ACRES

PIPE LINE AGREEMENT BETWEEN ATLANTIC REFINING CO. AND ESSO STANDARD OIL CO. RECORDED IN LIBER 3304, PAGE 334

EXXON CORPORATION
(REPUTED OWNER)

LANDS CONVEYED TO NEW YORK CENTRAL RAILROAD

OVERHEAD WIRE (1)

METAL SHED

METAL BLDG.

31
30' DIAM. AVIATION FUEL

CONC BLOCK BLDG.

PARCEL "C"
AREA = 4.001±ACRES

ASHLAND OIL
(REPUTED OWNER)

FENCE 1.10 NORTH

OVERHEAD WIRES (4)

FOUND 3" EDGE FILLED IRON PIPE

ROAD

ERIE COUNTY INDUSTRIAL DEVELOPMENT AGENCY
(REPUTED OWNER)

9' WIDE EASEMENT GRANTED TO ATLANTIC REFINING CO

NOCO ENERGY CORP
(REPUTED OWNER)

CHEMCENTRAL CORP
(REPUTED OWNER)

NOTE
RESERVATIONS OF RIGHT OF WAY & EASEMENT TO BUILD OR CONSTRUCT RAILROAD TRACKS AND PIPELINES RECORDED IN LIBER 1912, PAGE 464.

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James Ave

AGREEMENT FOR 15' WIDE STRIP OF LAND FOR "FREE BLOW" PIPELINE RECORDED IN LIBER 3516, PAGE 572

6' WIDE EASEMENT RECORDED UNDER LIBER 2162, PAGE 375

NIAGARA POWER 230 KV HIGH TENSION WIRES

ERIE NOW ABANDONED & FILLED CANAL

NIAGARA MOHAWK POWER CORP

BUFFALO RIVER

NIAGARA (INTERNATIONAL BOUNDARY LINE 1275 SOUTH)

Exhibit 16

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NOTE
PARCEL
"A" "B" "C" & "D"
PARCEL DESIGNATIONS
REFERENCED TO TITLE
REPORT Nº B-83347

AREA
PARCEL "A" 6.198 ACRES
PARCEL "B" 0.077 ACRES
PARCEL "C" 13.018 ACRES
PARCEL "D" 3.693 ACRES

I HEREBY CERTIFY TO:
TICOR TITLE GUARANTEE COMPANY
THAT THIS SURVEY WAS PREPARED IN ACCORDANCE WITH THE CURRENT CODE OF PRACTICE FOR LAND SURVEYS ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS AND AS AMENDED BY THE NIAGARA FRONTIER LAND SURVEYORS AND THAT THE SURVEY SHOWN HEREON WAS MADE ON THE GROUND UNDER MY DIRECT SUPERVISION AND CONTROL AND THAT IT CORRECTLY SHOWS THE RESULTS OF SAID SURVEY MADE BY ME OR UNDER MY DIRECTION AND THAT THIS SURVEY HAS BEEN KEPT CURRENT AND UP TO DATE AS REQUIRED BY THE SURVEYOR.

DATE OF INITIAL SURVEY DECEMBER 8, 1986

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FOR TRANSFER OF TITLE, MORT-
GAGE PURPOSES OR BUILDING
PERMITS

REVISED JAN 21, 1987 ADDED EASEMENTS & TITLE DATA
CERTIFIED DECEMBER 23, 1986
RESURVEYED DECEMBER 8, 1986 CH
ADDED DEED INFORMATION FOR PARCELS "C" & "D", ALSO DIMENSIONS, SEPT. 28, 1979
ADDED REMAINING INTERIOR ANGLES AND DIMENSIONS, AUG. 2, 1979
ADDED ADJACENT PROPERTY OWNERS NAMES, JULY, 20, 1979

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SINCE THE ORIGINAL SURVEY,
THIS PRINT CANNOT BE USED
FOR TRANSFER OF TITLE, MORT-
GAGE PURPOSES OR BUILDING
PERMITS

SURVEY of PART OF LOT 98 OF THE NEW YORK STATE RESERVATION

TOWN OF TONAWANDA, ERIE COUNTY, NEW YORK STATE.

KREHBIEL ASSOCIATES
ENGINEERS - SURVEYORS
1868 NIAGARA FALLS BLVD., TONAWANDA, N.Y. 14150

DWG NO. B-941
FB
SCALE 1"=100'
DATE 8/8/79

B&B-16

COMPARABLE PROPERTY SALE NO._____

ADDRESS: 3701 River Road

PROPERTY TYPE: Petroleum Terminal

Exhibit 17

7

SALE PRICE: 218,293 6 DATE: 3-18-87

GRANTOR: Ashland Oil, Inc.

GRANTEE: Noco Energy Corp.

LIBER: 9690 PAGE: 283

LOT SIZE: 19.2± Acres ZONING: G-I General Industrial

Barrel Capacity:
~~GROSS BUILDING AREA:~~ 348,000 NET BUILDING AREA:

BUILDING AGE: 50-30 CONDITION: Fair

DESCRIPTION: The sale is a petroleum terminal with a 348,000 barrel capacity. The tanks range from poor to avg. condition. The facility does not have vapor recovery or bottom loading system. The property has rail access. The sale also included 1/5 interest to a dock on the River. The dock is in fair condition.

~~SALE PRICE PER SQ. FT. OF BUILDING:~~

SALE PRICE PER BARREL: .63

SREA MEMBER #117

1 - 3½ Hr. Gal. 21,000
9,500
1 - 1½ "
30,500
6
18,300
16 "
34,500

5/19/09
1970 #42059
1972

185,000
"

3-21-73 Fire Damage $500.
(Rock & wood shingle roof)

55698 10-19-87 $30,000 Removal of 11 Tanks
(Total gallonage approx. 10 million)

1989 # [illegible]

59547 1-30-92 $1,845 Remove (1) Tank 1000gal Heating oil

12/12/95 $300,000 Ent. Alterations to warehouse Canopy 25x70 Addition

1995 L-200,000 T-230,000

1996	REVIEW	260,000
2004	BAR N/C	330,400
2006		300,000
2011	BAR NE	300,000
2012	BAR N/C	300,000

9/30/96 $500 above ground 1000gal propane tank

BP2002-590 8/22/02 $10,000
Communication Tower
BP2004-709 9/27/04 $20,000
Demo 2 story bldg

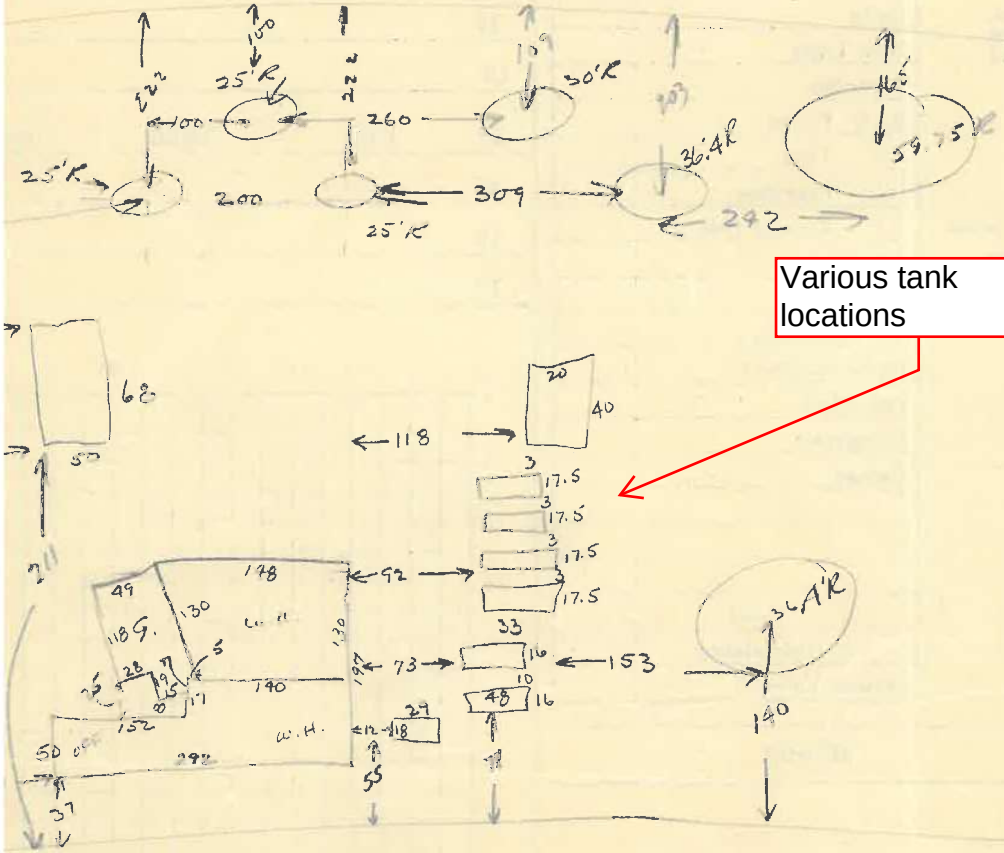


Exhibit 18

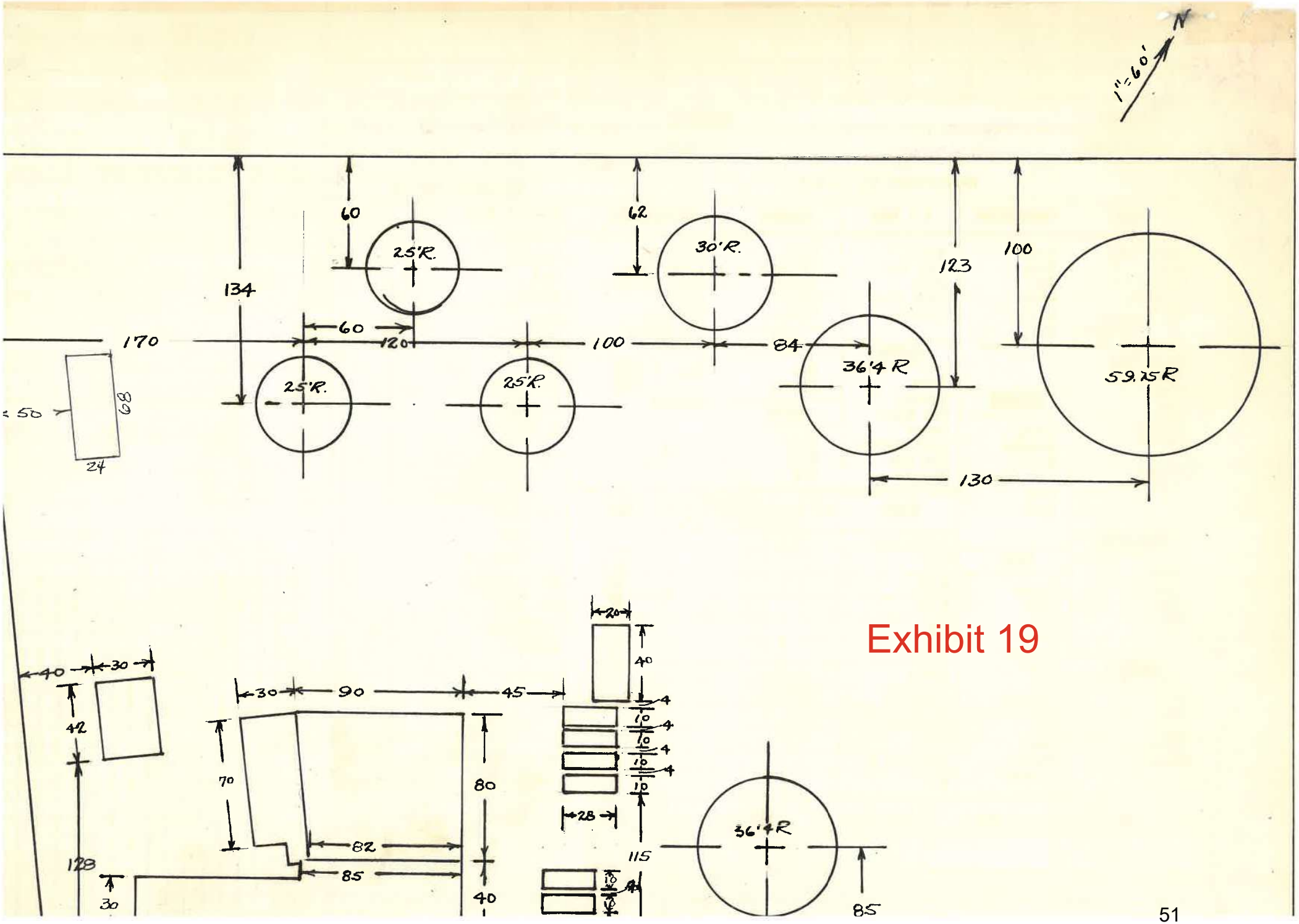

1"=60'
N
60
62
134
123
100
170
60
120
100
84
130
25'R.
25'R.
25'R.
30'R.
36'4 R
59.25R
50
68
24
40
30
42
128
30
30
90
45
70
80
82
85
40
20
40
4
10
4
10
4
10
4
10
28
115
36'4R
85

Exhibit 19

55698

BUILDING PERMIT

imated Cost ....$30,000.00..... Town of Tonawanda, N. Y. ...October 19, 1987.....

Permission is hereby granted to.....Noco Energy Corp.....to erect a.....Removal of 11 Tanks (total gallonage approx. 10 million)

e constructed of.....to be located.....feet from one side Lot line as per plot plan.

not less than.....feet from the other side Lot line, and to be occupied by.....famil.....to be located on the.....of Storage Terminal

No. 64.12-1-15.....on the.....side of River Rd.....

se No. 3701 .....feet from.....Lot line, completed building to be.....feet wide, ...feet long, ...feet h, in accordance with plans and specifications submitted and all driveways must be on the same side of house in the same ck; see Zoning Ordinance for regulations.

All trenches for sewer connections shall remain open until approved by Town Plumbing Inspector.

All water connections to main lines shall be made by the Water Department. Any water fee paid is for construction purpose only.

Water shut-off boxes shall be placed at curb or where directed by the Superintendent of Water Department.

This permit is granted on the express condition that the owner or his agent shall in all respects conform to the Zoning Ordinance and Building Code, Plumbing Code and Water Ordinance of the Town of Tonawanda, relating to the construction of buildings and may be revoked at any time upon the violation of any of the provisions of said Zoning Ordinance and Building Code, Plumbing Code and Water Ordinance, or the above named plans and specifications.

No building materials can be placed on street without permission of Supervising Building Official.

Supervising Building Official to be notified when foundation is completed, fire stops are in, chimneys completed and all pipes installed. Certificate must be issued by Supervising Building Official before concealing same.

Permit Fee.....$140.00..... By Order of Town Board,

Water Fee..... Signed .....
Supervising Building Official

Remarks .....

.....

ck Telephone, Power and Gas Companies before using this permit. If there is any chance of a conflict in locations, ask utility involved for an inspector to be on the job.

Exhibit 20

LOADING RACK AND TANKS TO BE DEMOLISHED

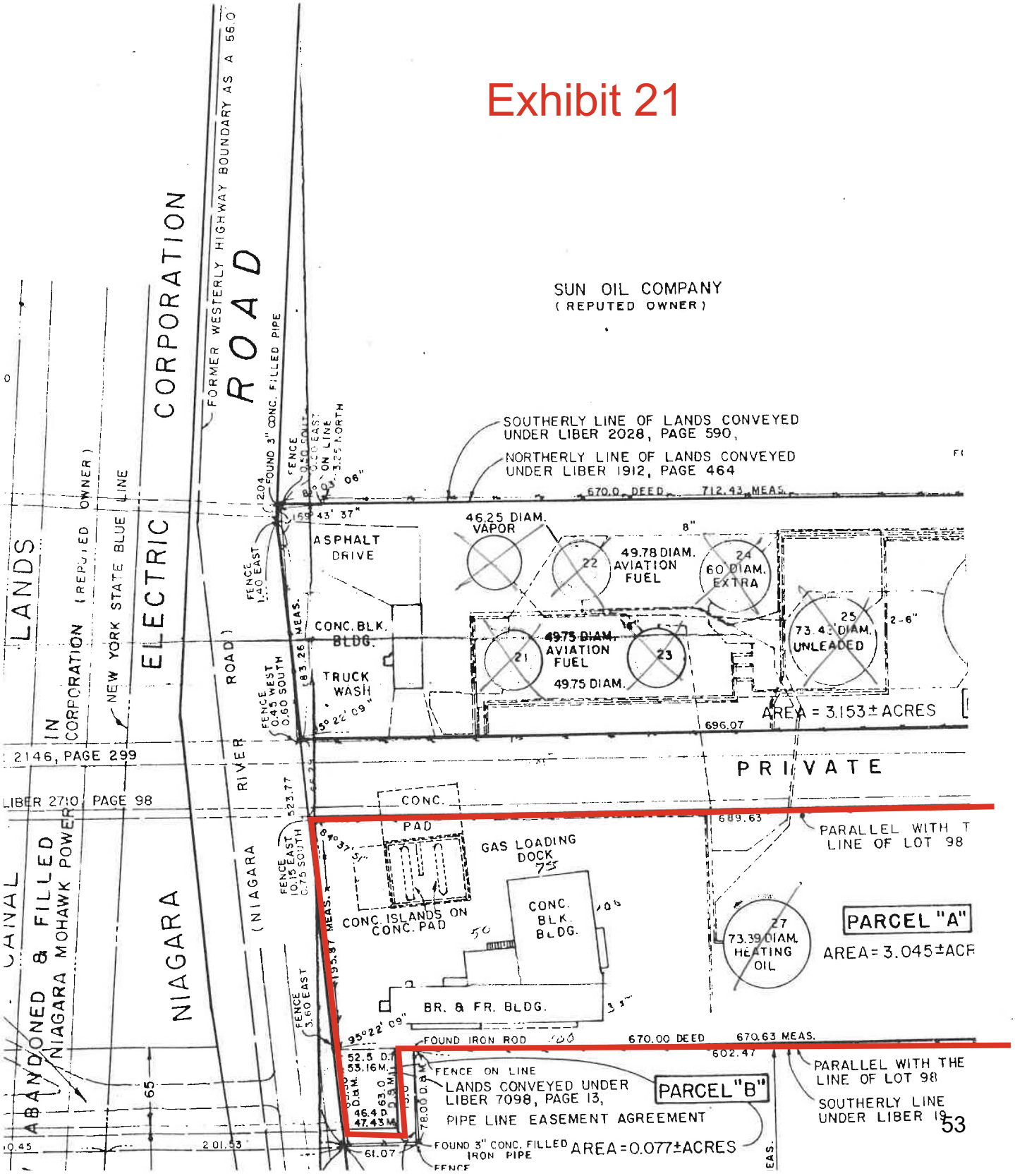
NOCO

Gary G. Roesch
OPERATIONS MANAGER

NOCO ENERGY CORP.
700 GRAND ISLAND BLVD.
P.O. BOX 86
TONAWANDA, N.Y. 14151-0086

(716) 874-6200
TWX 510 101 2792

Exhibit 21



BP-7689

COLONIAL BEACON OIL COMPANY
(INCORPORATED)

BOSTON, MASS.

September 28, 1942

PLEASE ADDRESS YOUR REPLY TO
REAL ESTATE DEPARTMENT
26 BROADWAY
NEW YORK, N. Y.

Mr. Ray H. Heiss
Tax Assessor
Town of Tonawanda
Municipal Building
Kenmore, New York

Dear Sir:

I wish to acknowledge and thank you for your letter of September 24 regarding the assessment on our plant in Tonawanda.

It is noted that you advise that since 1933 we erected a 25,000-barrel tank and a 40' x 100' warehouse. You also refer to the four tanks recently erected consisting of one 80,000-barrel, two 30,000-barrel, and one 20,000-barrel tank, and a 10' x 70' extension to the garage. The above is correct, with the exception of the 25,000-barrel tank, which seems to be in error, as we have no record of this item.

For your information, we are listing below the tankage at this plant:

✓ 3 - 10 M Bbl. Tanks
1 - 80 M " Tank
2 - 30 M " Tanks
1 - 20 M " Tank

6 — ~~2 - 20,000-Gallon Tanks~~
✓ 2 - 18,000- " "

In 1929 our assessment was increased $1,000.00, which increase was undoubtedly due to the two 18,000-gallon tanks erected during the previous year. In 1934 our assessment was increased $10,000, which we cannot account for, unless it was due to the completion of the community dock and possibly to the misunderstanding that a 25,000-barrel tank had been erected. In 1936 the assessment was increased $5,000.00, which no doubt was due to the warehouse addition. This year there has been an increase of $43,000.00 covering the four new tanks and extension to the garage.

Exhibit 22

Appendix B

curriculum vitae – Mark Jonathan Cejas

Mark Jonathan Cejas

Current Position
Principal/Founder – ChemQuants, LLC.

Markcejas@chemquants.com

www.ChemQuants.com

Years Experience
12+ Years – Environmental Forensics Consultant & Expert

20+ Years – Analytical Chemist

Education
- MS, Analytical Chemistry, Florida International University, 2009
- B.S., Chemistry & Biochemistry, Florida International University, 2003
- B.S., Environmental Science, Florida International University, 2003

Professional Affiliations
- Environmental Forensics Session Chair SCIX 2019, Palm Springs, CA
- Editorial Board for Environmental Forensics Journal
- American Chemical Society (ACS)
- Society of Environmental Toxicology & Chemistry (SETAC)

Mr. Cejas specializes in problem-solving with environmental forensics tools for client teams at contaminated sites. Client teams include environmental consultants, litigation experts, oil and gas companies, property developers, regulators, and insurance companies. Mr. Cejas's experience with contaminated sites spans most U.S. states, and in all instances, his efforts led to defensible outcomes from the principal Environmental Forensics questions – Who or what caused the contamination, how did the contamination occur, are the test results valid, and wherever possible when did the contamination occur?

Mr. Cejas's specialties include chemical release investigations on coastal waterways, subsurface environments at petroleum terminals, fueling stations, airports, dry cleaners, brownfield reclamation properties, and industrial sites. Mr. Cejas has directed client teams to favorable outcomes in pollution liability management problems and, in many instances, success from litigious disputes at contaminated sites with the country's highest-tier environmental forensics experts and legal teams.

Expert Advisory

Mr. Cejas routinely services client teams with expert testimonials that involve chemical fingerprinting, fuel release age dating, and "big environmental data" chemometrics and data visualization. Mr. Cejas has written over one hundred petroleum forensics expert reports regarding fugitive releases of gasoline, distillate fuels, heavy fuel oils, residual petroleum products, waste oils, solvents, coal tars, renewable fuels, crude oils, petroleum vapors, and residues from Manufactured Gas Plants (MGPs). A specific type of forensics report may be available in redacted form upon request. Specifically related to petroleum fuels, Mr. Cejas is an expert in the characterization and time of fugitive release of gasoline and other fuels in subsurface soil and groundwater. Mr. Cejas firmly adheres to scientific principles to support reasonably accurate conclusions. His approach to petroleum forensics has yielded a proven history of success.

Beyond petroleum contamination, Mr. Cejas has driven successful outcomes for client teams in aquatic sediments and waterways impacted by legacy contaminants such as PCBs, Dioxins/Furans, etc., from industrial process sources. Mr. Cejas often collaborates with client teams to objectively unravel chemical mixtures for chemical source differentiation and cost allocation in pollution liability disputes among multiple potentially responsible parties.

Selected Projects

Homefed Village III Master, LLC v. Recycling International Inc. 3:20-cv-0784-L-JLB (U.S. District Court for the Southern District of California, 2024) – Retained Expert

Mr. Cejas was retained as environmental forensics testifying expert on behalf of a plaintiff, a prominent developer of master-planned communities. Provided Expert Report, Deposition, Rebuttals, and Declaration prior to settlement.

Homefed Village III Master, LLC v. Otay Landfill, Inc. 3:20-cv-0784-L-JLB (U.S. District Court for the Southern District of California, 2024) – Retained Expert

Mr. Cejas is retained as environmental forensics testifying expert on behalf of a plaintiff, a prominent developer of master-planned communities. Provided Expert Report, Deposition, Rebuttals, and Declaration – Case Ongoing

Traveler's Insurance – Lenice Morgan v. Hawkwood Energy Operating, LLC, and Hawkwood Energy Midstream, LLC, 20-000091-CV-85 (85th Judicial District Brazos County, Texas) – Retained Expert

Mr. Cejas applied petroleum forensics and geochemistry principles to estimate the onset of a natural gas pipeline release that impacted a residential property zone, causing vapor intrusions and groundwater contamination risks. Compound Specific Isotope Analysis (CSIA) of light gasses was applied for contaminant source characterization. First-order kinetics principles were applied to estimate when the natural gas pipeline failed. The result of the objective investigation was utilized for decision-making in an insurance claim. Provided Expert Report.

Greenberg Traurig, LLP – Chemometrics of PCBs in Bay Sediments – Confidential Location – Retained Expert

A forensic evaluation was performed to determine potential Polychlorinated Biphenyls (PCB) sources in marine sediments. Mr. Cejas developed data analysis and interpretation strategies to assess the potential contributions of multiple PRPs. Mr. Cejas conducted industrial source characterization for remedial cost apportionment with an integrated multivariate analysis approach, using Polytopic Vector Analysis (PVA) for data exploration and t-Distributed Stochastic Neighbor Embedding (t-SNE) for data visualization. Provided Expert Report.

Cox – Colvin & Associates – Petroleum Contamination Dispute Among Oil & Gas Companies – Retained Expert

A forensic evaluation is being performed to determine the composition, spatial distribution, and time of release of petroleum contamination at a refinery previously owned by a different Oil and gas company. Mr. Cejas is a retained expert who supports significant cost allocation among stakeholders. Provided Expert Report.

Neuner Pate – Chemical Forensics in a Salt Dome – Napoleonville, Louisiana – Retained Expert

The client was a midstream oil and gas company allegedly responsible for causing catastrophic damage to a salt dome reservoir on an adjacent property. Mr. Cejas was a retained forensic expert for the client. Expert objectives included evaluating historical environmental conditions and chemical data, developing chemical databases, overseeing laboratory coordination for light gas stable isotopes analysis, conducting forensic investigations, and developing expert opinions. His expert report supplied factual evidence that led to his client's success. Provided Expert Report.

JHA Consulting Engineers – Jet Fuel Forensics at a Main Airport – Los Angeles, CA – Retained Expert

The client was a major international airline allegedly responsible for contaminating the airport's groundwater. Mr. Cejas applied defensible environmental forensics techniques to historical Site-related and chemical data, including all available Jet Fuel records and groundwater samples. Mr. Cejas generated multiple lines of evidence in the investigation that delineated historical releases with minimal relationship to a recently suspected fugitive release of Jet Fuel. The objective and unbiased forensic investigation led to a favorable outcome for the client team. Provided Expert Report.

Linebach & Funkhouser – Forensic Study of Petroleum Vapor Intrusion to a Residential Community – Harlan, Kentucky – Retained Expert

Mr. Cejas applied petroleum forensics and geochemistry principles to evaluate vapor phase hydrocarbons from indoor, sub-slab, and outdoor air samples. The forensic investigation

generated multiple lines of evidence that presented an objective fingerprinting model supporting multiple (primarily unexpected) vapor phase hydrocarbon sources and pathways to indoor air. The forensic study provided data-driven insights, which enabled a targeted approach to addressing and mitigating vapor intrusion risk to the community. Mr. Cejas's forensic report enabled the client team to work effectively with the KYDEP in their objective position. Consequently, Mr. Cejas's report was critical in Kentucky's Brownfield Program issues. Provided Expert Report.

Givaudan – Chemical Source and Transport Assessment / Passaic River– Retained Expert

Mr. Cejas was retained as a forensic expert, providing alternative interpretations of conditions and contaminant sources of PCDD/Fs along the Passaic River. Mr. Cejas developed novel data analysis and interpretation strategies to assess the potential of upstream contributions based on chemical forensics, multivariate ordination and classification techniques, GIS, and 3D data visualization perspectives. Mr. Cejas's expert work was among the most comprehensive forensic studies of PCDD/Fs in the history of contaminant studies in the Passaic River. Provided Expert Reports.

Stantec – Application of Petroleum Forensics to Inform Finite-difference Flow Models for Remedial Cost Apportionment among Multiple Stakeholders – Philadelphia, PA – Retained Expert

Mr. Cejas is the petroleum forensics expert supporting refinery-wide delineations of subsurface contamination plumes. Multiple lines of evidence are applied to include VOC and SVOC range molecular chemistry methods, compound-specific isotope (CSIA) methods for conventional and non-conventional analytes, and source-specific wastewater tracers, e.g., sucralose. The primary objectives for the forensics investigations were to inform Finite-difference Flow Models to enhance pollution source diagnostics for cost allocation strategies in one of the largest refinery redevelopment projects in the nation. Mr. Cejas is the resident Environmental Forensic expert supporting multiple stakeholders in a refinery-wide remedial cost apportionment. Provided Expert Reports.

Krazan-VEIR – Aqueous Phase Hydrocarbons Forensics at Two Gasoline Stations – Wofford Heights & Orange Cove, California – Expert Advisory

In response to alleged fugitive fuel releases, forensic evaluations of groundwater samples were undertaken at two gasoline station sites. Both projects only sampled groundwater samples, so Mr. Cejas developed similar chemical analysis strategies to explore VOC and SVOC hydrocarbon range signatures. For both projects, the comprehensive forensic studies revealed that the groundwater contamination originated not from the gasoline station but from off-site industrial and car wash facilities adjacent to the properties. Mr. Cejas's report gave the client team the information to recommend alternative actions and eliminated a significant cost burden of remediation for the client. Provided Expert Report.

EA Engineering, S & T – Sources of PAHs in Surface Soil at Eielson Air Force Base – Expert Advisory

Mr. Cejas applied petroleum forensics and geochemistry principles to evaluate the range of PAH concentrations on Eielson AFB and nearby areas. PAH compositions were assessed with multivariate statistics—PVA & t-SNE—and diagnostic ratio analysis to support a multiple-lines-of-evidence approach for characterizing sources and their geospatial distributions on and off-site. Results from the investigation provided convincing evidence that dominant PAH sources on-site were unassociated with specific release events. Provided Expert Report.

Wood – Sitewide Characterization and Age Dating of Diesel Fuel at Amtrak Maintenance Facility – Ivy City Railyard – Washington, D.C. – Expert Advisory

Mr. Cejas led a sitewide forensic investigation at an Amtrak maintenance facility. The initiative was driven by the need to understand the nature and extent of diesel fuel contamination, specifically the historical and potentially recent subsurface impacts of fuel by all diesel combustion engines utilized on-site. Mr. Cejas's expert report addressed concerns about potential environmental risks from historical and current activities. Provided Expert Report.

Pilot Geological, PLLC – Two Dry Cleaners, a Client's Property, & One Major Plume – Who Did It? – Durham, North Carolina - Expert Advisory

Mr. Cejas applied environmental forensics techniques in a groundwater pollution liability dispute between a Site represented by the client team and two adjacent Dry Cleaners facilities with different operational histories. Mr. Cejas's forensic report proved the contamination was migrating from one dry-cleaning facility, absolving the client team from pollution liability and remediation cost burden. Provided Expert Report.

Orion Environmental, Inc. - A Gasoline Station, A Large Historic Gasoline Plume & Questions of Natural Source Zone Depletion – Long Beach, California - Expert Advisory

Mr. Cejas conducted a forensic evaluation focused on characterizing the extent of a significant historical plume of gasoline from a gasoline station. In addition to assessing the potential presence of a recent fugitive release of gasoline on-site, Mr. Cejas undertook a molecular forensic-focused assessment of natural source ozone depletion (NSZD) on the client team's Site. Mr. Cejas's forensic report ruled out recent gasoline releases during a critical period in question. Also, the forensic report provided an additional line of evidence that NSZD was occurring at the Site. The report successfully supported the client team on both fronts. Provided Expert Report.

Alta Science & Engineering, Inc. – A Fueling Stations, a Known Historic Release, & Questions of a Recent Fugitive Release – Lewiston, Idaho - Expert Advisory

Forensic evaluations of groundwater samples were undertaken at a fueling station in response to alleged gasoline releases. Mr. Cejas developed a laboratory methods and chemical analysis strategy to explore VOC hydrocarbon range signatures. The comprehensive forensic studies revealed that the groundwater contamination was not from any fugitive gasoline release during the 11 years of groundwater monitoring at the Site. Instead, the forensic investigation led to defensible conclusions that the elevated concentrations of regulated gasoline hydrocarbons occurring in the wells were associated with a documented historical gasoline release. Mr. Cejas's report aided the client team with a clean-up approach that significantly reduced the cost burden on the property owner. Provided Expert Report.

EarthNet – Age Dating of Petro/Bio-Diesel Fuel – Glade Spring, VA - Expert Advisory

Mr. Cejas applied environmental forensics techniques to determine the release time for a service station's mixed biodiesel/Petro diesel fuel. The principal question posed by the client team, financed by the insurance carrier, was whether the groundwater contamination derived from a historic release of the mixed fuel or an ongoing slow leak. Mr. Cejas's forensic report indicated that a leaking system did not cause the contamination. Instead, it was determined that the release of biodiesel/Petro diesel fuel mixture from an earlier documented system failure caused the contamination. Mr. Cejas's report enabled the client team, which included the client, the Virginia Department of Environmental Quality (VDEQ), and the insurance carrier, to move forward confidently with data-driven objectivity to achieve practical remediation at the Site. Provided Expert Report.

Core – Forensics at a Gasoline Station – Fingerprinting Source Diagnostics Leading to 100% Coverage by Insurance Claim, Carnegie, PA - Expert Advisory

Mr. Cejas led the client team to success with applications of environmental forensics techniques that included powerful molecular and isotope-based fingerprinting diagnostics for gasoline station forensics and deep reviews of historical records that included decades of routine chemical monitoring. The forensic objective involved determining the origin and time of gasoline release in a dispute between two gasoline station properties and an insurance carrier. Mr. Cejas's forensic report was instrumental in removing the remediation cost burden from the client team and maintaining 100% coverage by the insurance carrier. In addition, Mr. Cejas's report paved an expedited path toward regulatory closure by year-end. Provided Expert Report.

Stantec – Condensate Crude Oil Forensics at a Major Crude Oil Hub in North America – Hardisty Terminal – Canada – Expert Advisory

Mr. Cejas led the client to success in differentiating condensate crude oil releases at a significant crude oil hub and storage facility in North America. Mr. Cejas designed a chemistry methods strategy with sophisticated methods for hydrocarbon fingerprinting that involved PIANO molecular fingerprinting and custom compound-specific isotope analysis (CSIA). Regarding data science, Mr. Cejas applied advanced chemometric techniques that involved integrated multivariate and high-dimensional data visualization techniques. Mr. Cejas's expert report effectively differentiated chemical sources at a large site involving many condensates crude oil releases. Provided Expert Report.

Infinity Solutions Group – Chemometrics of PCBs in Sediments (Swan Lake) – Portland, Oregon – Retained Expert

A forensic evaluation was performed to determine potential Polychlorinated Biphenyls (PCB) sources in lake sediments. Mr. Cejas conducted source characterization and their mixing apportionment with an integrated multivariate analysis approach, using Polytopic Vector Analysis (PVA) for data exploration and t-Distributed Stochastic Neighbor Embedding (t-SNE) for data visualization. Provided Expert Report.

Haley & Aldrich– PAH Source Differentiation Between Historical MGP and Significant Urban Influences for Sediments in San Francisco Bay – Expert Advisory

A forensic evaluation was performed to determine sources of polycyclic aromatic hydrocarbons (PAHs) in nearshore sediments in a portion of the northern waterfront of San Francisco Bay, California. The focus of the evaluation was PAH composition in sediments and the presence of potential point and nonpoint petrogenic and pyrogenic source types from contaminants associated with manufactured gas plant (MGP) operations. Mr. Cejas conducted source characterization with an integrated multivariate analysis approach, using Polytopic Vector Analysis (PVA) for data exploration and t-Distributed Stochastic Neighbor Embedding (t-SNE) for data visualization. Mr. Cejas's results provided the client team with a statistically based "map" of different contaminant source types and their mixing profiles in the bay sediments. Provided Expert Report.

Pinnacle Engineering – Discovery of a Historic Waste Plume, not the Suspected Gasoline Plume from a UST Release, Montana – Expert Advisory

Mr. Cejas's forensic objective was to characterize the free product of automotive gasoline that mysteriously re-emerged after being undetected in the subsurface for five years. A comprehensive chemical characterization of gasoline range hydrocarbons and an exploration of unknown chemistry led to the discovery of specific industry tracers that identified a waste plume from a historic asphalt refinery. Consequently, the client was absolved from the significant cost burden of remediation. *Provided Expert Report.*

Cardno – Age Constraining a Remobilized LNAPL – Santa Barbara, California – Retained Expert

An earthquake caused a tank rupture in the mid-1980s. More than twenty years later, the re-emergence of LNAPL triggered a forensic age-constraining investigation. Mr. Cejas served as the third-party expert in the matter. His expert report supplied factual evidence that led to his client team's success. *Provided Expert Report.*

B.P. – Petroleum Geochemistry Review of Deepwater Sediments Subjected to Toxicity Tests – NRDA – Retained Expert

Mr. Cejas conducted a petroleum geochemistry review of deep sediment chemistry near an offshore oil well. The data analysis strategy included a review of petroleum biomarker biodegradation potential, geospatial visualization of diagnostic chemical ratios, traditional oil fingerprinting techniques, and toxicity test comparisons with *Leptocheirus plumulosis.* The report was for Cardno's Natural Resource Damage Assessment on behalf of B.P. for the Deepwater Horizon incident in the Gulf of Mexico. Provided Expert Report.

B.P. – Spatial and Temporal Distribution of PAH Fingerprints in Oysters – NRDA – Retained Expert

Mr. Cejas developed a data analysis strategy to investigate PAH fingerprints' spatial and temporal distribution in oyster tissue. Polytopic Vector Analysis (PVA) was applied to discover chemical source' end members' and their mixing proportions in natural samples. The report was conducted for Cardno's Natural Resource Damage Assessment on behalf of B.P. for the Deepwater Horizon incident in the Gulf of Mexico. Provided Expert Report.

Cardno –Environmental Forensics Data Scientist – Deepwater Horizon Oil Spill - Gulf of Mexico, Louisiana – Retained Expert

Mr. Cejas was the chief data scientist for Petroleum Forensics investigations for Cardno on the Deepwater Horizon Oil Spill in support of B.P. Mr. Cejas collaborated with multidisciplinary teams of scientists and engineers for the Natural Resource Damage Assessment (NRDA). As the principal environmental forensics data scientist, Mr. Cejas's responsibilities spanned the design and management of analytical chemistry data coordination through the complete life cycle of the largest oil spill in U.S. history - chemical sampling, chemical data acquisition, chemistry database management, quality assurance, and control, and chemometrics investigations. Furthermore, Mr. Cejas supported Cardno's principal forensic expert in designing statistical data analysis techniques to differentiate spilled petroleum from other environmental hydrocarbon signatures. Mr. Cejas's interpretive reports and presentations were critical tools for communicating facets of oil contamination to the client, other stakeholders, and litigation teams from the context of environmental forensics. Provided Expert Reports.

Publications

- Time of Release Estimate for Contained Gas in the Subsurface – A Chemical Data Strategy Environmental Forensics, 1-10.
- PAH Source Differentiation between Historical MGP and Significant Urban Influences for Sediments in San Francisco Bay. Marine Pollution Bulletin 166 (2021): 112248.
- Integrated Chemometric Assessment PCDD/F Contamination and Sources in the Passaic River, New Jersey. (Article in Review) Environmental Forensics.
- Chemometric Mapping of Polychlorinated Dibenzo-p-Dioxin (PCDD) and Dibenzofuran (PCDF) Congeners from the Passaic River, NJ: Integrated Application of RSIMCA, PVA, and t-SNE. Environmental Forensics 22.1-2 (2021): 155-171.
- Sources and Reference Concentrations of PAHs in Surface Soil at Eielson Air Force Base. Battelle 2024 Chlorinated Conference (2024). June 2-6, Denver, Colorado
- Forensic Problem-solving in the Subsurface with Multiple Lines of Evidence – 3 Case Studies. SCIX 2019. October 13-18, Palm Springs, CA.

- Integrated Application of RSIMCA, tSNE, and PVA for Chemometric mapping of PCDD/F congeners. Battelle Tenth International Conference on the Remediation and Management of Contaminated Sediments (2019). February 11-14, New Orleans, LA.
- Integrated Chemometric Assessment PCDD/F Contamination and Sources Passaic River, NJ. Battelle Tenth International Conference on the Remediation and Management of Contaminated Sediments (2019). February 11-14, New Orleans, LA.
- Integrated Application of RSIMCA, tSNE, and PVA for Chemometric mapping of PCDD/F congeners. International Network of Environmental Forensics (INEF 2018). Annual Meeting – Salt Lake City, UT.
- Nearshore Sediment Exposure to Louisiana Crude Oil: Spatial and Temporal Patterns in the northern Gulf of Mexico. 33rd SETAC Annual Meeting, Long Beach, California.
- Post-Deepwater Horizon Toxicity Study of Gulf of Mexico Sediments using the Amphipod Leptocheirus Plumulosus. 33rd SETAC Annual Meeting – Long Beach, California.
- Confirmation of non-MC-252 Oil in Water Column Samples Southwest of the Wellhead using Hydrocarbon Biomarkers and PAH ratios. SETAC Focused Topic Meeting 2011, Pensacola Beach, Fl.
- Determining Optimal Electrospray Ionization of Sucralose – An Application of Response Surface Modeling and Weighted Least Squares Regression for a Robust Determination of Detection and Quantification Limits. FAME 2009, Orlando, Florida.
- Improved analytical method for determining unstable organophosphorus pesticides in organic-rich soil/sediment and fish tissue matrices. American Chemical Society 80th Florida Annual Meeting and Exposition FAME 2004, Orlando, Florida.
- Paleo-reconstruction of hydrocarbon sources and their contribution to the pollution loads of wetlands in the Florida Keys and the Southern Everglades. 24th SETAC Annual Meeting - Austin, Texas.
- Endosulfan Sulfate in Fish Tissue from Everglades National Park: Tales of an Unregulated Pesticide Metabolite. GEER 2008—Naples, FL.
- Microconstituents in Surface Waters from South Florida: Occurrence, Persistence, and Relevance concerning Water Reuse GEER 2008 – Naples, Fl.
- Regional Distribution of Organic Contaminants in Water and Sediments in Everglades National Park. GEER 2008—Naples, FL.
- Multivariate Analysis of Selected Microconstituents in Coastal Environments of Southeast Florida. 29th SETAC Annual Meeting - Austin, Texas

Relevant Work Experience

- Principal / Founder – ChemQuants, LLC. May 2020 - Current
- Chief Data Officer / Co-Founder – CitiQuants Corporation Feb 2017 to April 2024
- Technical Director/Petroleum Forensics – Pace Analytical Energy Services – Formerly Zymax Forensics - July 2015-June 2020
- Managing Scientist – Infinity Solutions Group - June 2014-February 2018
- Senior Project Scientist/Applied Chemistry & Data Sciences - Cardno - January 2012-November 2017
- Senior Project Scientist – Entrix - January 2011-January 2012
- Project Manager – Southeast Environmental Research Center - June 2010-January 2011
- Senior Chemist - TDI Brooks International - August 2004 – July 2006

APPENDIX C

Fish and Wildlife Resources Impact Analysis Decision Key

Appendix 3C Fish and Wildlife Resources Impact Analysis Decision Key	If YES Go to:	If NO Go to:
1. Is the site or area of concern a discharge or spill event?	13	2
2. Is the site or area of concern a point source of contamination to the groundwater which will be prevented from discharging to surface water? Soil contamination is not widespread, or if widespread, is confined under buildings and paved areas.	13	3
3. Is the site and all adjacent property a developed area with buildings, paved surfaces and little or no vegetation?	4	9
4. Does the site contain habitat of an endangered, threatened or special concern species?	Section 3.10.1	5
5. Has the contamination gone off-site?	6	14
6. Is there any discharge or erosion of contamination to surface water or the potential for discharge or erosion of contamination?	7	14
7. Are the site contaminants PCBs, pesticides or other persistent, bioaccumulable substances?	Section 3.10.1	8
8. Does contamination exist at concentrations that could exceed ecological impact SCGs or be toxic to aquatic life if discharged to surface water?	Section 3.10.1	14
9. Does the site or any adjacent or downgradient property contain any of the following resources? i. Any endangered, threatened or special concern species or rare plants or their habitat ii. Any DEC designated significant habitats or rare NYS Ecological Communities iii. Tidal or freshwater wetlands iv. Stream, creek or river v. Pond, lake, lagoon vi. Drainage ditch or channel vii. Other surface water feature viii. Other marine or freshwater habitat ix. Forest x. Grassland or grassy field xi. Parkland or woodland xii. Shrubby area xiii. Urban wildlife habitat xiv. Other terrestrial habitat	11	10
10. Is the lack of resources due to the contamination?	3.10.1	14
11. Is the contamination a localized source which has not migrated and will not migrate from the source to impact any on-site or off-site resources?	14	12
12. Does the site have widespread surface soil contamination that is not confined under and around buildings or paved areas?	Section 3.10.1	12
13. Does the contamination at the site or area of concern have the potential to migrate to, erode into or otherwise impact any on-site or off-site habitat of endangered, threatened or special concern species or other fish and wildlife resource? (See #9 for list of potential resources. Contact DEC for information regarding endangered species.)	Section 3.10.1	14
14. No Fish and Wildlife Resources Impact Analysis needed.		

APPENDIX D

Field Operating Procedures

ROUX

FIELD OPERATING PROCEDURES

Abandonment of Borehole Procedures

FOP 001.1

ABANDONMENT OF BOREHOLE PROCEDURE

PURPOSE

Soil borings that are not completed as monitoring wells will be plugged by filling the holes with a cement/bentonite grout. Field staff will calculate the borehole volume and compare it to the final installed volume of grout to evaluate whether bridging or loss to the formation has occurred. These calculations and the actual volume placed will be noted on the Boring Log.

PROCEDURE

1. Determine most suitable seal materials. Grout specifications generally have mixture ratios as follows:

   Grout Slurry Composition (% Weight)

1.5 to 3.0%	-	Bentonite (Quick Gel)
40 to 60 %	-	Cement (Portland Type I)
40 to 60 %	-	Potable Water

2. Calculate the volume of the borehole base on the bit or auger head diameter plus 10% and determine the volume of grout to be emplaced. Generally, the total mixed volume is the borehole volume plus 20%.

3. Identify the equipment to be used for the preparation and mixing of the grout. Ensure the volume of the tanks to be used for mixing has been measured adequately. Document these volumes on the Well Abandonment/Decommissioning Log (sample attached).

4. Identify the source of the water to be used for the grout and determine its suitability for use. In particular, water with high sulfate, or chloride levels or heated water should not be used. These types of waters can cause operational difficulties or modify the set-up for the grout.

5. Identify the equipment to be used for emplacing the grout. Ensure that the pump to be used has adequate pressure to enable complete return to surface.

6. Identify the volumes to be pumped at each stage or in total if only one stage is to be used.

7. Prepare the borehole abandonment plan and discuss the plan and activities with the drilling contractor prior to beginning any mixing activities.

8. Begin mixing the grout to be emplaced.

9. Record the type and amount of materials used during the mixing operation. Ensure the ratios are within specifications tolerance.

10. Begin pumping the grout through the return line bypass system to confirm all pump and surface fittings are secure.

11. Initiate downhole pumping from the bottom of the borehole. Record the times and volumes emplaced on the Well Abandonment/Decommissioning Log (sample attached).

12. Document the return circulation of grout. This may be facilitated by using a colored dye or other tagging method if a mudded borehole condition exists prior to grout injection.

13. Identify what procedures will be used for grouting in the upper 3 feet. When casing exists in the borehole, decisions are required as to the timing for removal and final disposition of the casing. Generally, it will not be removed prior to grouting because of the potential for difficult access and loss of circulation in the upper soil or rock layers. Accordingly, when cement return is achieved at surface, the casing is commonly removed and the borehole is topped off with grout or soils. If casing removal is not possible or not desired, the casing left in place should be cut off at a depth of 5 feet or greater below ground surface. If casing is not present during grouting, the grout level in the borehole is topped off after the rods or tremie pipe is removed.

14. Clear and clean the surface near the borehole.

15. The uppermost five feet of the borehole at the land surface should be filled with material physically similar to the natural soils. The surface of the borehole should be restored to the condition of the area surrounding the borehole. For example, concrete or asphalt will be patched with concrete or asphalt of the same type and thickness, grassed areas will be seeded, and topsoil will be used in other areas. All solid waste materials generated during the decommissioning process must be disposed of properly.

16. A follow-up check at each site should be made within one week to 10 days of completion. It should be noted that on occasion, the grout and/or surface material may settle over several days. If settling occurs, additional material physically similar to surrounding materials (i.e., asphalt, concrete, or soil) must be used to match the existing grade.

17. Document borehole and/or well/piezometer decommissioning activities on a Well Abandonment/Decommissioning Log (sample attached).

ATTACHMENTS

Well Abandonment/Decommissioning Log (sample)

REFERENCES

ASTM D 5299: *Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities*.

NYSDEC, July 1988, *Drilling and Monitoring Well Installation Guidance Manual.*

NYSDEC, November 2009, *CP-43: Groundwater Monitoring Well Decommissioning Policy.*

Driscoll, F.G., 1987, *Groundwater and Wells*, Johnson Division, St. Paul, Minnesota, 1089 p.

WELL ABANDONMENT/ DECOMMISSIONING LOG

PROJECT INFORMATION	WELL INFORMATION
Project Name:	WELL I.D.:
Client:	Stick-up (fags):
Project Job Number:	Total Depth (fbgs):
Date:	Screen Interval (fbgs):
Weather:	Well Material:
	Diameter (inches):
Roux Personnel:	
Drilling Company:	Drilling Company Personnel:
Drill Rig Type:	

DECOMMISSIONING PROCEDURES

Time	Description of Field Activities

SAMPLE

PREPARED BY: DATE:

FIELD OPERATING PROCEDURES

Abandonment of Monitoring Wells Procedure

FOP 002.0

ABANDONMENT OF MONITORING WELLS PROCEDURE

PURPOSE

This guideline presents a method for the abandonment and decommissioning of wells that are no longer reliable as competent monitors of formation groundwater. Well abandonment and decommissioning is required in order to remove a potential pathway for the vertical migration of impacted groundwater and/or surface water.

PROCEDURE

1. Examine the existing well to be abandoned/decommissioned and review well construction detail information (if applicable) to determine well depth,, screened interval, diameter, material of composition and other construction details. Establish appropriate equipment requirements for removal of the well.

2. Determine the most suitable seal materials as discussed in the next section.

3. Attempt to remove the well using a drilling rig, by using the following procedures:
    - Attaching the winch line to the well to see if it can be removed by pulling;
    - Using the rig's hydraulics to advance casing incrementally;
    - If a cable tool rig is available, bump back the casing using the cathead and drive block.

3. Upon removal of the well, ream the borehole by advancing the augers approximately one foot beyond the total depth of the well. Rotate the augers at a speed sufficient to remove the construction materials (i.e., filter pack, bentonite seal, etc.) from the borehole annulus (if possible). Backfill the resulting borehole with cement/bentonite grout, by tremie method, to approximately one foot below ground surface. Fill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary). Go to Step 10.

4. If the well cannot be removed from the borehole over-drill the borehole and well to approximately two (2) feet below the well depth. Upon reaching the desired depth, remove the well from within the augers and go back to Step 3.

5. If the borehole cannot be reamed out using conventional drilling techniques (i.e., over-drilled), remove or puncture the base plate of the well screen using the drill rig and associated equipment by pounding with the drill rods. Upon filling the well with grout by tremie method, slowly pull the well from the ground surface to allow the grout to evacuate through the bottom of the well to fill the void space created by removal of the well casing. Continue adding grout mix to the well casing, as necessary, to fill the void space to approximately one foot below ground surface. Fill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary). Go to Step 10.

   If the driller is unsuccessful at removing or puncturing the base plate of the well due, in part, to well construction materials (i.e., stainless steel or black iron), go to Step 6.

6. Insert a tremie pipe down the well to the bottom and pump a cement/bentonite grout mixture to a depth one to two feet above the top of the screen.

7. Perform a hydraulic pressure test on the portion of the well casing above the grouted screen section. Allow the grout to set up for a period not less than 72 hours before pressure testing of the grouted interval. Place a pneumatic packer a maximum of 4.5 feet above the top of the slotted screen section of the well. The infiltration pressure applied to the packer shall not exceed the pressure rating of the well casing material. If the interval between the top of the grout and the bottom of the packer is not saturated, potable water will be used to fill the interval. A gauge pressure of 5 psig at the well head shall be applied to the interval for a period of 5 minutes to allow for temperature stabilization. After 5 minutes, the pressure will be maintained at 5 psig for 30 minutes. The grout seal shall be considered acceptable if the total loss of water to the seal does not exceed 0.5 gallons over a 30-minute period.

8. If the grout seal is determined to be unacceptable, tremie grout an additional 5 feet of well riser above the failing interval and retest as specified above (see Step 7).

9. If the grout seal is determined to be acceptable, tremie grout the remainder of the well until grout displaces all formation water and a grout return is visible in the well at the surface. Cut off well casing at a depth of five feet or greater below ground surface and backfill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary).

10. Record all well construction details and abandonment procedures on the **Well Abandonment/Decommissioning Log** (sample attached).

CEMENT/BENTONITE GROUT MIXTURE

The cement/bentonite grout mixture identified below is generally considered the most suitable seal material for monitoring well advancement and abandonment. Grout specifications generally have mixture ratios as follows:

Grout Slurry Composition (% Weight)

1.5 to 3.0%	-	Bentonite (Quick Gel)
40 to 60%	-	Cement (Portland Type I)
40 to 60%	-	Potable Water

MISCELLANEOUS

All removed well materials (PVC, stainless steel, steel pipe) should be decontaminated (if necessary) as per the project specific **Drilling and Excavation Equipment Decontamination FOP** and removed from the site. The project manager will determine the destination of final disposal for all well materials. All drill cuttings (depending on site protocol) should be placed in DOT-approved 55-gallon drums, labeled and sampled in

accordance with Roux's field operating procedure **Management of Investigation-Derived Waste** in order to determine proper removal and disposal procedures. The drilling subcontractor will provide any potable water utilized during this field activity from a known and reliable source (see Notes section).

ATTACHMENTS

Well Abandonment/Decommissioning Log (sample)

REFERENCES

New York State Department of Environmental Conservation, July 1988, *Drilling and Monitoring Well Installation Guidance Manual.*

Driscoll, F.G., 1987, *Groundwater and Wells*, Johnson Division, St. Paul, Minnesota, p. 1089.

Roux FOPs:

018 Drilling/Excavation Equipment Decontamination Protocols
032 Management of Investigation-Derived Waste

NOTES

Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.

ROUX

WELL ABANDONMENT / DECOMMISSIONING LOG

PROJECT INFORMATION	WELL INFORMATION
Project Name:	WELL I.D.:
Client:	Stick-up (fags):
Project Job Number:	Total Depth (fbgs):
Date:	Screen Interval (fbgs):
Weather:	Well Material:
	Diameter (inches):
Roux Personnel:	
Drilling Company:	Drilling Company Personnel:
Drill Rig Type:	

DECOMMISSIONING PROCEDURES

Time	Description of Field Activities

SAMPLE

FIELD OPERATING PROCEDURES

Soil Vapor Sample Collection Procedures

FOP 004.7

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

BACKGROUND

In October 2006, the New York State Department of Health (NYSDOH) finalized their vapor intrusion guidance document entitled "Guidance for Evaluating Soil Vapor Intrusion in the State of New York." (www.health.state.ny.us/nysdoh/gas/svi_guidance/), which has been guiding NYSDOH and New York State Department of Environmental Conservation (NYSDEC) decisions concerning the need for subslab vapor mitigation at sites undergoing investigation, cleanup and monitoring under formal NY Sate remedial programs (e.g., Brownfield Cleanup Program sites, Inactive Hazardous Waste Site Remediation Program sites, etc.). Per the most recent update, February 2024, guidance presents six (6) soil vapor/indoor air matrices to assist in interpreting the comparison of subslab and ambient air data. As of February 2024, 20 compounds have been assigned to these six (6) current matrices (i.e., "Matrix A", "Matrix B", "Matrix C", "Matrix D", "Matrix E", and "Matrix F") as follows:

Soil Vapor / Indoor Air Matrix	Volatile Chemical
Matrix A	Carbon tetrachloride
	1,1-Dichloroethene
	cis-1,2-Dichloroethene
	Trichloroethene
Matrix B	Methylene Chloride
	Tetrachlorethene
	1,1,1-Trichloroethane
Matrix C	Vinyl chloride
Matrix D	Benzene
	Ethylbenzene
	Naphthalene

	Cyclohexane
	Isooctane (2,2,4-Trimethylpentane)
	1,2,4-Trimethylbenzene
	1,3,5-Trimethylbenzene
	o-Xylene
Matrix E	m,p-Xylene
	Heptane
	Hexane
Matrix F	Toluene

The matrices are attached as Figures 1 through 6.

PURPOSE

The procedures presented herein delineate the scope of additional investigation at a building on the project site to determine if volatile organic compounds (VOCs) detected in groundwater and/or soil near the building are intruding into the building airspace or have the potential, in sufficient concentrations, to adversely impact indoor air quality. The soil vapor, subslab vapor, and ambient air monitoring procedures follow the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006) as well as USEPA Methods TO-14 and TO-15, for volatile organic compounds (VOCs) using Summa passive canisters.

SURVEYS AND PRE-SAMPLING BUILDING PREPARATION (IF REQUIRED)

If required, a pre-sampling inspection should be performed prior to each sampling event to identify and minimize conditions that may interfere with the proposed testing. The

inspection should evaluate the type of structure, floor layout, airflows, and physical conditions of the building(s) being studied. This information, along with information on sources of potential indoor air contamination, should be identified on a building inventory form. An example of the building inventory form is attached. Items to be included in the building inventory include the following:

- Construction characteristics, including foundation cracks and utility penetrations or other openings that may serve as preferential pathways for vapor intrusion;
- Presence of an attached garage;
- Recent renovations or maintenance to the building (e.g., fresh paint, new carpet or furniture);
- Mechanical equipment that can affect pressure gradients (e.g., heating systems, clothes dryers or exhaust fans);
- Use or storage of petroleum products (e.g., fuel containers, gasoline operated equipment and unvented kerosene heaters); and
- Recent use of petroleum-based finishes or products containing volatile chemicals.

Each room on the floor of the building being tested and on lower floors, if possible, should be inspected. This is important because even products stored in another area of a building can affect the air of the room being tested.

The presence and description of odors (e.g., solvent, moldy) and portable vapor monitoring equipment readings (e.g., PIDs, ppb RAE, Jerome Mercury Vapor Analyzer, etc.) should be noted and used to help evaluate potential sources. This includes taking readings near products stored or used in the building.

Potential interference from products or activities releasing volatile chemicals may need to be controlled. Removing the source from the indoor environment prior to testing is the most effective means of reducing interference. Ensuring that containers are tightly sealed may be acceptable. When testing for volatile organic compounds, containers should be tested with portable vapor monitoring equipment to determine whether compounds are leaking. The inability to eliminate potential interference may be justification for not testing, especially when testing for similar compounds at low levels. The investigator should consider the possibility that chemicals may adsorb onto porous materials and may take time to dissipate.

In some cases, the goal of the testing is to evaluate the impact from products used or stored in the building (e.g., pesticide misapplications, school renovation projects). If the goal of the testing is to determine whether products are an indoor volatile chemical contaminant source, the removing these sources does not apply.

Once interfering conditions are corrected (if applicable), ventilation may be needed prior to sampling to eliminate residual contamination in the indoor air. If ventilation is appropriate, it should be completed 24 hours or more prior to the scheduled sampling time. Where applicable, ventilation can be accomplished by operating the building's HVAC system to maximize outside air intake. Opening windows and doors, and operating exhaust fans may also help or may be needed if the building has no HVAC system.

Air samples are sometimes designed to represent typical exposure in a mechanically ventilated building and the operation of HVAC systems during sampling should be noted on the building inventory form (see attached sample). In general, the building's HVAC system should be operating under normal conditions. Unnecessary building ventilation should be avoided within 24 hours prior to and during sampling. During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time.

Depending upon the goal of the indoor air sampling, some situations may warrant deviation from the above protocol regarding building ventilation. In such cases, building conditions and sampling efforts should be understood and noted within the framework and scope of the investigation.

To avoid potential interferences and dilution effects, every effort should be made to avoid the following for 24 hours prior to sampling:

- Opening any windows, fireplace dampers, openings or vents;
- Operating ventilation fans unless special arrangements are made;
- Smoking in the building;
- Painting;
- Using a wood stove, fireplace or other auxiliary heating equipment (e.g., kerosene heater);
- Operating or storing automobile in an attached garage;
- Allowing containers of gasoline or oil to remain within the house or garage area, except for fuel oil tanks;
- Cleaning, waxing or polishing furniture, floors or other woodwork with petroleum- or oil-based products;
- Using air fresheners, scented candles or odor eliminators;
- Engaging in any hobbies that use materials containing volatile chemicals;
- Using cosmetics including hairspray, nail polish, nail polish removers, perfume/cologne, etc.;
- Lawn mowing, paving with asphalt, or snow blowing;
- Applying pesticides; and
- Using building repair or maintenance products, such as caulk or roofing tar.

PRODUCT INVENTORY (IF REQUIRED)

If required, the primary objective of the product inventory is to identify potential air sampling interference by characterizing the occurrence and use of chemicals and products throughout the building, keeping in mind the goal of the investigation and site-specific

contaminants of concern. For example, it is not necessary to provide detailed information for each individual container of like items. However, it is necessary to indicate that "20 bottles of perfume" or "12 cans of latex paint" were present with containers in good condition. This information is used to help formulate an indoor environment profile.

An inventory should be provided for each room on the floor of the building being tested and on lower floors, if possible. This is important because even products stored in another area of a building can affect the air of the room being tested.

The presence and description of odors (e.g., solvent, moldy) and portable vapor monitoring equipment readings (e.g., PIDs, ppb RAE, Jerome Mercury Vapor Analyzer, etc.) should be noted and used to help evaluate potential sources. This includes taking readings near products stored or used in the building. Products in buildings should be inventoried every time air is tested to provide an accurate assessment of the potential contribution of volatile chemicals. If available, chemical ingredients of interest (e.g., analyte list) should be recorded for each product. If the ingredients are not listed on the label, record the product's exact and full name, and the manufacturer's name, address and telephone number, if available. In some cases, Material Safety Data Sheets (MSDS) may be useful for identifying confounding sources of volatile chemicals in air. Adequately documented photographs of the products and their labeled ingredients can supplement the inventory and facilitate recording the information.

SAMPLE LOCATIONS

The following are types of samples that are collected to investigate the soil vapor intrusion pathway:

- Subsurface vapor samples:

  - *Soil vapor* samples (i.e., soil vapor samples not beneath the foundation or slab of a building) and
  - *Sub-slab vapor* samples (i.e., soil vapor samples immediately beneath the foundation or slab of a building);
- Indoor air samples; and
- Outdoor air samples.

The types of samples that should be collected depend upon the specific objective(s) of the sampling, as described below.

- Soil vapor
  Soil vapor samples are collected to determine whether this environmental medium is contaminated, characterize the nature and extent of contamination, and identify possible sources of the contamination. Soil vapor sampling results are used when evaluating the following:
  - The potential for *current* human exposures;
  - The potential for *future* human exposures (e.g., should a building be constructed); and
  - The effectiveness of measures implemented to remediate contaminated subsurface vapors.

- Sub-slab vapor
  Sub-slab vapor samples are collected to characterize the nature and extent of soil vapor contamination immediately beneath a building with a basement foundation and/or a slab-on-grade. Sub-slab vapor sampling results are used when evaluating the following:
  - *Current* human exposures;
  - The potential for *future* human exposures (e.g., if the structural integrity of the building changes or the use of the building changes); and
  - Site-specific attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations).

  Sub-slab vapor samples are collected after soil vapor characterization and/or other environmental sampling (e.g., soil and groundwater characterization) indicate a need. Subslab samples are typically collected concurrently with indoor and outdoor air samples. However, outside of the heating season, sub-slab vapor samples may be collected independently depending on the sampling objective

(e.g., characterize the extent of subsurface vapor contamination outside of the heating season to develop a more comprehensive, focused investigation plan for the heating season).

- Indoor air

  Indoor air samples are collected to characterize exposures to air within a building, including those with earthen floors and crawlspaces. Indoor air sampling results are used when evaluating the following:
  - *Current* human exposures;
  - The potential for *future* exposures (e.g., if a currently vacant building should become occupied); and
  - Site-specific attenuation factors (e.g., the ratio of indoor air to sub-slab vapor concentrations).

  Indoor air samples are collected after subsurface vapor characterization and other environmental sampling (e.g., soil and groundwater characterization) indicate a need. When indoor air samples are collected, concurrent sub-slab vapor and outdoor air samples are collected to evaluate the indoor air results appropriately. However, indoor air and outdoor air samples, without sub-slab vapor samples, may be collected when confirming the effectiveness of a mitigation system.

  In addition, site-specific situations may warrant collecting indoor air samples prior to characterizing subsurface vapors and/or without concurrent sub-slab sampling due to a need to examine immediate inhalation hazards. Examples of such situations may include, but are not limited to, the following:
  - In response to a spill event when there is a need to qualitatively and/or quantitatively characterize the contamination;
  - If high readings are obtained in a building when screening with field equipment (e.g., a photoionization detector (PID), an organic vapor analyzer, or an explosimeter) and the source is unknown;
  - If significant odors are present and the source needs to be characterized; or
  - If groundwater beneath the building is contaminated, the building is prone to groundwater intrusion or flooding (e.g., sump pit overflows), and subsurface vapor sampling is not feasible.

- Outdoor air

  Outdoor air samples are collected to characterize site-specific background outdoor air conditions. These samples must be collected simultaneously with indoor air samples. They may also be collected concurrently with soil vapor samples. Outdoor air sampling results are primarily used when evaluating the extent to which outdoor sources may be influencing indoor air quality. They may also be used in the evaluation of soil vapor results (i.e., to identify potential outdoor air interferences associated with the infiltration of outdoor air into the sampling apparatus while the soil vapor sample was collected).

SOIL VAPOR SAMPLE COLLECTION PROCEDURES

Soil vapor probe installations (see Figure 4 attached) may be permanent, semi-permanent, or temporary. In general, permanent installations are preferred for data consistency reasons. Soil implants or probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be included in any construction protocol:

- Soil vapor probes should be installed using direct push technology or, if necessary to attain the desired depth, using an auger;

- Porous backfill material (e.g., glass beads or coarse sand) should be used to create a sampling zone 1 to 2 feet in length;

- Soil vapor probes should be fitted with inert tubing (e.g., polyethylene, stainless steel, or Teflon®) of the appropriate size (typically 1/8 inch to 1/4 inch diameter) and of laboratory or food grade quality to the surface;

- Soil vapor probes should be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet to prevent outdoor air infiltration and the remainder of the borehole backfilled with clean material;

- For multiple probe depths, the borehole should be grouted with bentonite between probes to create discrete sampling zones; and

- For permanent installations, a protective casing should be set around the top of the probe tubing and grouted in place to the top of bentonite to minimize infiltration of water or outdoor air, as well as to prevent accidental damage.

Soil vapor samples should be collected in the same manner at all locations to minimize possible discrepancies. The following procedures should be included in any sampling protocol:

- At least 24 hours after the installation of permanent probes and shortly after the installation of temporary probes, one to three implant volumes (i.e., the volume of the sample probe and tube) must be purged prior to collecting the samples to ensure samples collected are representative;

- Flow rates for both purging and collecting must not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling;

- The target final field vacuum after 24 hours will be approximately -5 inches of mercury. Samples with a final field vacuum of greater than -10 inches of mercury, or equal to zero, will be flagged (usability of data will depend on sample volume and reporting limits that can be achieved).

- Samples must be collected, using conventional sampling methods, in an appropriate container — one which meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation), meets the requirements of the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and is certified clean by the laboratory;

- Sample size depends upon the volume of sample required to achieve minimum reporting limit requirements; and

- A tracer gas (e.g., helium, butane, or sulfur hexafluoride) must be used when collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring) (discussed later in this procedure). Once verified, continued use of the tracer gas may be reconsidered.

When soil vapor samples are collected, the following actions should be taken to document local conditions during sampling that may influence interpretation of the results:

- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified;

- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor ambient air sample locations (if applicable), and compass orientation (north);

- Weather conditions (e.g., precipitation, outdoor temperature, barometric pressure, wind speed and direction) should be noted for the past 24 to 48 hours; and

- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

The field sampling team must maintain a sample log sheet summarizing the following:

- Sample identification,
- Date and time of sample collection,
- Sampling depth,
- Identity of samplers,
- Sampling methods and devices,
- Purge volumes,
- Volume of soil vapor extracted,
- If canisters used, the vacuum before and after samples collected,
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and
- Chain of custody protocols and records used to track samples from sampling point to analysis.

SUB-SLAB VAPOR SAMPLE COLLECTION PROCEDURES

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. Prior to installation of the sub-slab vapor probe, the building floor should be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) should be noted and recorded. Probes should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.

Sub-slab vapor probe installations (see Figure 5 attached) may be permanent, semi-permanent, or temporary. Sub-slab implants or probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be included in any construction protocol:

- Permanent recessed probes must be constructed with brass or stainless steel tubing and fittings;
- Temporary probes must be constructed with polyethylene or Teflon® tubing of laboratory or food grade quality;
- Tubing should not extend further than 2 inches into the sub-slab material;
- Coarse sand or glass beads should be added to cover about 1 inch of the probe tip for permanent installations; and
- The soil vapor probe should be sealed to the surface with permagum grout, melted beeswax, putty or other non-VOC-containing and non-shrinking products for temporary installations or cement for permanent installations.

Sub-slab vapor samples should be collected in the following manner:

- After installation of the probes, one to three volumes (i.e., the volume of the sample probe and tube) must be purged prior to collecting the samples to ensure samples collected are representative;
- Flow rates for both purging and collecting must not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling;
- The target final field vacuum after 24 hours will be approximately -5 inches of mercury. Samples with a final field vacuum of greater than -10 inches of mercury,

or equal to zero, will be flagged (usability of data will depend on sample volume and reporting limits that can be achieved).

- Samples must be collected, using conventional sampling methods, in an appropriate container — one which meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation), meets the requirements of the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and is certified clean by the laboratory;
- Sample size depends upon the volume of sample required to achieve minimum reporting limit requirements [Section 2.9 of the Guidance], the flow rate, and the sampling duration; and
- Ideally, samples should be collected over the same period of time as concurrent indoor and outdoor air samples.

When sub-slab vapor samples are collected, the following actions should be taken to document conditions during sampling and ultimately to aid in the interpretation of the sampling results:

- If sampling within a commercial or industrial building, uses of volatile chemicals in commercial or industrial processes and/or during building maintenance, should be identified;
- The use of heating or air conditioning systems during sampling should be noted;
- Floor plan sketches should be drawn that include the floor layout with sample locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), and any other pertinent information should be completed;
- If possible, photographs should accompany floor plan sketches;
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sample locations (if applicable), compass orientation (north), footings that create separate foundation sections, and paved areas;
- Weather conditions (e.g., precipitation, indoor and outdoor temperature, and barometric pressure) and ventilation conditions (e.g., heating system active and windows closed) should be reported;

- Smoke tubes or other devices should be used to confirm pressure relationships and air flow patterns, especially between floor levels and between suspected contaminant sources and other areas; and
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppb RAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

The field sampling team must maintain a sample log sheet summarizing the following:

- Sample identification,
- Date and time of sample collection,
- Sampling depth,
- Identity of samplers,
- Sampling methods and devices,
- Soil vapor purge volumes,
- Volume of soil vapor extracted,
- If canisters used, the vacuum before and after samples collected,
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and
- Chain of custody protocols and records used to track samples from sampling point to analysis.

The following describes the subslab air sampling procedure:

1. Canisters will be supplied by the laboratory that will be conducting the analysis.

2. Sampling will take place in accordance with the project work plan sufficiently spaced to allow locations to be modified, if necessary.

3. The number of Summa canisters required as well as the flow rate of the constant differential low volume flow controllers will be supplied by the laboratory in accordance with the project work plan.

4. The sampling program will consist of concurrently collecting and analyzing one sub-slab vapor sample and one indoor ambient air sample (discussed in

the next section). Sample locations should be selected based on the likelihood for potential continuous human occupancy during the workday (i.e., due to the size of the areas and available infrastructure), and to account for the possibility of varying foundation depths in different areas of the building. In addition, sample locations typically are based upon the results of a subsurface investigation (i.e., soil gas survey or boring advancement) conducted prior to air sample collection activities. Canisters are typically placed in areas where the highest concentrations of soil gas were observed. Indoor air sample locations preferably should be selected near the middle of the sampled room, well away from the edges where dilution is more likely to occur.

5. Collect at least one outdoor ambient air sample from a location on the building roof or designated background area of the site positioned away from building ventilation system equipment on the highest portion of the building roof or site. See the Outdoor Ambient Air Sampling Procedure section in this procedure.

6. Field personnel should assure conservative sampling conditions prior to and throughout the sampling event. The building should be closed (windows and doors shut) and existing building ventilation systems should be turned off 12 to 24 hours before the air sampling is scheduled to begin as well as during sample collection. Any air-handling units that may induce large pressure gradients (i.e., exhaust fans, HVAC units etc.) should also be turned off.

7. Any activity being conducted by current building tenants involving volatile organic compounds, such as the use of lacquer thinner and cleaning solvents, prior to and/or during air sampling activities should be noted in the Project Field Book. These activities have the potential to bias the analytical results.

8. At each location, drill an approximately ¾-inch diameter hole through the concrete slab (typically 6-8 inches thick) using a hand-held hammer drill.

9. Measure and record the concrete thickness in the Project Field Book.

10. Insert polyethylene or Teflon® tubing of laboratory or food grade quality into the drilled hole and no further than 2 inches into the subslab material.

11. Seal the tubing with an appropriately sized volatile organic compound-free stopper (i.e., permagum grout, melted beeswax, putty, or other non-VOC-containing and non-shrinking product) into the concrete core hole and secure in-place making sure the fit is very snug. Supplement any visible gaps between the stopper and concrete slab with a VOC-free sealant, such as beeswax or bentonite slurry.

12. Run the tubing assembly through a shroud (plastic pail, cardboard box, or garbage bag) creating a tight seal with the surface making sure not to disturb the seal around the tubing penetration.

13. Enrich the atmosphere of the shroud with helium. Measure and record the helium concentration within the shroud.

14. Purge approximately 1 to 3 tubing volumes (i.e., the volume of the sample probe and tube) using a hand pump (or similar approved device) to ensure the collection of a representative sample.

15. Flow rates for both purging and sample collection must not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling.

16. Use a portable monitoring device to analyze a sample of soil vapor for the tracer **prior to and after** sampling for the compounds of concern. Note that the tracer gas samples can be collected via syringe, Tedlar bag etc. They need not be collected in Summa® canisters or minicans.

17. If concentrations greater than 10% of tracer gas are observed either prior to and/or after sampling, the probe seal should be enhanced to reduce the infiltration of outdoor air. Following enhancement of the seal, repeat steps 14 through 17 above until purged concentrations are less than 10% of the tracer gas within the shroud.

18. Following tubing purge and adequate seal integrity testing via helium tracer gas, immediately attach a 6-liter Summa Canister fitted with a 24-hour regulator (or approved other duration) to the opposite end of the tubing.

Concurrent with each subslab sample location, prepare an indoor ambient air sample by staging a second Summa Canister on a ladder (approximately 2 to 5-feet above the floor) adjacent to the sub-slab sample location.

19. All Summa Canister valves should remain closed until all subslab borings are complete and all of the canisters in their respective positions.

20. Open the valves to all of the canisters for the required collection period (i.e., 24-hours). Record initial canister pressure on the Air Canister Field Record form.

21. Following sample collection and prior to closing canister valve, record final canister pressure on the Air Canister Field Record form. Close canister valve.

22. Collect all Summa Canisters and ship, under chain-of-custody command to an approved analytical laboratory for VOC analysis in accordance with USEPA Method TO-14 or TO-15.

23. Repair all concrete openings with a cement patch.

24. Analytical results submitted by the laboratory should be reported as concentrations of each VOC at each location, typically in parts per billion by volume (ppbv).

INDOOR AIR SAMPLE COLLECTION PROCEDURES

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. If possible, prior to collecting indoor samples, a pre-sampling inspection, discussed earlier in this procedure, should be performed to evaluate the physical layout and conditions of the building being investigated, to identify conditions that may affect or interfere with the proposed sampling, and to prepare the building for sampling.

In general, indoor air samples should be collected in the following manner:

- Sampling duration should reflect the exposure scenario being evaluated without compromising the detection limit or sample collection flow rate (e.g., an 8 hour sample from a workplace with a single shift versus a 24 hour sample from a workplace with multiple shifts). To ensure that air is representative of the locations sampled and to avoid undue influence from sampling personnel, samples should be collected for at least 1 hour. If the goal of the sampling is to represent average concentrations over longer periods, then longer duration sampling periods may be appropriate. Typically, 24 hour samples are collected from residential settings;

- Personnel should avoid lingering in the immediate area of the sampling device while samples are being collected;

- Sample flow rates must conform to the specifications in the sample collection method and, if possible, should be consistent with the flow rates for concurrent outdoor air and sub-slab samples;

- The target final field vacuum after 24 hours will be approximately -5 inches of mercury. Samples with a final field vacuum of greater than -10 inches of mercury, or equal to zero, will be flagged (usability of data will depend on sample volume and reporting limits that can be achieved); and

- Samples must be collected, using conventional sampling methods, in an appropriate container — one which meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation), meets the requirements of the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and is certified clean by the laboratory.

At sites with tetrachloroethene contamination, passive air monitors that are specifically analyzed for tetrachloroethene (i.e., "perc badges") are commonly used to collect indoor and outdoor air samples. If site characterization activities indicate that degradation products of

tetrachloroethene also represent a vapor intrusion concern, perc badges may be used to indicate the likelihood of vapor intrusion (i.e., by using tetrachloroethene as a surrogate) followed, as needed, by more comprehensive sampling and laboratory analyses to quantify both tetrachloroethene and its degradation products. Perc badge samples ideally should be collected over a twenty-four hour period, but for no less than eight hours.

The following actions should be taken to document conditions during indoor air sampling and ultimately to aid in the interpretation of the sampling results:

- A product inventory survey must be completed (discussed earlier);
- The use of heating or air conditioning systems during sampling should be noted;
- Floor plan sketches should be drawn that include the floor layout with sample locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system supply and return registers, compass orientation (north), and any other pertinent information should be completed;
- If possible, photographs should accompany floor plan sketches;
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sample locations (if applicable), compass orientation (north), footings that create separate foundation sections, and paved areas;
- Weather conditions (e.g., precipitation, indoor and outdoor temperature, and barometric pressure) and ventilation conditions (e.g., heating system active and windows closed) should be reported;
- Smoke tubes or other devices should be used to confirm pressure relationships and air flow patterns, especially between floor levels and between suspected contaminant sources and other areas; and

- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppb RAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

The field sampling team must maintain a sample log sheet summarizing the following:

- Sample identification,
- Date and time of sample collection,
- Sampling height,
- Identity of samplers,
- Sampling methods and devices,
- Depending upon the method, volume of air sampled,
- If canisters used, the vacuum before and after samples collected,
- Chain of custody protocols and records used to track samples from sampling point to analysis.

The following describes the indoor air sampling procedure:

1. Canisters will be supplied by the laboratory that will be conducting the analysis.

2. Sampling will take place in accordance with the project work plan sufficiently spaced to allow locations to be modified, if necessary.

3. The number of Summa canisters required as well as the flow rate of the constant differential low volume flow controllers will be supplied by the laboratory in accordance with the project work plan. Indoor air sampling typically requires the continuous collection of samples over a 24-hour period.

4. The sampling program will consist of concurrently collecting and analyzing one sub-slab vapor sample and one indoor ambient air sample. Sample locations should be selected based on the likelihood for potential continuous human occupancy during the workday (i.e., due to the size of the areas and available infrastructure), and to account for the possibility of varying foundation depths in different areas of the building. In addition, sample locations typically are based upon the results of a subsurface investigation (i.e.,

soil gas survey or boring advancement) conducted prior to air sample collection activities. Canisters are typically placed in areas where the highest concentrations of soil gas were observed. Indoor air sample locations preferably should be selected near the middle of the sampled room, well away from the edges where dilution is more likely to occur.

5. Collect at least one outdoor ambient air sample from a location on the building roof or designated background area of the site positioned away from building ventilation system equipment on the highest portion of the building roof or site. See the Outdoor Ambient Air Sampling Procedure presented in this procedure.

6. Field personnel should assure conservative sampling conditions prior to and throughout the sampling event. The building should be closed (windows and doors shut) and existing building ventilation systems should be turned off 12 to 24 hours before the air sampling is scheduled to begin as well as during sample collection. Any air-handling units that may induce large pressure gradients (i.e., exhaust fans, HVAC units etc.) should also be turned off.

7. Any activity being conducted by current building tenants involving volatile organic compounds, such as the use of lacquer thinner and cleaning solvents, prior to and/or during air sampling activities should be noted in the Project Field Book. These activities have the potential to bias the analytical results.

8. Concurrent with each subslab sample location, prepare an indoor ambient air sample by staging a second Summa Canister on a ladder (approximately 2 to 5-feet above the floor) adjacent to the sub-slab sample location.

9. All Summa Canister valves should remain closed until all subslab borings are complete and all of the canisters in their respective positions.

10. Open the valves to all of the canisters for the required collection period (i.e., 24-hours). Record initial canister pressure on the Air Canister Field Record form.

11. Following sample collection and prior to closing canister valve, record final canister pressure on the Air Canister Field Record form. Close canister valve.

12. Collect all Summa Canisters and ship, under chain-of-custody command to an approved analytical laboratory for VOC analysis in accordance with USEPA Method TO-14 or TO-15.

13. Analytical results submitted by the laboratory should be reported as concentrations of each VOC at each location, typically in parts per billion by volume (ppbv).

OUTDOOR AIR SAMPLE COLLECTION PROCEDURES

Outdoor air samples must be collected simultaneously with indoor air samples and may be collected concurrently with subsurface vapor samples. Outdoor air samples must be collected in the same manner as indoor samples.

The following actions should be taken to document conditions during outdoor air sampling and ultimately to aid in the interpretation of the sampling results:

- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sample locations (if applicable), the location of potential interferences (e.g., gasoline stations, factories, lawn movers, etc.), compass orientation (north), footings that create separate foundation sections, and paved areas;

- Weather conditions (e.g., precipitation, indoor and outdoor temperature, and barometric pressure) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and

- Any pertinent observations, such as odors, readings from field instrumentation, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) should be recorded.

The following describes the outdoor air sampling procedure:

1. Canisters will be supplied by the laboratory that will be conducting the analysis.

2. Sampling will take place in accordance with the project work plan sufficiently spaced to allow locations to be modified, if necessary.

3. The number of Summa canisters required as well as the flow rate of the constant differential low volume flow controllers will be supplied by the laboratory in accordance with the project work plan.

4. Sample locations typically are collected upwind of the facility.

5. Collect at least one outdoor ambient air sample from a location on the building roof or designated background area of the site positioned away from building ventilation system equipment on the highest portion of the building roof or site. Place canisters on the ground or step ladder, with a clear plastic sheet beneath to prevent contamination. Locate the sampling inlet approximately 18-inches above the ground surface.

6. Sample collection should take place on warm, dry days. If rain or high humidity conditions develop during sampling, the sampling event should be suspended. Temperature, barometric pressure, and wind speed should be monitored during the sampling event, for use in analysis of the results.

7. The combination of sampling location, height, and meteorological conditions will assure that sampling will measure VOCs at their highest concentrations.

8. All Summa Canister valves should remain closed until all subslab borings are complete and all of the indoor and outdoor canisters in their respective positions.

9. Open the valves to all of the canisters for the required collection period (i.e., 24-hours). Record initial canister pressure on the Air Canister Field Record form.

10. Following sample collection and prior to closing canister valve, record final canister pressure on the Air Canister Field Record form. Close canister valve.

11. Collect all Summa Canisters and ship, under chain-of-custody command to an approved analytical laboratory for VOC analysis in accordance with USEPA Method TO-14 or TO-15.

12. Air samples will be analyzed by Gas Chromatography/Mass Spectroscopy (GC/MS) in accordance with EPA Method TO-14 or TO-15.

13. Analytical results will be reported as concentrations of each VOC at each location during each sampling event, typically in parts per billion by volume (ppbv).

TRACER GAS

When collecting soil vapor samples as part of a vapor intrusion evaluation, a tracer gas serves as a quality assurance/quality control device to verify the integrity of the soil vapor probe seal. Without the use of a tracer, there is no way to verify that a soil vapor sample has not been diluted by surface air.

Depending on the nature of the contaminants of concern, a number of different compounds can be used as a tracer. Typically, sulfur hexafluoride (SF6) or helium are used as tracers because they are readily available, have low toxicity, and can be monitored with portable measurement devices. Butane and propane (or other gases) could also be used as a tracer in some situations. The protocol for using a tracer gas is straightforward: simply enrich the atmosphere in the immediate vicinity of the area where the probe intersects the ground surface with the tracer gas, and measure a vapor sample from the probe for the presence of high concentrations (> 10%) of the tracer. A cardboard box, a plastic pail, or even a garbage bag can serve to keep the tracer gas in contact with the probe during the testing.

There are two basic approaches to testing for the tracer gas:

- Include the tracer gas in the list of target analytes reported by the laboratory; or

- Use a portable monitoring device to analyze a sample of soil vapor for the tracer prior to and after sampling for the compounds of concern. (Note that the tracer gas samples can be collected via syringe, Tedlar bag etc. They need not be collected in Summa® canisters or minicans.)

The advantage of the second approach is that the real time tracer sampling results can be used to confirm the integrity of the probe seals prior to formal sample collection. Figure 6 (attached) depicts common methods for using tracer gas. In each of the examples, a, b and c, the tracer gas is released in the enclosure prior to initially purging the sample point. Care should be taken to avoid excessive purging prior to sample collection. Care should also be taken to prevent pressure build-up in the enclosure during introduction of the tracer gas. Inspection of the installed sample probe, specifically noting the integrity of the surface seal and the porosity of the soil in which the probe is installed, will help to determine the tracer gas setup. Figure 6(a) may be most effective at preventing tracer gas infiltration; however, it may not be required in some situations depending on site-specific conditions. Figures 6(b) and 6(c) may be sufficient for probes installed in tight soils with well-constructed surface seals. In all cases, the same tracer gas application should be used for all probes at any given site.

Because minor leakage around the probe seal should not materially affect the usability of the soil vapor sampling results, the mere presence of the tracer gas in the sample should not be a cause for alarm. Consequently, portable field monitoring devices with detection limits in the low ppm range are more than adequate for screening samples for the tracer. If high concentrations (> 10%) of tracer gas are observed in a sample, the probe seal should be enhanced to reduce the infiltration of ambient air.

During the initial stages of a soil vapor sampling program, tracer gas samples should be collected at each of the sampling probes. If the results of the initial samples indicate that the probe seals are adequate, the project manager can consider reducing the number of locations at which tracer gas samples are employed. At a minimum, at least 10% of the subsequent samples should be supported with tracer gas analyses. When using permanent soil vapor probes as part of a long-term monitoring program, annual testing of the probe integrity is recommended.

QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

Extreme care should be taken during all aspects of sample collection to ensure that sampling error is minimized and high quality data are obtained. The sampling team members should avoid actions (e.g., fueling vehicles, using permanent marking pens, and wearing freshly dry-cleaned clothing or personal fragrances), which can cause sample interference in the field. Appropriate QA/QC protocols must be followed for sample collection and laboratory analysis, such as use of certified clean sample devices, meeting sample holding times and temperatures, sample accession, chain of custody, etc. Samples should be delivered to the analytical laboratory as soon as possible after collection. In addition, laboratory accession procedures must be followed including field documentation (sample collection information and locations), chain of custody, field blanks, field sample duplicates, and laboratory duplicates, as appropriate.

Some methods require collecting samples in duplicate (e.g., indoor air sampling using passive sampling devices for tetrachloroethene) to assess errors. Duplicate and/or split samples should be collected in accordance with the requirements of the sampling and analytical methods being implemented.

For certain regulatory programs, a Data Usability Summary Report (DUSR) may be required to determine whether or not the data, as presented, meets the site or project specific criteria for data quality and data use. This requirement may dictate the level of QC and the category of data deliverable to request from the laboratory. Guidance on preparing a DUSR is available by contacting the NYSDEC's Division of Environmental Remediation.

New York State Public Health Law requires laboratories analyzing environmental samples collected from within New York State to have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. If ELAP certification is not currently required for an analyte (e.g., trichloroethene), the analysis should be performed by a laboratory that has ELAP certification for similar compounds in air and uses analytical methods with detection limits similar to background (e.g., tetrachloroethene via EPA Method TO-15).

The work plan must state that all samples that will be used to make decisions on appropriate actions to address exposures and environmental contamination will be analyzed by an ELAP-certified laboratory. If known, the name of the laboratory should also be provided. Similarly, the name of the laboratory that was used must be included in the report of the sampling results. For samples collected and tested in the field for screening purposes by using field testing technology, the qualifications of the field technician must be documented in the work plan.

The target final field vacuum of any sample canister after 24 hours will be approximately -5 inches of mercury. Samples with a final field vacuum of greater than -10 inches of mercury, or equal to zero, will be flagged (usability of data will depend on sample volume and reporting limits that can be achieved).

DECISION MATRICES (FIGURES 1 THROUGH 6)

The considerations in assigning a chemical to a matrix include the following:

- Human health risks, including such factors as a chemical's ability to cause cancer, reproductive, developmental, liver, kidney, nervous system, immune system or other effects, in animals and humans and the doses that may cause those effects;
- The data gaps in its toxicological database;
- Background concentrations of volatile chemicals in indoor air [Section 3.2.4]; and
- Analytical capabilities currently available.

To use the matrices accurately as a tool in the decision-making process, the following must be noted:

- The matrices are generic. As such, it may be necessary to modify recommended actions to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or site-specific conditions (e.g., proximity of building to identified subsurface contamination) for the protection of public health. Additionally, actions more conservative than those specified within the matrix may be implemented at any time. For example, the decision to implement more conservative actions may be based on a comparison of the costs associated with resampling or monitoring to the costs associated with installation and monitoring of a mitigation system.
- Indoor air concentrations detected in samples collected from the building's basement or, if the building has a slab-on-grade foundation, from the building's lowest occupied living space should be used.
- Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude the need to investigate possible sources of vapor contamination, nor does it preclude the need to remediate contaminated soil vapors or the source of soil vapor contamination.

- When current exposures are attributed to sources other than vapor intrusion, the agencies must be provided documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix and to support assessment and follow-up by the agencies.

RECOMMENDED ACTIONS

Actions recommended in the matrix are based on the relationship between sub-slab vapor concentrations and corresponding indoor air concentrations. They are intended to address both potential and current human exposures and include the following:

- *No further action*
  When the volatile chemical is not detected in the indoor air sample and the concentration detected in the corresponding sub-slab vapor sample is not expected to substantially affect indoor air quality.

- *Identify source(s) and resample or mitigate*
  Reasonable and practical actions are recommended to identify the source(s) affecting indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Resampling may be required in the event indoor and/or outdoor sources are not readily identified or confirmed to demonstrate SVI mitigation actions are not needed. Steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile chemical-containing products in places where people do not spend much time, such as a garage or shed). Mitigation may be required if soil vapor intrusion cannot be ruled out.

- *Monitor*
  Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in

the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure HVAC systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building specific basis, taking into account applicable environmental data and building operating conditions.

- *Mitigate*
  Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. Methods to mitigate exposures related to soil vapor intrusion are described in Section 4 of the Guidance.

TIME OF YEAR

Sub-slab vapor samples and, unless there is an immediate need for sampling, indoor air samples are typically collected during the heating season because soil vapor intrusion is more likely to occur when a building's heating system is in operation and air is being drawn into the building. In general, heating systems are expected to be operating routinely from November 15th to March 31st throughout the state. However, this timeframe may vary depending on factors, such as the location of the site (e.g., upstate versus downstate) and the weather conditions for a particular year.

A vapor intrusion investigation may also be conducted outside of the heating season. However, the results may not be used to rule out exposures. For example, results indicating "no further action" or "monitoring required" must be verified during the heating season to ensure these actions are protective during the heating season as well.

SAMPLING ROUNDS

Investigating a soil vapor intrusion pathway usually requires more than one round of subsurface vapor, indoor air, and/or outdoor air sampling, for reasons such as the following:

- To characterize the nature and extent of subsurface vapor contamination (similar to the delineation of groundwater contamination) and to address corresponding exposure concerns;

- To evaluate fluctuations in concentrations due to
  - Different weather conditions (e.g., seasonal effects),
  - Changes in building conditions (e.g., various operating conditions of a building's HVAC system),
  - Changes in source strength, or
  - Vapor migration or contaminant biodegradation processes (particularly when degradation products may be more toxic than the parent compounds); or
- To confirm sampling results or the effectiveness of mitigation or remedial systems.

Overall, successive rounds of sampling are conducted until the following questions can be answered:

- Are subsurface vapors contaminated? If so, what are the nature and extent of contamination? What is/are the source(s) of the contamination?
- What are the current and potential exposures to contaminated subsurface vapors?
- What actions, if any, are needed to prevent or mitigate exposures and to remediate subsurface vapor contamination?

Toward this end, multiple rounds of sampling may be required to characterize the nature and extent of subsurface vapor contamination such that

- Both potential and current exposures are adequately addressed;
- Measures can be designed to remediate subsurface vapor contamination, either directly (e.g., SVE system) or indirectly (e.g., soil excavation or groundwater remediation), given that monitoring and mitigation are considered temporary measures implemented to address exposures related to vapor intrusion until contaminated environmental media are remediated; and
- The effectiveness of remedial measures can be monitored and confirmed (e.g., endpoint sampling).

ATTACHMENTS

Figure 1 *Soil Vapor/Indoor Air Matrix A*
Figure 2 *Soil Vapor/Indoor Air Matrix B*
Figure 3 *Soil Vapor/Indoor Air Matrix C*
Figure 4 *Soil Vapor/Indoor Air Matrix D*
Figure 5 *Soil Vapor/Indoor Air Matrix E*
Figure 6 *Soil Vapor/Indoor Air Matrix F*
Figure 7 *Schematics of a permanent soil vapor probe and permanent nested soil vapor probes*
Figure 8 *Schematic of a sub-slab vapor probe*
Figure 9 *Schematics of tracer gas applications*

Air Canister Field Record

Indoor Air Quality Questionnaire and Building Inventory

REFERENCES

New York State Department of Health, *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, October 2006.

New York State Department of Health, *Indoor Air Sampling & Analysis Guidance.* (February 1, 2005).

Office of Solid Waste and Emergency Response (OSWER). *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)*. November 2002.

United States Environmental Protection Agency. *EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*. 1988

- Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). Pp. 15-1 through 15-62.

- Method TO-17, Determination of Volatile Organic Compounds in Ambient Air using Active Sampling on Sorbent Tubes. Pp. 17-1 through 17-49.

- Compendium of Methods for the Determination of Air Pollutants in Indoor Air, EPA/600/4-90-010.

FIGURE 1

Soil Vapor/Indoor Air Matrix A

May 2017

Analytes Assigned:
Trichloroethene (TCE), *cis*-1,2-Dichloroethene (*c*12-DCE), 1,1-Dichloroethene (11-DCE), Carbon Tetrachloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m³)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m³)	< 0.2	0.2 to < 1	1 and above
< 6	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	4. No further action	5. MONITOR	6. MITIGATE
60 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX A Page 1 of 2

ADDITIONAL NOTES FOR MATRIX A

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

FIGURE 2

Soil Vapor/Indoor Air Matrix B

May 2017

Analytes Assigned:
Tetrachloroethene (PCE), 1,1,1-Trichloroethane (111-TCA), Methylene Chloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m³)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m³)	< 3	3 to < 10	10 and above
< 100	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
100 to < 1,000	4. No further action	5. MONITOR	6. MITIGATE
1,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX B Page 1 of 2

ADDITIONAL NOTES FOR MATRIX B

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

FIGURE 3

Soil Vapor/Indoor Air Matrix C

May 2017

Analytes Assigned:
Vinyl Chloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m³)	
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m³)	< 0.2	0.2 and above
< 6	1. No further action	2. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	3. MONITOR	4. MITIGATE
60 and above	5. MITIGATE	6. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX C Page 1 of 2

ADDITIONAL NOTES FOR MATRIX C

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

FIGURE 4

Soil Vapor/Indoor Air Matrix D

February 2024

Analytes Assigned:
Benzene, ethylbenzene, naphthalene, cyclohexane, isooctane (2,2,4-trimethylpentane), 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, *o*-xylene

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m³)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m³)	< 2	2 to < 10	10 and above
< 60	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) or RESAMPLE or MITIGATE
60 to < 600	4. No further action	5. MONITOR	6. MITIGATE
600 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

mcg/m³ = micrograms per cubic meter

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) or Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation, and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building -specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2. **MATRIX D Page 1 of 2**

ADDITIONAL NOTES FOR MATRIX D

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented ***in lieu*** of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

MATRIX D Page 2 of 2

FIGURE 5

Soil Vapor/Indoor Air Matrix E

February 2024

Analytes Assigned:
***m,p*-xylene, heptane, hexane**

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m³)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m³)	< 6	6 to < 20	20 and above
< 200	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) or RESAMPLE or MITIGATE
200 to < 2,000	4. No further action	5. MONITOR	6. MITIGATE
2,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

mcg/m³ = micrograms per cubic meter

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) or Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation, and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building -specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2. **MATRIX E Page 1 of 2**

ADDITIONAL NOTES FOR MATRIX E

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented ***in lieu*** of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

MATRIX E Page 2 of 2

FIGURE 6

Soil Vapor/Indoor Air Matrix F

February 2024

Analytes Assigned:
Toluene

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m³)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m³)	< 10	10 to < 50	50 and above
< 300	1. No Further Action	2. No Further Action	3. IDENTIFY SOURCE(S) or RESAMPLE or MITIGATE
300 to < 3,000	4. No Further Action	5. MONITOR	6. MITIGATE
3,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

mcg/m³ = micrograms per cubic meter

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) or Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation, and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building -specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2. **MATRIX F Page 1 of 2**

ADDITIONAL NOTES FOR MATRIX F

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented ***in lieu*** of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

MATRIX F Page 2 of 2

FIGURE 7

Schematics of a permanent soil vapor probe and permanent nested soil vapor probes

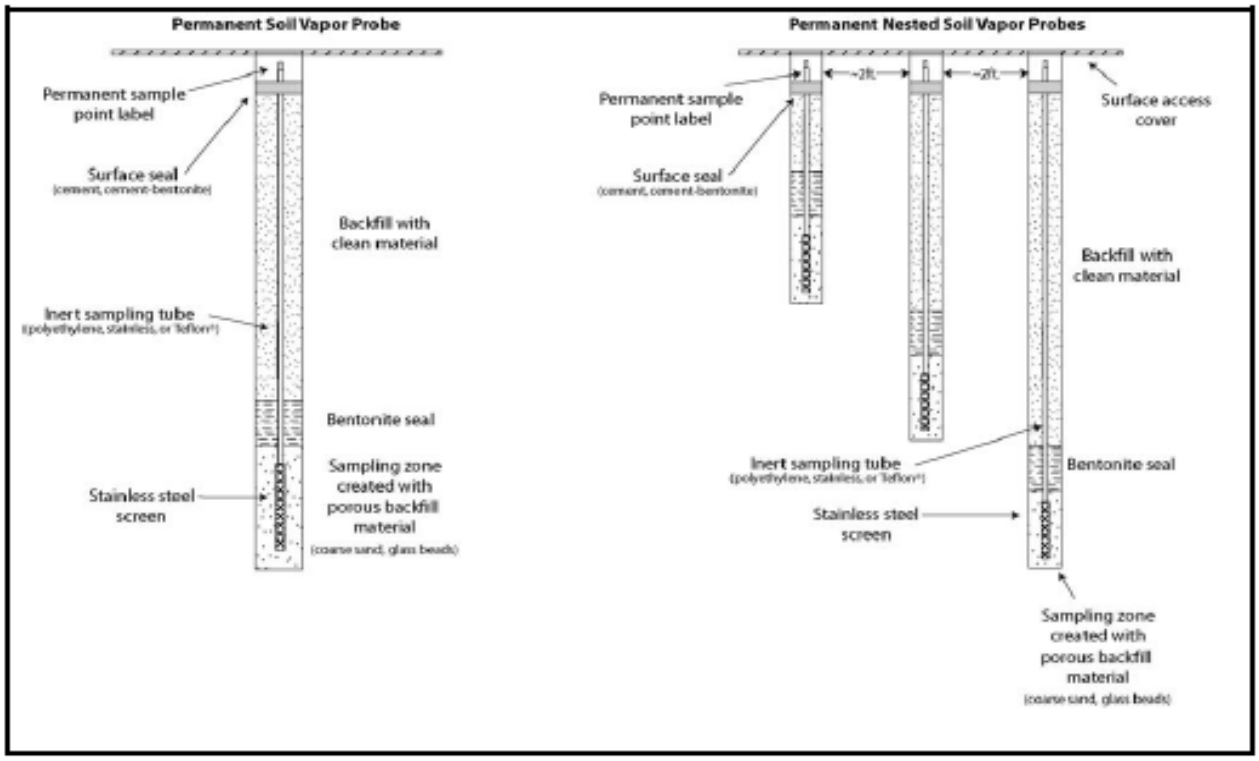


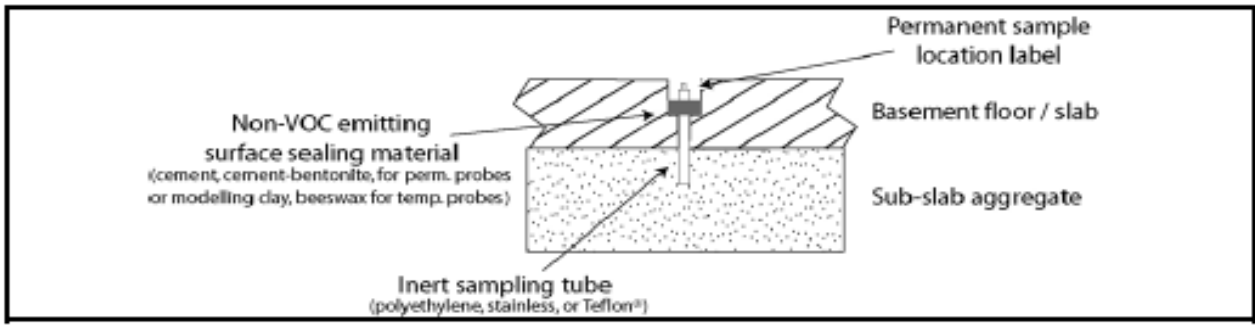






FIGURE 8

Schematic of a sub-slab vapor probe



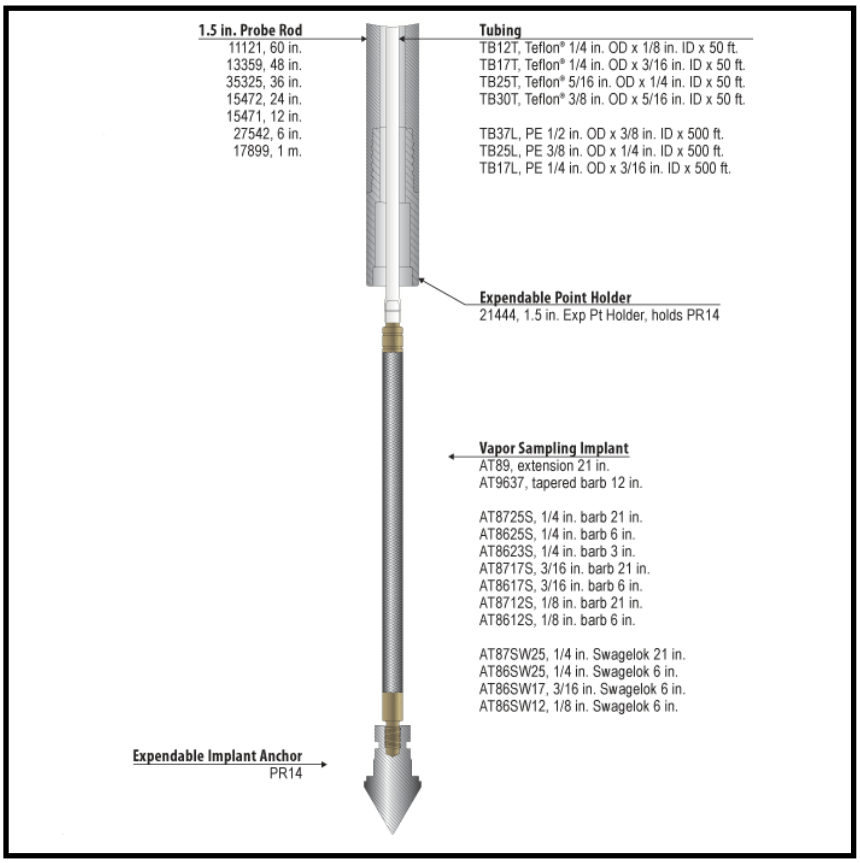
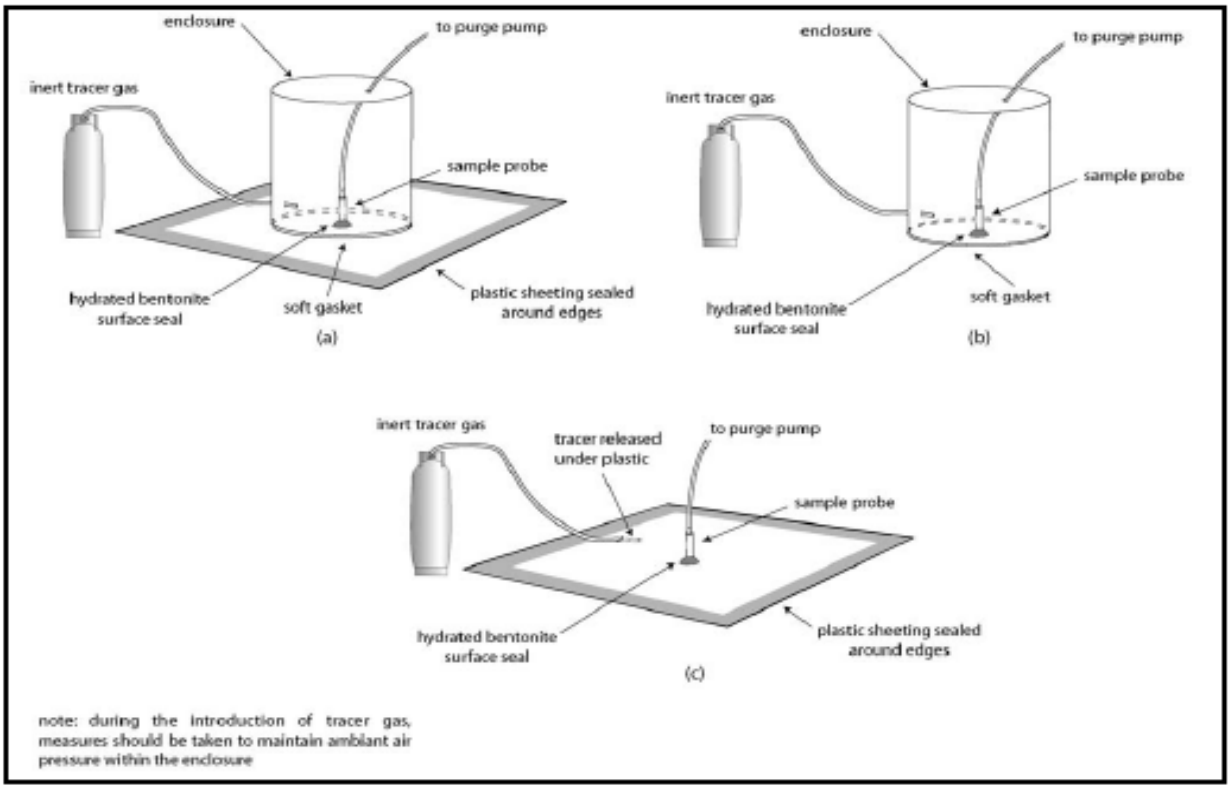


FIGURE 9

Schematics of tracer gas applications







ROUX

AIR CANISTER FIELD RECORD

PROJECT INFORMATION:

Project:
Job No:
Location:
Field Staff:
Client:

SAMPLE I.D.:

Size of Canister:
Canister Serial No.:
Flow Controller No.:
Sample Date(s):
Shipping Date:
Sample Type: ☐ ☐
☐ ☐
Soil Gas Probe Depth:

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.:
Ambient Air Temp. - P.M.:
Wind Direction:
Wind Speed:
Precipitation:

FIELD SAMPLING INFORMATION:

READING	TIME	VACUUM (inches Hg) or PRESSURE (psig)	DATE	INITIALS
Lab Vacuum (on tag)				
Field Vacuum Check [1]				
Initial Field Vacuum [2]				
Final Field Vacuum [3]				
Duration of Sample Collection				

LABORATORY CANISTER PRESSURIZATION:

Initial Vacuum (inches Hg and psia)		
Final Pressure (psia)		
Pressurization Gas		

SUBSLAB SHROUD:

Shroud Helium Concentration:
Calculated tubing volume x 3 =
Purged Tubing Volume Concentration:
Is the purged volume concentration less than or equal to 10% in shroud?
☐
☐

COMPOSITE TIME (hours)	FLOW RATE RANGE (ml/min)
15 Min.	316 - 333
0.5 Hours	158 - 166.7
1	79.2 - 83.3
2	39.6 - 41.7
4	19.8 - 20.8
6	13.2 - 13.9
8	9.9 - 10.4
10	7.92 - 8.3
12	6.6 - 6.9
24	3.5 - 4.0

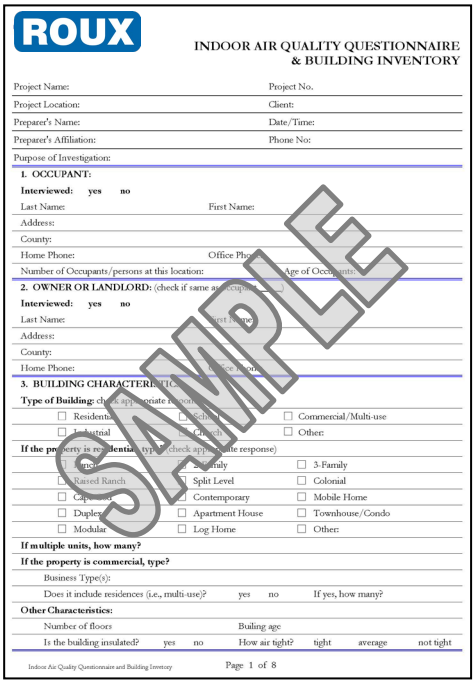
NOTES:

1 Vacuum measured using portable vacuum gauge (provided by Lab)
2 Vacuum measured by canister gauge upon opening valve
3 Vacuum measured by canister gauge prior to closing valve

Signed:

SAMPLE

SOIL VAPOR SAMPLE COLLECTION PROCEDURE



ROUX

INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

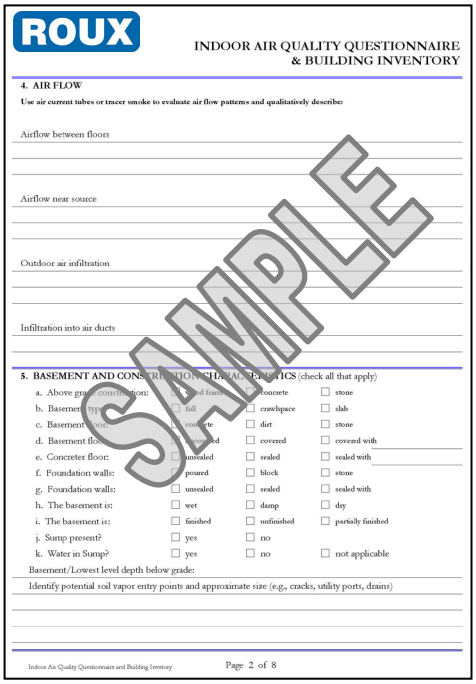
Project Name: Project No.
Project Location: Client:
Preparer's Name: Date/Time:
Preparer's Affiliation: Phone No:
Purpose of Investigation:

1. OCCUPANT:
Interviewed: yes no
Last Name: First Name:
Address:
County:
Home Phone: Office Phone:
Number of Occupants/persons at this location: Age of Occupants:

2. OWNER OR LANDLORD: (check if same as occupant)
Interviewed: yes no
Last Name: First Name:
Address:
County:
Home Phone: Office Phone:

3. BUILDING CHARACTERISTICS
Type of Building: (check appropriate response)
☐ Residential ☐ School ☐ Commercial/Multi-use
☐ Industrial ☐ Church ☐ Other:
If the property is residential, type? (check appropriate response)
☐ Ranch ☐ 2-Family ☐ 3-Family
☐ Raised Ranch ☐ Split Level ☐ Colonial
☐ Cape Cod ☐ Contemporary ☐ Mobile Home
☐ Duplex ☐ Apartment House ☐ Townhouse/Condo
☐ Modular ☐ Log Home ☐ Other:
If multiple units, how many?
If the property is commercial, type?
Business Type(s):
Does it include residences (i.e., multi-use)? yes no If yes, how many?
Other Characteristics:
Number of floors Builing age
Is the building insulated? yes no How air tight? tight average not tight

SAMPLE



ROUX

INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

4. AIR FLOW
Use air current tubes or tracer smoke to evaluate air flow patterns and qualitatively describe:

Airflow between floors

Airflow near source

Outdoor air infiltration

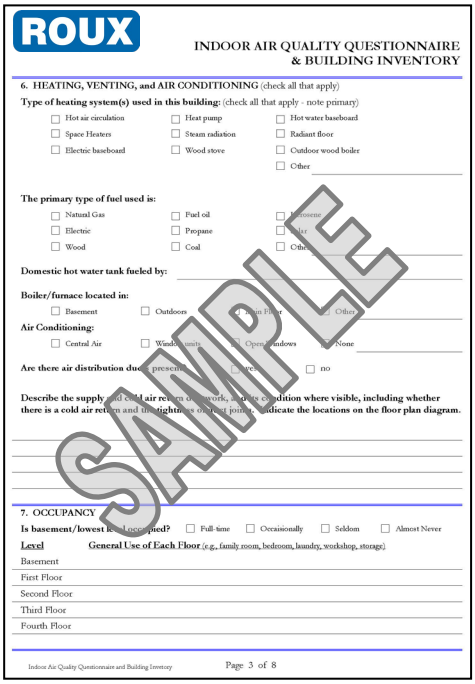
Infiltration into air ducts

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (check all that apply)

a. Above grade construction:	☐ wood frame	☐ concrete	☐ stone
b. Basement type:	☐ full	☐ crawlspace	☐ slab
c. Basement floor:	☐ concrete	☐ dirt	☐ stone
d. Basement floors:	☐ unsealed	☐ covered	☐ covered with
e. Concreter floor:	☐ unsealed	☐ sealed	☐ sealed with
f. Foundation walls:	☐ poured	☐ block	☐ stone
g. Foundation walls:	☐ unsealed	☐ sealed	☐ sealed with
h. The basement is:	☐ wet	☐ damp	☐ dry
i. The basement is:	☐ finished	☐ unfinished	☐ partially finished
j. Sump present?	☐ yes	☐ no	
k. Water in Sump?	☐ yes	☐ no	☐ not applicable

Basement/Lowest level depth below grade:
Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

SAMPLE



ROUX

INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

6. HEATING, VENTING, and AIR CONDITIONING (check all that apply)
Type of heating system(s) used in this building: (check all that apply - note primary)
☐ Hot air circulation ☐ Heat pump ☐ Hot water baseboard
☐ Space Heaters ☐ Steam radiation ☐ Radiant floor
☐ Electric baseboard ☐ Wood stove ☐ Outdoor wood boiler
☐ Other

The primary type of fuel used is:
☐ Natural Gas ☐ Fuel oil ☐ Kerosene
☐ Electric ☐ Propane ☐ Solar
☐ Wood ☐ Coal ☐ Other

Domestic hot water tank fueled by:

Boiler/furnace located in:
☐ Basement ☐ Outdoors ☐ First Floor ☐ Other

Air Conditioning:
☐ Central Air ☐ Window units ☐ Open windows ☐ None

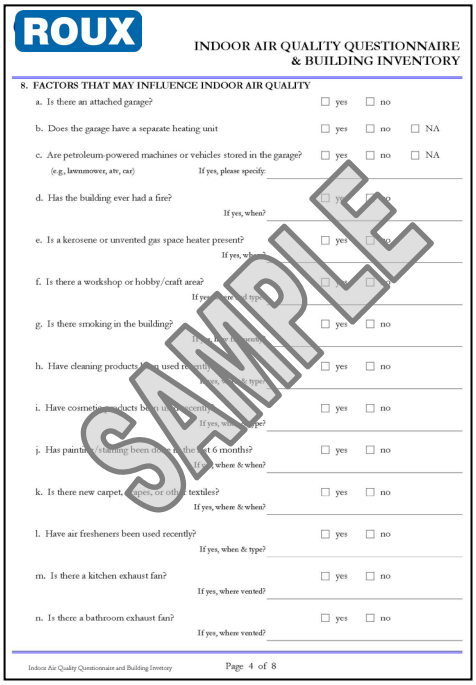
Are there air distribution ducts present? ☐ yes ☐ no

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

7. OCCUPANCY
Is basement/lowest level occupied? ☐ Full-time ☐ Occasionally ☐ Seldom ☐ Almost Never

Level	General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage)
Basement	
First Floor	
Second Floor	
Third Floor	
Fourth Floor	

SAMPLE



ROUX

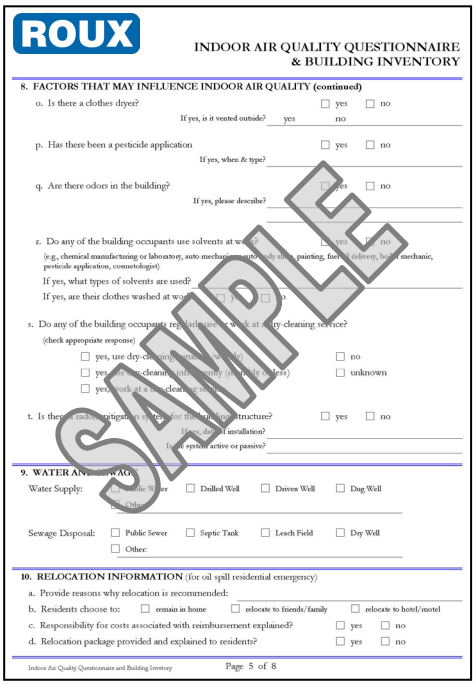
INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage?	☐ yes	☐ no	
b. Does the garage have a separate heating unit	☐ yes	☐ no	☐ NA
c. Are petroleum-powered machines or vehicles stored in the garage? (e.g., lawnmower, atv, car)	☐ yes	☐ no	☐ NA
If yes, please specify:			
d. Has the building ever had a fire?	☐ yes	☐ no	
If yes, when?			
e. Is a kerosene or unvented gas space heater present?	☐ yes	☐ no	
If yes, where?			
f. Is there a workshop or hobby/craft area?	☐ yes	☐ no	
If yes, where and type?			
g. Is there smoking in the building?	☐ yes	☐ no	
If yes, how frequently?			
h. Have cleaning products been used recently?	☐ yes	☐ no	
If yes, when and type?			
i. Have cosmetic products been used recently?	☐ yes	☐ no	
If yes, what type?			
j. Has painting/staining been done in the last 6 months?	☐ yes	☐ no	
If yes, where & when?			
k. Is there new carpet, drapes, or other textiles?	☐ yes	☐ no	
If yes, where & when?			
l. Have air fresheners been used recently?	☐ yes	☐ no	
If yes, when & type?			
m. Is there a kitchen exhaust fan?	☐ yes	☐ no	
If yes, where vented?			
n. Is there a bathroom exhaust fan?	☐ yes	☐ no	
If yes, where vented?			

SAMPLE

SOIL VAPOR SAMPLE COLLECTION PROCEDURE



ROUX

INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY (continued)

o. Is there a clothes dryer? ☐ yes ☐ no

If yes, is it vented outside? yes no

p. Has there been a pesticide application ☐ yes ☐ no

If yes, when & type?

q. Are there odors in the building? ☐ yes ☐ no

If yes, please describe?

r. Do any of the building occupants use solvents at work? ☐ yes ☐ no

(e.g., chemical manufacturing or laboratory, auto mechanic, auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist)

If yes, what types of solvents are used?

If yes, are their clothes washed at work? ☐ yes ☐ no

s. Do any of the building occupants regularly work at a dry-cleaning service?

(check appropriate response)

☐ yes, use dry-cleaning service frequently ☐ no

☐ yes, dry-cleaning service employ (number of employees) ☐ unknown

☐ yes, work at a dry-cleaning service

t. Is there a radon mitigation system for the building/structure? ☐ yes ☐ no

If yes, date of installation?

Is the system active or passive?

9. WATER AND SEWAGE

Water Supply: ☐ Public Water ☐ Drilled Well ☐ Driven Well ☐ Dug Well

If Public Water, Source:

Sewage Disposal: ☐ Public Sewer ☐ Septic Tank ☐ Leach Field ☐ Dry Well

☐ Other:

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended:

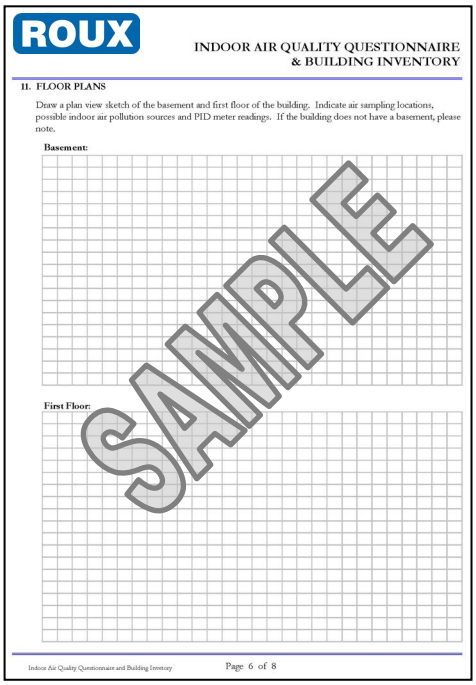
b. Residents choose to: ☐ remain in home ☐ relocate to friends/family ☐ relocate to hotel/motel

c. Responsibility for costs associated with reimbursement explained? ☐ yes ☐ no

d. Relocation package provided and explained to residents? ☐ yes ☐ no

Indoor Air Quality Questionnaire and Building Inventory Page 5 of 8

SAMPLE



ROUX

INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

11. FLOOR PLANS

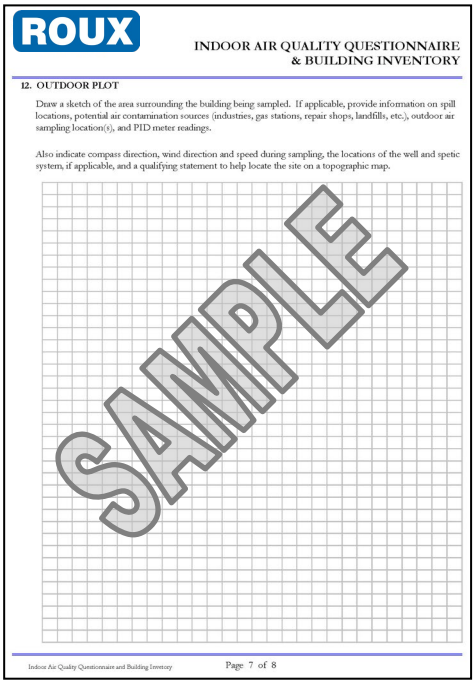
Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:

First Floor:

Indoor Air Quality Questionnaire and Building Inventory Page 6 of 8

SAMPLE



ROUX

INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

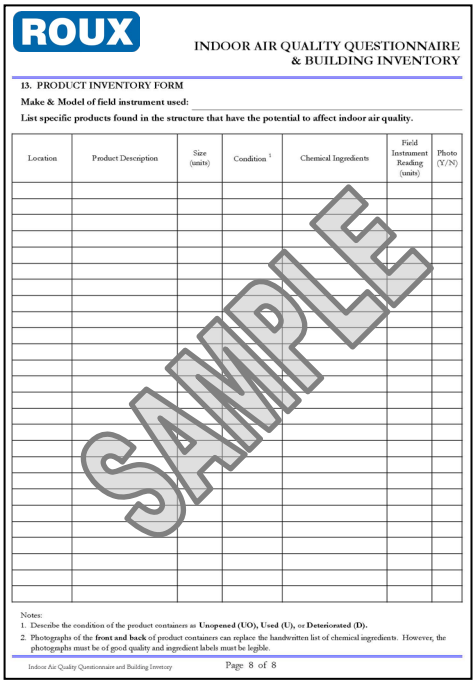
12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s), and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and spetic system, if applicable, and a qualifying statement to help locate the site on a topographic map.

Indoor Air Quality Questionnaire and Building Inventory Page 7 of 8

SAMPLE



ROUX

INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

13. PRODUCT INVENTORY FORM

Make & Model of field instrument used:

List specific products found in the structure that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition [1]	Chemical Ingredients	Field Instrument Reading (units)	Photo (Y/N)

Notes:

1. Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D).**
2. Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

Indoor Air Quality Questionnaire and Building Inventory Page 8 of 8

SAMPLE

FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Dissolved Oxygen Meter

FOP 007.0

CALIBRATION AND MAINTENANCE OF PORTABLE DISSOLVED OXYGEN METER

PURPOSE

This guideline describes a method for calibration of a portable dissolved oxygen meter. This meter measures the concentration of dissolved oxygen within a water sample. This parameter is of interest both as a general indicator of water quality, and because of its pertinence to fate and transport of organics and inorganics. This guideline presents a method for calibration of this meter, which is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the dissolved oxygen meter will be within ± 1% of full-scale over the temperature range of 23° to 113° F (-5° to +45° C).

PROCEDURE

1. Calibrate the dissolved oxygen meter to ambient air based on probe temperature and true local atmospheric pressure conditions (or feet above sea level). Because procedures vary with different brands and models of meters, refer to the manufacturer's recommended calibration procedures.

2. In the event of a failure to adequately calibrate, follow the corrective action directed by the manufacturer.
3. If calibration cannot be achieved or maintained, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

4. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:
    - Time, date, and initials of the field team member performing the calibration
    - The unique identifier for the meter, including manufacturer, model, and serial number
    - The brand and expiration dates of calibration solutions
    - The calibration readings
    - The instrument settings (if applicable)
    - The approximate response time
    - The overall adequacy of calibration including the Pass or fail designation in accordance with the accuracy specifications presented above
    - Corrective action taken (see Step 5 above) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use or between measurements, the dissolved oxygen probe will be kept immersed in or moist with deionized water.

- The meter batteries will be checked prior to each meter's use and will be replaced when the meter cannot be redline adjusted.

- The meter response time and stability will be tracked to determine the need for instrument maintenance. When response time becomes greater than two minutes, probe service is indicated.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 007.0

CALIBRATION AND MAINTENANCE OF PORTABLE DISSOLVED OXYGEN METER

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re
						____ ppm Iso. Gas		factor =
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

SAMPLE

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Field pH/Eh Meter

FOP 008.0

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH/Eh METER

PURPOSE

This guideline describes a method for calibration of a portable pH/Eh meter. The pH/Eh meter measures the hydrogen ion concentration or acidity of a water sample (pH function), and the oxidation/reduction potential of a water sample (Eh function). Calibration is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the pH/Eh meter will be:

pH ± 0.2 pH unit, over the temperature range of ± 0.2 C.

Eh ± 0.2 millivolts (mV) over the range of ± 399.9 mV, otherwise ± 2 mV.

PROCEDURE

Note: Meters produced by different manufacturers may have different calibration procedures. These instructions will take precedence over the procedure provided herein. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

1. Obtain and active the meter to be used. As stated above, initial calibrations will be performed at the beginning of each sampling day.

2. Immerse the sensing probe in a container of certified pH 7.0 buffer solution traceable to the National Bureau of Standards.

3. Measure the temperature of the buffer solution, and adjust the temperature setting accordingly.

4. Compare the meter reading to the known value of the buffer solution while stirring. If the reading obtained by the meter does not agree with the known value of the buffer solution, recalibrate the meter according to the manufacturer's instructions until the desired reading is obtained. This typically involves accessing and turning a dial or adjustment screw while measuring the pH of the buffer solution. The meter is adjusted until the output agrees with the known solution pH.

5. Repeat Steps 2 through 5 with a pH 4.0 and 10.0 buffer solution to provide a three-point calibration. Standards used to calibrate the pH meter will be of concentrations that bracket the expected values of the samples to be analyzed, especially for two-point calibrations (see note below).

Note: Some pH meters only allow two-point calibrations. Two-point calibrations should be within the suspected range of the groundwater to be analyzed. For example, if the groundwater pH is expected to be approximately 8, the two-point calibration should bracket that value. Buffer solutions of 7 and 10 should then be used for the two-point calibration.

6. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:

   - Time, date, and initials of the field team member performing the calibration
   - The unique identifier for the meter, including manufacturer, model, and serial number
   - The brand and expiration dates of buffer solutions
   - The instrument readings
   - The instrument settings (if applicable)

- Pass or fail designation in accordance with the accuracy specifications presented above
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use, or between measurements, keep the pH/Eh probe immersed in or moist with buffer solutions.

- Check the meter batteries at the end of each day and recharge or replace as needed.

- Replace the pH/Eh probe any time that the meter response time becomes greater than two minutes or the meeting system consistently fails to retain its calibrated accuracy for a minimum of ten sample measurements.

- If a replacement of the pH/Eh probe fails to resolve instrument response time and stability problems, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 008.0

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH/Eh METER

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re
						____ ppm Iso. Gas		factor =
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

SAMPLE

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Field Turbidity Meter

FOP 009.0

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD TURBIDITY METER

PURPOSE

This guideline describes the method for calibration of the HACH 2100P portable field turbidity meter. Turbidity is one water quality parameter measured during purging and development of wells. Turbidity is measured as a function of the samples ability to transmit light, expressed as Nephelometric Turbidity Units (NTUs). The turbidity meter is factory calibrated and must be checked daily prior to using the meter in the field. Calibration is performed to verify instrument accuracy and function. This procedure also documents critical maintenance activities for this meter.

ACCURACY

Accuracy shall be ± 2% of reading below 499 NTU or ± 3% of reading above 500 NTU with resolution to 0.01 NTU in the lowest range. The range key provides for automatic or manual range selection for ranges of 0.00 to 9.99, 0.0 to 99.9 and 0 to 1000 NTU. Another key provides for selecting automatic signal averaging. Pressing the key shall toggle signal averaging on or off.

PROCEDURE

Calibration of the 2100P Turbidimeter is based on formazin, the primary standard for turbidity. The instrument's electronic and optical design provides long-term stability and minimizes the need for frequent calibration. The two-detector ratioing system compensates for most fluctuations in lamp output. **A formazin recalibration should be performed at least once every three months,** more often if experience indicates the need. During calibration, use a primary standard such as StablCal™ Stabilized Standards or formazin standards.

Note: Meters produced by different manufacturers may have different calibration check procedures. These manufacturers' instructions will take precedence over the procedure provided here. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

Note: Because the turbidity meter measures light transmission, it is critical that the meter and standards be cared for as precision optical instruments. Scratches, dirt, dust, etc. can all temporarily or permanently affect the accuracy of meter readings.

Preparing StablCal Stabilized Standards in Sealed Vials

Sealed vials that have been sitting undisturbed for longer than a month must be shaken to break the condensed suspension into its original particle size. Start at *step 1* for these standards. If the standards are used on at least a weekly interval, start at *step 3*.

Note: These instructions do not apply to < 0.1 NTU StablCal Standards; < 0.1 NTU StablCal Standards should not be shaken or inverted.

1. Shake the standard vigorously for 2-3 minutes to re-suspend any particles.
2. Allow the standard to stand undisturbed for 5 minutes.
3. Gently invert the vial of StablCal 5 to 7 times.
4. Prepare the vial for measurement using traditional preparation techniques. This usually consists of oiling the vial (see *Section 2.3.2 on page 11 of the manual*)

and marking the vial to maintain the same orientation in the sample cell compartment (see *Section 2.3.3 on page 12 of the manual*). This step will eliminate any optical variations in the sample vial.

5. Let the vial stand for one minute. The standard is now ready for use in the calibration procedure.

Calibration Procedure

1. Turn the meter on.

2. Shake pre-mixed formazin primary standards in accordance with the above procedure.

3. Wipe the outside of the < 0.1 NTU standard and insert the sample cell in the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment.

4. Close the lid and press **I/O**.

5. Press the **CAL** button. The **CAL** and **S0** icons will be displayed and the 0 will flash. The four-digit display will show the value of the **S0** standard for the previous calibration. If the blank value was forced to 0.0, the display will be blank. Press the right arrow key (→) to get a numerical display.

6. Press **READ**. The instrument will count from 60 to 0, read the blank and use it to calculate a correction factor for the 20 NTU standard measurement. If the dilution water is ≥ 0.5 NTU, E 1 will appear when the calibration is calculated (*see Section 3.6.2.3 on page 31 of the manual*). The display will automatically increment to the next standard. Remove the sample cell from the cell compartment

Note: The turbidity of the dilution water can be "forced" to zero by pressing → rather than reading the dilution water. The display will show "S0 NTU" and the ↑ key must be pressed to continue with the next standard.

7. Repeat steps 1 through 7 for the 20, 100 and 800 standards.

8. Following the 800 NTU standard calibration, the display will increment back to the **S0** display. Remove the sample cell from the cell compartment.

9. Press **CAL** to accept the calibration. The instrument will return to measurement mode automatically.

10. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:
    - Time, date, and initials of the field team member performing the calibration
    - The unique identifier for the meter, including manufacturer, model, and serial number
    - The brand of calibration standards
    - The instrument readings
    - The instrument settings (if applicable)
    - Pass or fail designation in accordance with the accuracy specifications presented above
    - Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

Note: Pressing CAL completes the calculation of the calibration coefficients. If calibration errors occurred during calibration, error messages will appear after CAL is pressed. If E 1 or E 2 appear, check the standard preparation and review the calibration; repeat the calibration if necessary. If "CAL?" appears, an error may have

occurred during calibration. If "CAL?" is flashing, the instrument is using the default calibration.

NOTES

- If the **I/O** key is pressed during calibration, the new calibration data is lost and the old calibration will be used for measurements. Once in calibration mode, only the **READ, I/O,** ↑ , and →keys function. Signal averaging and range mode must be selected before entering the calibration mode.

- If **E 1** or **E 2** are displayed, an error occurred during calibration. Check the standard preparation and review the calibration; repeat the calibration if necessary. Press **DIAG** to cancel the error message (**E 1** or **E 2)**. To continue without repeating the calibration, press **I/O** twice to restore the previous calibration. If "**CAL?"** is displayed, an error may have occurred during calibration. The previous calibration may not be restored. Either recalibrate or use the calibration as is.

- To review a calibration, press **CAL** and then ↑ to view the calibration standard values. As long as **READ** is never pressed and **CAL** is not flashing, the calibration will not be updated. Press **CAL** again to return to the measurement mode.

MAINTENANCE

- **Cleaning**: Keep the turbidimeter and accessories as clean as possible and store the instrument in the carrying case when not in use. Avoid prolonged exposure to sunlight and ultraviolet light. Wipe spills up promptly. Wash sample cells with non-abrasive laboratory detergent, rinse with distilled or demineralized water, and air dry. Avoid scratching the cells and wipe all moisture and fingerprints off the cells before inserting them into the instrument. Failure to do so can give inaccurate readings. See *Section 2.3.1 on page 11of the manual* for more information about sample cell care.

- **Battery Replacement**: AA alkaline cells typically last for about 300 tests with the signal-averaging mode off, about 180 tests if signal averaging is used. The "battery" icon flashes when battery replacement is needed. Refer to *Section 1.4.2 on page 5 of the manual* for battery installation instructions. If the batteries are changed within 30

seconds, the instrument retains the latest range and signal average selections. If it takes more than 30 seconds, the instrument uses the default settings. If, after changing batteries, the instrument will not turn off or on and the batteries are good, remove the batteries and reinstall them. If the instrument still won't function, contact Hach Service or the nearest authorized dealer.

- **Lamp Replacement**: The procedure in *Section 4.0 on page 49 of the manual* explains lamp installation and electrical connections. Use a small screwdriver to remove and install the lamp leads in the terminal block. The instrument requires calibration after lamp replacement.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 009.0

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD TURBIDITY METER

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re
						____ ppm Iso. Gas		factor =
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

SAMPLE

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Photoionization Detector (PID)

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

PURPOSE

This procedure describes a general method for the calibration and maintenance of a portable photoionization detector (PID). The PID detects and initially quantifies a reading of the volatile organic compound (VOC) concentration in air. The PID is used as a field-screening tool for initial evaluation of soil samples and for ambient air monitoring of compounds with ionization potentials (IP) less than the PID lamp electron voltage (eV) rating. The IP is the amount of energy required to move an electron to an infinite distance from the nucleus thus creating a positive ion plus an electron. It should be noted that all of the major components of air (i.e., carbon dioxide, methane, nitrogen, oxygen etc.) have IP's above 12 eV. As a result, they will not be ionized by the 9.8, 10.6, or 11.7 eV lamps typically utilized in field PIDs. The response of the PID will then be the sum of the organic and inorganic compounds in air that are ionized by the appropriate lamp (i.e., 9.8, 10.6 or 11.7 eV). Attached to this FOP is a table summarizing common organic compounds and their respective IPs.

Calibration is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Compound-specific calibration methods should be selected on a project-by-project basis to increase the accuracy of the instrument. The best way to calibrate a PID to different compounds is to use a standard of the gas of interest. However, correction factors have been determined that enable the user to quantify a large number of chemicals using only a single calibration gas, typically isobutylene. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

Note: The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the MiniRAE 2000 Portable VOC Monitor equipped with a 10.6 eV lamp. The actual equipment to be used in the field will be equivalent or similar. The following information is provided for general reference; the equipment-specific manufacturer's manual should be followed with precedence over this FOP.

Note: The PID indicates total VOC concentration readings that are normalized to a calibration standard, so actual quantification of individual compounds is not provided. In addition, the PID response to compounds is highly variable, dependent on ionization potential of the compound, and the presence or absence of other compounds.

ACCURACY

The MiniRAE 2000 is accurate to ± 2 ppm or 10% of the reading for concentrations ranging from 0-2,000 ppm and ± 20% of the reading at concentrations greater than 2,000 ppm. Response time is less than two seconds to 90 percent of full-scale. The operating temperature range is 0 to 45° C and the operating humidity range is 0 to 95 % relative humidity (non-condensing).

CALIBRATION PROCEDURE

The calibration method and correction factor, if applicable, will be selected on a project-by-project basis and confirmed with the Project Manager prior to the start of field work.

1. Calibrate all field test equipment at the beginning of each sampling day. Check and recalibrate the PID according to the manufacture's specifications.

2. Calibrate the PID using a compressed gas cylinder or equivalent containing the calibration standard, a flow regulator, and a tubing assembly. In addition, a compressed gas cylinder containing zero air ("clean" air) may be required if ambient air conditions do not permit calibration to "clean air".

3. Fill two Tedlar® bags equipped with a one-way valve with zero-air (if applicable) and the calibration standard gas.

4. Assemble the calibration equipment and actuate the PID in its calibration mode.

5. Select the appropriate calibration method. Calibration may be completed with two methods: 1) where the calibration standard gas is the same as the measurement gas (no correction factor is applied) or 2) where the calibration standard gas is not the same as the measurement gas and a correction factor will be applied. An isobutylene standard gas must be used as the calibration standard gas for the use of correction factors with the MiniRAE 2000. See below for additional instructions for calibration specific to use with or without correction factors.

Calibrating Without a Correction Factor

Navigate within the menu to select the "cal memory" for the specific calibration standard gas prior to calibration. The default gas selections for the MiniRAE 2000 are as follows:

Cal Memory #0	Isobutylene
Cal Memory #1	Hexane
Cal Memory #2	Xylene
Cal Memory #3	Benzene
Cal Memory #4	Styrene
Cal Memory #5	Toluene
Cal Memory #6	Vinyl Chloride
Cal Memory #7	Custom

The calibration standard gas for Cal Memory #1-7 may be toggled for selection of any of the approximately 100 preprogrammed calibration standard gases for use without an applied correction factor (i.e., the calibration gas must be the same as the measurement gas).

Calibrating With a Correction Factor

Navigate within the menu to select the "Cal Memory".

Select "Cal Memory #0" and toggle for selection of any of the approximately 100 preprogrammed chemicals. During calibration, the unit requests isobutylene gas and displays the isobutylene concentration immediately following calibration, but when the unit is returned to the normal reading mode, it displays the selected chemical and applies the correction factor.

If the pre-programmed list does not include the desired chemical or a user-defined measurement gas and correction factor is desired, toggle Cal Memory #0 to "user defined custom gas". A list of approximately 300 correction factors is attached in Technical Note 106 generated by MiniRAE.

6. Once the PID settings have been verified, connect the PID probe to the zero air calibration bag (or calibrate to ambient air if conditions permit) and wait for a stable indication.

7. Connect the PID probe to the calibration standard bag. Measure an initial reading of the standard and wait for a stable indication.

8. Keep the PID probe connected to the calibration standard bag, calibrate to applicable concentration (typically 100 ppm with isobutylene) with the standard and wait for a stable indication.

9. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample), indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish

maintenance schedules and component replacement. Information will include, at a minimum:

- Time, date and initials of the field team member performing the calibration
- The unique identifier for the meter, including manufacturer, model, and serial number
- The calibration standard and concentration
- Correction factors used, if any
- The brand and expiration date of the calibration standard gas
- The instrument readings: before and after calibration
- The instrument settings (if applicable)
- Pass or fail designation in accordance with the accuracy specifications presented above
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

MAINTENANCE

- The probe and dust filter of the PID should be checked before and after every use for cleanliness. Should instrument response become unstable, recalibration should be performed. If this does not resolve the problem, access the photoionization bulb and clean with the manufacturer-supplied abrasive compound, then recalibrate.

- The PID battery must be recharged after each use. Store the PID in its carrying case when not in use. Additional maintenance details related to individual components of the PID are provided in the equipment manufacturer's instruction manual. If calibration or instrument performance is not in accordance with specifications, send the instrument to the equipment manufacturer for repair.

- Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

ATTACHMENTS

Table 1; Summary of Ionization Potentials
Equipment Calibration Log (sample)
Technical Note TN-106

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
A		
2-Amino pyridine	8	
Acetaldehyde	10.21	
Acetamide	9.77	
Acetic acid	10.69	X
Acetic anhydride	10	
Acetone	9.69	
Acetonitrile	12.2	X
Acetophenone	9.27	
Acetyl bromide	10.55	
Acetyl chloride	11.02	X
Acetylene	11.41	X
Acrolein	10.1	
Acrylamide	9.5	
Acrylonitrile	10.91	X
Allyl alcohol	9.67	
Allyl chloride	9.9	
Ammonia	10.2	
Aniline	7.7	
Anisidine	7.44	
Anisole	8.22	
Arsine	9.89	
B		
1,3-Butadiene (butadiene)	9.07	
1-Bromo-2-chloroethane	10.63	X
1-Bromo-2-methylpropane	10.09	
1-Bromo-4-fluorobenzene	8.99	
1-Bromobutane	10.13	
1-Bromopentane	10.1	
1-Bromopropane	10.18	
1-Bromopropene	9.3	
1-Butanethiol	9.14	
1-Butene	9.58	
1-Butyne	10.18	
2,3-Butadione	9.23	
2-Bromo-2-methylpropane	9.89	
2-Bromobutane	9.98	
2-Bromopropane	10.08	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
2-Bromothiophene	8.63	
2-Butanone (MEK)	9.54	
3-Bromopropene	9.7	
3-Butene nitrile	10.39	
Benzaldehyde	9.53	
Benzene	9.25	
Benzenethiol	8.33	
Benzonitrile	9.71	
Benzotrifluoride	9.68	
Biphenyl	8.27	
Boron oxide	13.5	X
Boron trifluoride	15.56	X
Bromine	10.54	
Bromobenzene	8.98	
Bromochloromethane	10.77	X
Bromoform	10.48	
Butane	10.63	X
Butyl mercaptan	9.15	
cis-2-Butene	9.13	
m-Bromotoluene	8.81	
n-Butyl acetate	10.01	
n-Butyl alcohol	10.04	
n-Butyl amine	8.71	
n-Butyl benzene	8.69	
n-Butyl formate	10.5	
n-Butyraldehyde	9.86	
n-Butyric acid	10.16	
n-Butyronitrile	11.67	X
o-Bromotoluene	8.79	
p-Bromotoluene	8.67	
p-tert-Butyltoluene	8.28	
s-Butyl amine	8.7	
s-Butyl benzene	8.68	
sec-Butyl acetate	9.91	
t-Butyl amine	8.64	
t-Butyl benzene	8.68	
trans-2-Butene	9.13	
C		

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
1-Chloro-2-methylpropane	10.66	X
1-Chloro-3-fluorobenzene	9.21	
1-Chlorobutane	10.67	X
1-Chloropropane	10.82	X
2-Chloro-2-methylpropane	10.61	X
2-Chlorobutane	10.65	X
2-Chloropropane	10.78	X
2-Chlorothiophene	8.68	
3-Chloropropene	10.04	
Camphor	8.76	
Carbon dioxide	13.79	X
Carbon disulfide	10.07	
Carbon monoxide	14.01	X
Carbon tetrachloride	11.47	X
Chlorine	11.48	X
Chlorine dioxide	10.36	
Chlorine trifluoride	12.65	X
Chloroacetaldehyde	10.61	X
α -Chloroacetophenone	9.44	
Chlorobenzene	9.07	
Chlorobromomethane	10.77	X
Chlorofluoromethane (Freon 22)	12.45	X
Chloroform	11.37	X
Chlorotrifluoromethane (Freon 13)	12.91	X
Chrysene	7.59	
Cresol	8.14	
Crotonaldehyde	9.73	
Cumene (isopropyl benzene)	8.75	
Cyanogen	13.8	X
Cyclohexane	9.8	
Cyclohexanol	9.75	
Cyclohexanone	9.14	
Cyclohexene	8.95	
Cyclo-octatetraene	7.99	
Cyclopentadiene	8.56	
Cyclopentane	10.53	
Cyclopentanone	9.26	
Cyclopentene	9.01	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Cyclopropane	10.06	
m-Chlorotoluene	8.83	
o-Chlorotoluene	8.83	
p-Chlorotoluene	8.7	
D		
1,1-Dibromoethane	10.19	
1,1-Dichloroethane	11.12	X
1,1-Dimethoxyethane	9.65	
1,1-Dimethylhydrazine	7.28	
1,2-Dibromoethene	9.45	
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	12.2	X
1,2-Dichloroethane	11.12	X
1,2-Dichloropropane	10.87	X
1,3-Dibromopropane	10.07	
1,3-Dichloropropane	10.85	X
2,2-Dimethyl butane	10.06	
2,2-Dimethyl propane	10.35	
2,3-Dichloropropene	9.82	
2,3-Dimethyl butane	10.02	
3,3-Dimethyl butanone	9.17	
cis-Dichloroethene	9.65	
Decaborane	9.88	
Diazomethane	9	
Diborane	12	X
Dibromochloromethane	10.59	
Dibromodifluoromethane	11.07	X
Dibromomethane	10.49	
Dibutylamine	7.69	
Dichlorodifluoromethane (Freon 12)	12.31	X
Dichlorofluoromethane	12.39	X
Dichloromethane	11.35	X
Diethoxymethane	9.7	
Diethyl amine	8.01	
Diethyl ether	9.53	
Diethyl ketone	9.32	
Diethyl sulfide	8.43	
Diethyl sulfite	9.68	
Difluorodibromomethane	11.07	X

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Dihydropyran	8.34	
Diiodomethane	9.34	
Diisopropylamine	7.73	
Dimethoxymethane (methylal)	10	
Dimethyl amine	8.24	
Dimethyl ether	10	
Dimethyl sulfide	8.69	
Dimethylaniline	7.13	
Dimethylformamide	9.18	
Dimethylphthalate	9.64	
Dinitrobenzene	10.71	X
Dioxane	9.19	
Diphenyl	7.95	
Dipropyl amine	7.84	
Dipropyl sulfide	8.3	
Durene	8.03	
m-Dichlorobenzene	9.12	
N,N-Diethyl acetamide	8.6	
N,N-Diethyl formamide	8.89	
N,N-Dimethyl acetamide	8.81	
N,N-Dimethyl formamide	9.12	
o-Dichlorobenzene	9.06	
p-Dichlorobenzene	8.95	
p-Dioxane	9.13	
trans-Dichloroethene	9.66	
E		
Epichlorohydrin	10.2	
Ethane	11.65	X
Ethanethiol (ethyl mercaptan)	9.29	
Ethanolamine	8.96	
Ethene	10.52	
Ethyl acetate	10.11	
Ethyl alcohol	10.48	
Ethyl amine	8.86	
Ethyl benzene	8.76	
Ethyl bromide	10.29	
Ethyl chloride (chloroethane)	10.98	X
Ethyl disulfide	8.27	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Ethyl ether	9.51	
Ethyl formate	10.61	X
Ethyl iodide	9.33	
Ethyl isothiocyanate	9.14	
Ethyl mercaptan	9.29	
Ethyl methyl sulfide	8.55	
Ethyl nitrate	11.22	X
Ethyl propionate	10	
Ethyl thiocyanate	9.89	
Ethylene chlorohydrin	10.52	
Ethylene diamine	8.6	
Ethylene dibromide	10.37	
Ethylene dichloride	11.05	X
Ethylene oxide	10.57	
Ethylenelmine	9.2	
Ethynylbenzene	8.82	
F		
2-Furaldehyde	9.21	
Fluorine	15.7	X
Fluorobenzene	9.2	
Formaldehyde	10.87	X
Formamide	10.25	
Formic acid	11.05	X
Freon 11 (trichlorofluoromethane)	11.77	X
Freon 112 (1,1,2,2-tetrachloro-1,2-difluoroethane)	11.3	X
Freon 113 (1,1,2-trichloro-1,2,2-trifluororethane)	11.78	X
Freon 114 (1,2-dichloro-1,1,2,2-tetrafluoroethane)	12.2	X
Freon 12 (dichlorodifluoromethane)	12.31	X
Freon 13 (chlorotrifluoromethane)	12.91	X
Freon 22 (chlorofluoromethane)	12.45	X
Furan	8.89	
Furfural	9.21	
m-Fluorotoluene	8.92	
o-Fluorophenol	8.66	
o-Fluorotoluene	8.92	
p-Fluorotoluene	8.79	
H		
1-Hexene	9.46	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
2-Heptanone	9.33	
2-Hexanone	9.35	
Heptane	10.08	
Hexachloroethane	11.1	X
Hexane	10.18	
Hydrazine	8.1	
Hydrogen	15.43	X
Hydrogen bromide	11.62	X
Hydrogen chloride	12.74	X
Hydrogen cyanide	13.91	X
Hydrogen fluoride	15.77	X
Hydrogen iodide	10.38	
Hydrogen selenide	9.88	
Hydrogen sulfide	10.46	
Hydrogen telluride	9.14	
Hydroquinone	7.95	
I		
1-Iodo-2-methylpropane	9.18	
1-Iodobutane	9.21	
1-Iodopentane	9.19	
1-Iodopropane	9.26	
2-Iodobutane	9.09	
2-Iodopropane	9.17	
Iodine	9.28	
Iodobenzene	8.73	
Isobutane	10.57	
Isobutyl acetate	9.97	
Isobutyl alcohol	10.12	
Isobutyl amine	8.7	
Isobutyl formate	10.46	
Isobutyraldehyde	9.74	
Isobutyric acid	10.02	
Isopentane	10.32	
Isophorone	9.07	
Isoprene	8.85	
Isopropyl acetate	9.99	
Isopropyl alcohol	10.16	
Isopropyl amine	8.72	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Isopropyl benzene	8.69	
Isopropyl ether	9.2	
Isovaleraldehyde	9.71	
m-Iodotoluene	8.61	
o-Iodotoluene	8.62	
p-Iodotoluene	8.5	
K		
Ketene	9.61	
L		
2,3-Lutidine	8.85	
2,4-Lutidine	8.85	
2,6-Lutidine	8.85	
M		
2-Methyl furan	8.39	
2-Methyl napthalene	7.96	
1-Methyl napthalene	7.96	
2-Methyl propene	9.23	
2-Methyl-1-butene	9.12	
2-Methylpentane	10.12	
3-Methyl-1-butene	9.51	
3-Methyl-2-butene	8.67	
3-Methylpentane	10.08	
4-Methylcyclohexene	8.91	
Maleic anhydride	10.8	X
Mesityl oxide	9.08	
Mesitylene	8.4	
Methane	12.98	X
Methanethiol (methyl mercaptan)	9.44	
Methyl acetate	10.27	
Methyl acetylene	10.37	
Methyl acrylate	9.9	
Methyl alcohol	10.85	X
Methyl amine	8.97	
Methyl bromide	10.54	
Methyl butyl ketone	9.34	
Methyl butyrate	10.07	
Methyl cellosolve	9.6	
Methyl chloride	11.28	X

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Methyl chloroform (1,1,1-trichloroethane)	11	X
Methyl disulfide	8.46	
Methyl ethyl ketone	9.53	
Methyl formate	10.82	X
Methyl iodide	9.54	
Methyl isobutyl ketone	9.3	
Methyl isobutyrate	9.98	
Methyl isocyanate	10.67	X
Methyl isopropyl ketone	9.32	
Methyl isothiocyanate	9.25	
Methyl mercaptan	9.44	
Methyl methacrylate	9.7	
Methyl propionate	10.15	
Methyl propyl ketone	9.39	
α -Methyl styrene	8.35	
Methyl thiocyanate	10.07	
Methylal (dimethoxymethane)	10	
Methylcyclohexane	9.85	
Methylene chloride	11.32	X
Methyl-n-amyl ketone	9.3	
Monomethyl aniline	7.32	
Monomethyl hydrazine	7.67	
Morpholine	8.2	
n-Methyl acetamide	8.9	
N		
1-Nitropropane	10.88	X
2-Nitropropane	10.71	X
Naphthalene	8.12	
Nickel carbonyl	8.27	
Nitric oxide, (NO)	9.25	
Nitrobenzene	9.92	
Nitroethane	10.88	X
Nitrogen	15.58	X
Nitrogen dioxide	9.78	
Nitrogen trifluoride	12.97	X
Nitromethane	11.08	X
Nitrotoluene	9.45	
p-Nitrochloro benzene	9.96	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
O		
Octane	9.82	
Oxygen	12.08	X
Ozone	12.08	X
P		
1-Pentene	9.5	
1-Propanethiol	9.2	
2,4-Pentanedione	8.87	
2-Pentanone	9.38	
2-Picoline	9.02	
3-Picoline	9.02	
4-Picoline	9.04	
n-Propyl nitrate	11.07	X
Pentaborane	10.4	
Pentane	10.35	
Perchloroethylene	9.32	
Pheneloic	8.18	
Phenol	8.5	
Phenyl ether (diphenyl oxide)	8.82	
Phenyl hydrazine	7.64	
Phenyl isocyanate	8.77	
Phenyl isothiocyanate	8.52	
Phenylene diamine	6.89	
Phosgene	11.77	X
Phosphine	9.87	
Phosphorus trichloride	9.91	
Phthalic anhydride	10	
Propane	11.07	X
Propargyl alcohol	10.51	
Propiolactone	9.7	
Propionaldehyde	9.98	
Propionic acid	10.24	
Propionitrile	11.84	X
Propyl acetate	10.04	
Propyl alcohol	10.2	
Propyl amine	8.78	
Propyl benzene	8.72	
Propyl ether	9.27	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Propyl formate	10.54	
Propylene	9.73	
Propylene dichloride	10.87	X
Propylene imine	9	
Propylene oxide	10.22	
Propyne	10.36	
Pyridine	9.32	
Pyrrole	8.2	
Q		
Quinone	10.04	
S		
Stibine	9.51	
Styrene	8.47	
Sulfur dioxide	12.3	X
Sulfur hexafluoride	15.33	X
Sulfur monochloride	9.66	
Sulfuryl fluoride	13	X
T		
o-Terphenyls	7.78	
1,1,2,2-Tetrachloro-1,2-difluoroethane (Freon 112)	11.3	X
1,1,1-Trichloroethane	11	X
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	11.78	X
2,2,4-Trimethyl pentane	9.86	
o-Toluidine	7.44	
Tetrachloroethane	11.62	X
Tetrachloroethene	9.32	
Tetrachloromethane	11.47	X
Tetrahydrofuran	9.54	
Tetrahydropyran	9.25	
Thiolacetic acid	10	
Thiophene	8.86	
Toluene	8.82	
Tribromoethene	9.27	
Tribromofluoromethane	10.67	X
Tribromomethane	10.51	
Trichloroethene	9.45	
Trichloroethylene	9.47	
Trichlorofluoromethane (Freon 11)	11.77	X

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Trichloromethane	11.42	X
Triethylamine	7.5	
Trifluoromonobromo-methane	11.4	X
Trimethyl amine	7.82	
Tripropyl amine	7.23	
V		
o-Vinyl toluene	8.2	
Valeraldehyde	9.82	
Valeric acid	10.12	
Vinyl acetate	9.19	
Vinyl bromide	9.8	
Vinyl chloride	10	
Vinyl methyl ether	8.93	
W		
Water	12.59	X
X		
2,4-Xylidine	7.65	
m-Xylene	8.56	
o-Xylene	8.56	
p-Xylene	8.45	

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

ROUX

EQUIPMENT CALIBRATION LOG

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	POST CAL. READING	SETTINGS
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00 7.00 10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	9706000145		< 0.4 00 800		
☐ Sp. Cond. meter	uS mS		Myron L Company Ultra Meter 6P			_____ mS @ 25 °C		
☐ PID	ppm		MinRAE 20			open air zero _____ ppm Iso. Gas		MIBK response factor = 1.0
☐ Dissolved Oxygen	ppm		YSI Model 5					
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/H					background area		
☐								

SAMPLE

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Specific Conductance Meter

FOP 012.0

CALIBRATION AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

PURPOSE

This guideline describes a method for calibration of a portable specific conductance meter. This meter measures the ability of a water sample to conduct electricity, which is largely a function of the dissolved solids within the water. The instrument has been calibrated by the manufacturer according to factory specifications. This guideline presents a method for checking the factory calibration of a portable specific conductance meter. A calibration check is performed to verify instrument accuracy and function. All field test equipment will be checked at the beginning of each sampling day. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the specific conductance meter will be within ± 1 percent of full-scale, with repeatability of ± 1 percent. The built-in cell will be automatically temperature compensated from at least 32° to 160° F (0° to 71°C).

PROCEDURE

Note: The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the Myron L Company Ultrameter Model 6P. The actual equipment to be used in the field will be equivalent or similar.

CALIBRATION AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

1. Calibrate all field test equipment at the beginning of each sampling day. Check and recalibrate the specific conductance meter according to the manufacture's specifications.

2. Use a calibration solution of known specific conductivity and salinity. For maximum accuracy, use a Standard Solution Value closest to the samples to be tested.

3. Rinse conductivity cell three times with proper standard.

4. Re-fill conductivity cell with same standard.

5. Press **COND** or **TDS**, then press **CAL/MCLR**. The "CAL" icon will appear on the display.

6. Press the **↑/MS** or **MR/↓** key to step the displayed value toward the standard's value or hold a key down to cause rapid scrolling of the reading.

7. Press CAL/MCLR once to confirm new value and end the calibration sequence for this particular solution type.

8. Repeat steps 1 through 7 with additional new solutions, as necessary.

9. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample), indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish maintenance schedules and component replacement. Information will include, at a minimum:
    - Time, date and initials of the field team member performing the calibration
    - The unique identifier for the meter, including manufacturer, model, and serial number
    - The brand and expiration date of the calibration standards
    - The instrument readings: before and after calibration

- The instrument settings (if applicable)
- The overall adequacy of calibration including the Pass or fail designation in accordance with the accuracy specifications presented above.
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

MAINTENANCE

NOTE: Ultrameters should be rinsed with clean water after use. Solvents should be avoided. Shock damage from a fall may cause instrument failure.

Temperature Extremes

Solutions in excess of 160°F/71°C should not be placed in the cell cup area; this may cause damage. Care should be exercised not to exceed rated operating temperature. Leaving the Ultrameter in a vehicle or storage shed on a hot day can easily subject the instrument to over 150°F voiding the warranty.

Battery Replacement

Dry Instrument THOROUGHLY. Remove the four bottom screws. Open instrument carefully; it may be necessary to rock the bottom slightly side to side to release it from the RS-232 connector. Carefully detach battery from circuit board. Replace with 9-volt alkaline battery. Replace bottom, ensuring the sealing gasket is installed in the groove of the top half of case. Re-install screws, tighten evenly and securely.

NOTE: Because of nonvolatile EEPROM circuitry, all data stored in memory and all calibration settings are protected even during power loss or battery replacement.

Cleaning Sensors

The conductivity cell cup should be kept as clean as possible. Flushing with clean water following use will prevent buildup on electrodes. However, if very dirty samples — particularly scaling types — are allowed to dry in the cell cup, a film will form. This film reduces accuracy. When there are visible films of oil, dirt, or scale in the cell cup or on the electrodes, use a foaming non-abrasive household cleaner. Rinse out the cleaner and your Ultrameter is ready for accurate measurements.

NOTE: Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 012.0

CALIBRATION AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

ROUX

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re
						____ ppm Iso. Gas		factor =
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

SAMPLE

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

FIELD OPERATING PROCEDURES

Composite Sample Collection Procedure for Non-VOC Analysis

FOP 013.1

COMPOSITE SAMPLE COLLECTION PROCEDURE FOR NON-VOLATILE ORGANIC ANALYSIS

PURPOSE

This guideline addresses the procedure to be used when soil samples are to be composited in the field.

PROCEDURE

1. Transfer equal weighted aliquots of soil from individual split-spoon samples, excavator bucket, hand auger or surface soil sample location to a large precleaned stainless steel (or Pyrex glass) mixing bowl.

2. Thoroughly mix (homogenize) and break up the soil using a stainless steel scoop or trowel.

3. Spread the composite sample evenly on a stainless steel tray and quarter the sample.

4. Discard alternate (i.e., diagonal) quarters and, using a small stainless steel scoop or spatula, collect equal portions of subsample from the remaining two quarters until the amount required for the composite sample is acquired. Transfer these subsamples to a precleaned stainless steel (or Pyrex glass) mixing bowl and re-mix.

5. Transfer the composite sample to the laboratory provided, precleaned sample jars. Store any excess sample from the stainless steel tray in a separate, precleaned, wide-mouth sample jar and refrigerate for future use, if applicable.

6. Decontaminate all stainless steel (or Pyrex glass) equipment in accordance with Roux's Non-disposable and Non-dedicated Sampling Equipment Decontamination procedures.

7. Prepare samples in accordance with Roux's Sample Labeling, Storage and Shipment FOP.

8. Record all sampling details in the Project Field Book and on the Soil/Sediment Sample Collection Summary Log (sample attached).

ATTACHMENTS

Soil/Sediment Sample Collection Summary Log (sample)

REFERENCES

Roux FOPs:

040 *Non-disposable and Non-dedicated Sampling Equipment Decontamination*

046 *Sample Labeling, Storage and Shipment*

COMPOSITE SAMPLE COLLECTION PROCEDURE FOR NON-VOLATILE ORGANIC ANALYSIS

ROUX

SOIL/SEDIMENT
SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Depth (feet)		Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, depth changes, important matrix observations or description, gravel thickness, etc.)
			from	to						

Equipment Rinsate Blanks *- Pour clean de yer or th lec amp equipment into sample containers. Collect at a frequency of 1 per 20 samples of each matrix when non-dedicated equipment is utilized in accordan*

MS/MSD *- Collect at a frequency of 1 per 20 in ac with DER-10.*

Field Blank *- Pour clean deionized water (used im e containers while at the sampling site. Collect field blanks at a frequency of 1 per 20 samples of each matrix.*

Investigation Derived Waste (IDW) Characterization samples *- C mposite samples from all drums of decon fluids and soil at the frequency required by the disposal facility. Please note number of drums and labels on collection log.*

Notes:
1. See QAPP for sampling frequency and actual number of QC s
2. MS/MSD - Matrix Spike, Matrix Spike Duplicate, Matrix Spike Blank.
3. BD - Blind Duplicate - indicate location of duplicate.

Sample Summary Collection Logs - soil and sediment-REV.xlsx Page ____ of ____ Prepared By: _____

SAMPLE

FOP 015.0

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

PURPOSE

The purpose of these documentation requirements is to document the procedures used for drilling and installing wells in order to ensure the quality of the data obtained from these operations. Roux field technical personnel will be responsible for developing and maintaining documentation for quality control of field operations. At least one field professional will monitor each major operation (e.g. one person per drilling rig) to document and record field procedures for quality control. These procedures provide a description of the format and information for this documentation.

PROCEDURE

Project Field Book

Personnel assigned by the Roux Field Team Leader or Project Manager will maintain a Project Field Book for all site activities. These Field Books will be started upon initiation of any site activities to document the field investigation process. The Field Books will meet the following criteria:

- Permanently bound, with nominal 8.5-inch by 11-inch gridded pages.
- Water resistant paper.
- Pages must be pre-numbered or numbered in the field, front and back.

Notations in the field book will be in black or blue ink that will not smudge when wet. Information that may be recorded in the Field Book includes:

- Time and date of all entries.

- Name and location of project site and project job number.
- Listing of key project, client and agency personnel and telephone numbers.
- Date and time of daily arrivals and departures, name of person keeping the log, names and affiliation of persons on site, purpose of visit (if applicable), weather conditions, outline of project activities to be completed.
- Details of any variations to the procedures/protocols (i.e., as presented in the Work Plan or Field Operating Procedures) and the basis for the change.
- Field-generated data relating to implementation of the field program, including sample locations, sample descriptions, field measurements, instrument calibration, etc.
- Record of all photographs taken in the field, including date, time, photographer, site location and orientation, sequential number of photograph, and roll number.

Upon completion of the site activities, all Field Books will be photocopied and both the original and photocopied versions placed in the project files. In addition, all field notes except those presented on specific field forms will be neatly transcribed into Field Activity Daily Log (FADL) forms (sample attached).

Field Borehole/Monitoring Well Installation Log Form

Examples of the Field Borehole Log and Field Borehole/Monitoring Well Installation Log forms are attached to this Field Operating Procedure. One form will be completed for every boring by the Roux field person overseeing the drilling. At a minimum, these forms will include:

- Project name, location, and number.
- Boring number.

- Rig type and drilling method.
- Drilling dates.
- Sampling method.
- Sample descriptions, to meet the requirements of the Unified Soil Classification System (USCS) for soils and the Unified Rock Classification System (URCS) for rock.
- Results of photoionization evaluations (scan and/or headspace determinations).
- Blow counts for sampler penetration (Standard Penetration Test, N-Value).
- Drilling rate, rig chatter, and other drilling-related information, as necessary.

All depths recorded on Boring/Monitoring Well Installation Log forms will be expressed in increments tenths of feet, and not in inches.

Well Completion Detail Form

An example of this form is attached to this Field Operating Procedure. One form will be completed for every boring by the Roux field person overseeing the well installation. At a minimum, these forms will include:

- Project name, location, and number.
- Well number.
- Installation dates.
- Dimensions and depths of the various well components illustrated in the Well Completion Detail (attached). These include the screened interval, bottom caps or plugs, centralizers, and the tops and bottoms of the various annular materials.

- Drilling rate, rig chatter, and other drilling related information.

All depths recorded on Field Borehole/Monitoring Well Installation Logs will be expressed in tenths of feet, and not in inches.

Daily Drilling Report Form

An example of this form is attached to this Field Operating Procedure. This form should be used to summarize all drilling activities. One form should be completed for each rig for each day. These forms will include summaries of:

- Footage drilled, broken down by diameter (e.g. 200 feet of 6-inch diameter hole, 50 feet of 10-inch diameter hole).
- Footage of well and screen installed, broken down by diameter.
- Quantities of materials used, including sand, cement, bentonite, centralizers, protective casings, traffic covers, etc. recorded by well or boring location.
- Active time (hours), and activity (drilling, decontamination, development, well installation, surface completions, etc.)
- Down-time (hours) and reason.
- Mobilizations and other events.
- Other quantities that will be the basis for drilling invoices.

The form should be signed daily by both the Roux field supervisor and the driller's representative, and provided to the Roux Field Team Leader.

Other Project Field Forms

Well purging/well development forms, test pit logs, environmental sampling field data sheets, water level monitoring forms, and well testing (slug test or pumping test) forms. Refer to specific guidelines for form descriptions.

ATTACHMENTS

Field Activity Daily Log (FADL) (sample)
Field Borehole Log (sample)
Field Borehole/Monitoring Well Installation Log (sample)
Stick-up Well/Piezometer Completion Detail (sample)
Flush-mount Well/Piezometer Completion Detail (sample)
Daily Drilling Report (sample)

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

DAILY LOG				
	DATE			
	NO.			
	SHEET		OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME:	PROJECT NO.
PROJECT LOCATION:	CLIENT:
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	

TIME	DESCRIPTION

SAMPLE

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS: A.M.: P.M.:	IMPORTANT TELEPHONE CALLS:
BM/TK PERSONNEL ON SITE:	
SIGNATURE	DATE:

(CONTINUED)

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

FIELD BOREHOLE LOG

PROJECT:		**Log of Boring No.:**	
BORING LOCATION:		ELEVATION AND DATUM:	
DRILLING CONTRACTOR:		DATE STARTED:	DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST: / COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	REMARKS

SAMPLE

ABANDONMENT:

Volume of cement/bentonite grout required:	$V = \pi r^2 \times 7.48 =$ gallons	borehole depth =	ft.
Volume of cement/bentonite grout installed:	gallons	borehole diameter =	ft.
Has bridging of grout occurred? ☐ yes ☐ no		borehole radius =	ft.
If yes, explain resolution:			
Method of installation:			

Project No:	**Benchmark Environmental Engineering & Science, PLLC**	Figure

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

PROJECT:			**Log of Well No.:**	
BORING LOCATION:			ELEVATION AND DATUM:	
DRILLING CONTRACTOR:			DATE STARTED:	DATE FINISHED:
DRILLING METHOD:			TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:			DEPTH TO WATER: FIRST: / COMPL.:	CASING:
SAMPLING METHOD:			LOGGED BY:	
HAMMER WEIGHT:	DROP:		RESPONSIBLE PROFESSIONAL:	REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION: USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

SAMPLE

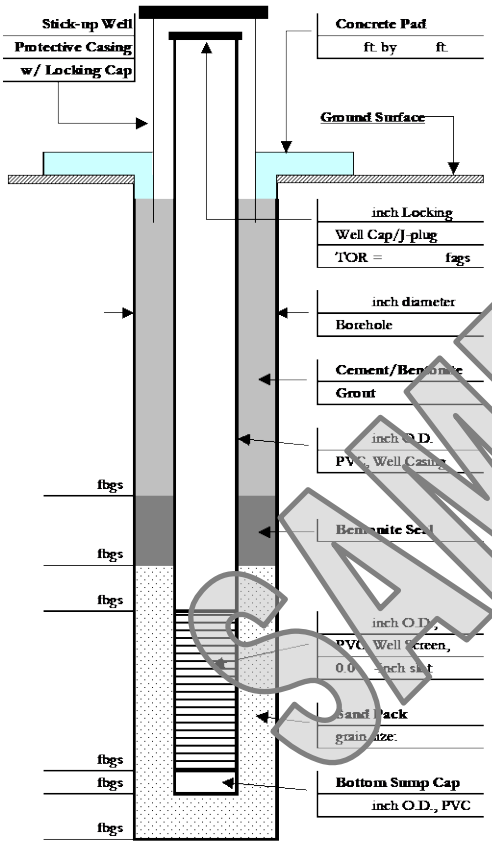
Project No:	Benchmark Environmental Engineering & Science, PLLC	Figure

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

STICK-UP WELL/PIEZOMETER COMPLETION DETAIL

Project Name:	WELL NUMBER:
Client:	Date Installed:
Boring Location:	Project Number:



Driller Information	
Company:	
Driller:	
Helper:	
Permit Number:	
Drill Rig Type:	

Well Information	
Land Surface Elevation:	fmsl (approximate)
Drilling Method:	
Soil Sample Collection Method:	
Drilling Fluid:	
Fluid Loss During Drilling:	gallons (approximate)

Material of Well Construction	
Casing:	
Screen:	
Sump:	
Sand Pack:	
Annular Seal:	

Well Development	
Well Purpose:	
Technique(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level:	ftTOR
Pump Depth:	
Purge Duration:	minutes
Yeild:	gpm
Specific Capacity:	gpm/ft

Comments:

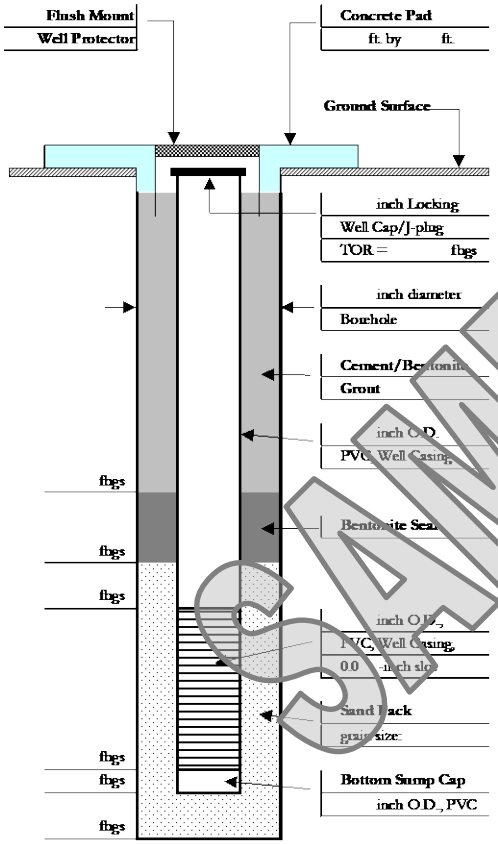
PREPARED BY: DATE:

SAMPLE

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

FLUSHMOUNT WELL/PIEZOMETER COMPLETION DETAIL

Project Name:	WELL NUMBER:
Client:	Date Installed:
Boring Location:	Project Number:



Driller Information	
Company:	
Driller:	
Helper:	
Permit Number:	
Drill Rig Type:	

Well Information	
Land Surface Elevation:	fmsl (approximate)
Drilling Method:	
Soil Sample Collection Method:	
Drilling Fluid:	
Fluid Loss During Drilling:	gallons (approximate)

Material of Well Construction:	
Casing:	
Screen:	
Sump:	
Sand Pack:	
Annular Seal:	

Well Development	
Well Purpose:	
Techneque(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level:	fbTOR
Pump Depth:	
Purge Duration:	minutes
Yeild:	gpm
Specific Capacity:	gpm/ft

Comments:

PREAPRED BY: DATE:

SAMPLE

FOP 015.0

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

DAILY DRILLING REPORT

CONTRACTOR:	DATE:
DRILLING EQUIPMENT:	PROJECT:
CREW MEMBERS:	JOB NUMBER:
SITE NAME:	BM PERSONNEL:

CATEGORY	Total Hours	a.m. 6 7 8 9 10 11 12	p.m. 1 2 3 4 5 6 7 8 9 10 11 12	a.m. 1 2 3 4 5 6
MOB / DEMOB				
DRILLING				
WELL INSTALLATION				
DEVELOPMENT / TESTING				
GROUTING				
STEAM / DECON				
DOWN TIME (explain below)				
STANDBY (explain below)				
CLEANUP				
PREP FOR DRILLING				
LUNCH				
OTHER:				

REMARKS:

DRILLING & WELL MATERIALS: Describe nature, quantity, size, etc.

ITEM OR SERVICE		LOCATION				TOTALS
Starting depth (fbgs)						--
Ending depth (fbgs)						--
Total footage drilled (feet)						
Drilling Method (HSA, air rotary, cable etc.)						--
Auger/Bit size						--
CSSS starting depth (fbgs)						--
CSSS ending depth (fbgs)						--
Total CSSS footage						
-inch Schedule 40 PVC screen, slot size =	QUANTITIES					
-inch Schedule 40 PVC riser						
-inch Schedule 40 PVC screen, slot size =						
-inch Schedule 40 PVC riser						
-inch Schedule 40 PVC screen, slot size =						
-inch Schedule 40 PVC riser						
Sand pack, size =						
Bentonite pellets/chips, size =						
Cement/beontonite grout						
☐ Protective casing ☐ Flushmount road box						
Lockable J-plug						
Lock						

PERSONNEL TIME LOG:

POSITION	NAME	HOURS
Observer		
Drillers		

DRILLER (optional): BM REP.

SAMPLE

FIELD OPERATING PROCEDURES

Drill Site Selection Procedure

FOP 017.0

DRILL SITE SELECTION PROCEDURE

PURPOSE

This procedure presents a method for selecting a site location for drilling. Drill site selection should be based on the project objectives, ease of site access, freedom from obstructions and buried metallic objects (drums) and site safety (appropriate set backs from overhead and buried services).

PROCEDURE

The following procedure outlines procedures prior to drilling activities:

1. Review project objectives and tentatively select drilling locations that provide necessary information for achieving objectives (i.e., Work Plan).

2. Clear locations with property owner/operator to ensure that drilling activities will not interfere with site operations and select appropriate access routes.

3. Stake locations in the field, measure distance from locations to recognizable landmarks, such as building or fence lines and plot locations on site plan. Ensure location is relatively flat, free of overhead wires and readily accessible. Survey location if property ownership is in doubt.

4. Obtain clearances from appropriate utilities and if buried waste/metallic objects are suspected, screen location with appropriate geophysical method.

5. Establish a secure central staging area for storage of drilling supplies and for equipment decontamination. Locate a secure storage area for drilling samples, as necessary.

ATTACHMENTS

none

FIELD OPERATING PROCEDURES

Drilling and Excavation Equipment Decontamination Procedures

FOP 018.0

DRILLING AND EXCAVATION EQUIPMENT DECONTAMINATION PROCEDURES

PURPOSE

This procedure is to be used for the decontamination of drilling and excavation equipment (i.e., drill rigs, backhoes, augers, drill bits, drill rods, buckets, and associated equipment) used during a subsurface investigation. The purpose of this procedure is to remove chemical constituents associated with a particular drilling or excavation location from this equipment. This prevents these constituents from being transferred between drilling or excavation locations, or being transported out of controlled areas.

PROCEDURE

The following procedure will be utilized prior to the use of drilling or excavation equipment at each location, and prior to the demobilization of such equipment from the site:

1. Remove all loose soil and other particulate materials from the equipment at the survey site.

2. Wrap augers, tools, plywood, and other reusable items with a plastic cover prior to transport from the site of use to the decontamination facility.

3. Transport equipment to the decontamination facility. All equipment must be decontaminated at an established decontamination facility. This facility will be placed within a controlled area, and will be equipped with necessary features to contain and collect wash water and entrained materials.

4. Wash equipment thoroughly with pressurized low-volume water or steam, supplied by a pressure washer or steam cleaner.

5. If necessary, use a brush or scraper to remove visible soils adhering to the equipment, and a non-phosphate detergent to remove any oils, grease, and/or hydraulic fluids adhering to the equipment. Continue pressure washing until all visible contaminants are removed.

6. Allow equipment to air dry.

7. Store equipment in a clean area or wrap the equipment in new plastic sheeting as necessary to ensure cleanliness until ready for use.

8. Manage all wash waters and entrained solids as described in the Roux Field Operating Procedure for Management of Investigation-Derived Waste.

ATTACHMENTS

none

FIELD OPERATING PROCEDURES

Establishing Horizontal and Vertical Control

FOP 021.0

ESTABLISHING HORIZONTAL AND VERTICAL CONTROL

PURPOSE

This guideline presents a method for establishing horizontal and vertical controls at a project site. It is imperative that this procedure be performed accurately, as all topographic and site maps, monitoring well locations and test pit locations will be based on these controls.

PROCEDURE

A. Establishing Horizontal Primary and Project Control

1. Research the State Plan Coordinate, USGS or project site applicable horizontal control monuments.
2. At the project site, recover the above-mentioned monuments, two markers minimum being recovered.
3. Establish control points on the project site by bringing in the primary control points recovered in the field.
4. All control points will be tied into a closed traverse to assure the error of closure.
5. Compute closures for obtaining degree of accuracy to adjust traverse points.

B. Establishing Vertical Primary and Project Control

1. Research project or USGS datum for recovering monument(s) for vertical control if different than those previously found.
2. Recover the monuments in the field, two markers minimum being found.
3. Set the projects benchmarks.
4. Run a level line from the monuments to the set project benchmarks and back, setting turning points on all benchmarks set on site.

5. Reduce field notes and compute error of closure to adjust benchmarks set on site.

6. Prepare the recovery sketches and tabulate a list for horizontal and vertical control throughout project site.

FIELD OPERATING PROCEDURES

Groundwater Level Measurement

FOP 022.0

GROUNDWATER LEVEL MEASUREMENT

PURPOSE

This procedure describes the methods used to obtain accurate and consistent water level measurements in monitoring wells, piezometers and well points. Water levels will be measured at monitoring wells and, if practicable, in supply wells to estimate purge volumes associated with sampling, and to develop a potentiometric surface of the groundwater in order to estimate the direction and velocity of flow in the aquifer. Water levels in monitoring wells will be measured using an electronic water level indicator (e-line) that has been checked for operation prior to mobilization.

PROCEDURE

1. Decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

2. Unlock and remove the well protective cap or cover and place on clean plastic.

3. Lower the probe slowly into the monitoring well until the audible alarm sounds. This indicates the depth to water has been reached.

4. Move the cable up and down slowly to identify the depth at which the alarm just begins to sound. Measure this depth against the mark on the lip of the well riser used as a surveyed reference point (typically the north side of the riser).

5. Read depth from the graduated cable to the nearest 0.01 foot. Do not use inches. If the e-line is not graduated, use a rule or tape measure graduated in 0.01-foot increments to measure from the nearest reference mark on the e-line cable.

6. Record the water level on a Water Level Monitoring Record (sample attached).

7. Remove the probe from the well slowly, drying the cable and probe with a clean paper wipe. Be sure to repeat decontamination before use in another well.

8. Replace well plug and protective cap or cover. Lock in place as appropriate.

ATTACHMENTS

Water Level Monitoring Record (sample)

REFERENCES

Roux FOPs:
040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination

GROUNDWATER LEVEL MEASUREMENT

WATER LEVEL MONITORING RECORD

Project Name:	Client:
Project No.:	Location:
Field Personnel:	Date:
Weather:	

Well No.	Time	Top of Riser Elevation (fmsl)	Static Depth to Water (fbTOR)	Groundwater Elevation (fmsl)	Total Depth (fbTOR)	Last Total Depth Measurement (fbTOR)

FIELD OPERATING PROCEDURES

Groundwater Purging Procedures Prior to Sample Collection

FOP 023.1

GROUNDWATER PURGING PROCEDURES PRIOR TO SAMPLE COLLECTION

PURPOSE

This procedure describes the methods for monitoring well/piezometer purging prior to groundwater sample collection in order to collect representative groundwater samples. The goal of purging is to remove stagnant, non-representative groundwater from the well and/or prevent stagnant water from entering collected samples. Purging involves the removal of at least three to five volumes of water in wells with moderate yields and at least one well volume from wells with low yields (slow water level recovery).

Purge and sample wells in order of least-to-most contaminated (this is not necessary if dedicated or disposable equipment is used). If you do not know this order, sample the upgradient wells first, then the furthest down-gradient or side-gradient wells, and finally the wells closest to, but down-gradient of the most contaminated area. Sampling should commence immediately following purging or as soon as the well has adequately recharged and not more than 24-hours following end time of evacuation.

PROCEDURE

1. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Roux Field Operating Procedure for Groundwater Level Measurement and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Roux Field Operating Procedure for Non-disposable and Non-dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

2. Inspect the interior and exterior of the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form and/or Groundwater Well Inspection Form (samples attached). Specifically, inspect

the integrity of the following: concrete surface seal, lock, protective casing and well cover, well riser and J-plug/cap. Report any irregular findings to the Project Manager.

3. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.

4. Calibrate the photoionization detector (PID) in accordance with the Roux Field Operating Procedure for Calibration and Maintenance of Portable Photoionization Detector.

5. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging.

6. Lower the e-line probe slowly into the monitoring well and record the initial water level in accordance with the procedures referenced in the Roux Field Operating Procedure for Groundwater Level Measurement.

7. Following static water level determinations, slowly lower the e-line to the bottom of the well/piezometer. Record the total depth to the nearest 0.01-foot and compare to the previous total depth measurement. If a significant discrepancy exists, re-measure the total depth. Continue with purging activities observing purge water to determine whether the well/piezometer had become silted due to inactivity or damaged (i.e., well sand within purge water). Upon confirmation of the new total depth and determination of the cause (i.e., siltation or damage), notify the Project Manager following field activities.

8. Calculate the volume of water in the well based on the water level below the top of riser and the total depth of the well using the following equation:

$$V = 0.0408[(B)^2 \times \{(A) - (C)\}]$$

Where,

A = Total Depth of Well (feet below measuring point)
B = Casing diameter (inches)
C = Static Water Level (feet below measuring point)

9. **For wells where the water level is 20 feet or less below the top of riser**, a peristaltic pump may be used to purge the well. Measure the purged volume using a calibrated container (i.e., graduated 5-gallon bucket) and record measurements on the attached Groundwater Well Development and Purge Log. Use new and dedicated tubing for each well. During the evacuation of shallow wells, the intake opening of the pump tubing should be positioned just below the surface of the water. As the water level drops, lower the tubing as needed to maintain flow. For higher yielding wells, the intake level should not be lowered past the top of the screen. Pumping from the top of the water column will ensure proper flushing of the well. Continue pumping until the required volumes are removed (typically three well volumes). For higher yielding wells, adjust the purging rate to maintain the water level above the screen. For lower yielding wells or wells where the screen straddles the water table, maintain purging at a rate that matches the rate of recovery of the well (well yield). If the well purges to dryness and is slow to recharge (greater than 15 minutes), terminate evacuation. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.**

10. **For wells where the water level is initially below 20 feet,** or drawn down to this level because of slow recharge rate, conduct purging using one of three devices listed below:

- Bailer – A bottom filling dedicated polyethylene bailer attached to a length of dedicated hollow-braid polypropylene rope. Purging a well utilizing a bailer should be conducted smoothly and slowly as not to agitate the groundwater or damage the well.

- Well Wizard Purge Pump (or similar) – This pneumatic bladder pump uses compressed air to push water to the surface. Groundwater is not in contact

with the drive air during the pumping process, therefore the pump may be used for sample collection.

- Submersible Pump (12 or 24 volt, or similar) – These submersible pumps are constructed of PVC or stainless steel and are capable of pumping up to 70 feet from ground surface using a 12 volt battery (standard pump) and standard low flow controller. For depths up to 200 feet from ground surface, a high performance power booster controller is used with a 12 volt battery. Unless these pumps are dedicated to the monitoring well location, decontamination between locations is necessary and an equipment blank may be required.

- Waterra™ Pump – This manually operated pump uses dedicated polyethylene tubing and a check valve that can be used as an optional method for purging deeper wells. The pump utilizes positive pressure to evacuate the well, therefore the pump may be used for sample collection, and however over-agitation groundwater should be avoided.

Prior to use in a well, non-dedicated bailers, exterior pump bodies and pump tubing should be cleaned in accordance with the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Dedicated and/or disposable equipment should be contained within the sealed original manufacturers packaging and certified pre-cleaned by the manufacturer with a non-phosphate laboratory detergent and rinsed using de-ionized water.

8. Purging will continue until a predetermined volume of water has been removed (typically three well volumes) or to dryness. Measurements for pH, temperature, specific conductance, dissolved oxygen (optional), Eh (optional), and turbidity will be recorded following removal of each well volume. Purge the well to dryness or until the readings for indicator parameters listed above (or well-specific indicator parameters) stabilize within the following limits for each parameter measured:

Field Parameter	Stabilization Criteria
Dissolved Oxygen	± 0.3 mg/L
Turbidity	± 10 %
Specific Conductance	± 3 %
Eh	± 10 mV
PH	± 0.1 unit

Stabilization criteria presented within the project Work Plan will take precedence.

DOCUMENTATION AND SAMPLE COLLECTION

This section pertains to the documentation of collected field data during and following purging activities and sample collection.

1. Record all data including the final three stable readings for each indicator parameter on the attached Groundwater Well Purge & Sample Log.

2. Record, at a minimum, the "volume purged," "purging stop-time," "purged dry (Y/N)," "purged below sand pack (Y/N)," and any problems purging on the attached Groundwater Well Purge & Sample Log.

3. Collect groundwater samples in accordance with the Roux Field Operating Procedure for Groundwater Sample Collection. Record "sample flow rate" as an average, "time sample collected," and any other pertinent information related to the sampling event on the attached Groundwater Well Purge & Sample Log.

4. Restore the well to its capped/covered and locked condition.

ALTERNATIVE METHODS

Alternative purging and sampling methods and equipment, other than those described herein are acceptable if they provide representative groundwater samples. The purging and sampling method and equipment must not adversely affect sample integrity, chemistry, temperature, and turbidity. In addition, alternative equipment must have minimal or no effect on groundwater geochemistry, aquifer permeability and well materials. Equipment materials must also minimize sorption and leaching. The field team is responsible for documenting and describing any alternative equipment and procedures used to purge a well and collect samples.

ATTACHMENTS

Groundwater Field Form
Groundwater Well Inspection Form

REFERENCES

Roux FOPs:

011 *Calibration and Maintenance of Portable Photoionization Detector*
022 *Groundwater Level Measurement*
024 *Groundwater Sample Collection Procedures*
040 *Non-disposable and Non-dedicated Sampling Equipment Decontamination*

GROUNDWATER PURGING PROCEDURES PRIOR TO SAMPLE COLLECTION

ROUX

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

SAMPLE

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:

GROUNDWATER WELL INSPECTION FORM

Project:	**WELL I.D.:**
Client:	
Job No.:	
Date:	
Time:	

EXTERIOR INSPECTION

Protective Casing:
Lock:
Hinge/Lid:
Concrete Surface Seal:
Bollards:
Label/I.D.:
Other:

INTERIOR INSPECTION

Well Riser:
Annular Space:
Well Cap:
Water Level (fbTOR):
Total Depth (fbTOR):
Other:

Comments/Corrective Actions:

PREPARED BY: DATE:

SAMPLE

ROUX

FIELD OPERATING PROCEDURES

Groundwater Sample Collection Procedures

FOP 024.1

GROUNDWATER SAMPLE COLLECTION PROCEDURES

PURPOSE

This procedure describes the methods for collecting groundwater samples from monitoring wells and domestic supply wells following purging and sufficient recovery. This procedure also includes the preferred collection order in which water samples are collected based on the volatilization sensitivity or suite of analytical parameters required.

PROCEDURE

Allow approximately 3 to 10 days following well development before performing purge and sample activities at any well location. Conversely, perform sampling as soon as practical after sample purging at any time after the well has recovered sufficiently to sample, or within 24 hours after evacuation, if the well recharges slowly. If the well does not yield sufficient volume for all required laboratory analytical testing (including quality control), a decision should be made to prioritize analyses based on contaminants of concern at the site. If the well takes longer than 24 hours to recharge, the Project Manager should be consulted. The following two procedures outline sample collection activities for monitoring and domestic type wells.

Monitoring Wells

1. Purge the monitoring well in accordance with the Roux FOPs for Groundwater Purging Procedures Prior to Sample Collection or Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedures. Perform sampling as soon as practical after purging at any time after the well has recovered sufficiently to sample, or within 24 hours after evacuation, if the well recharges slowly. If the well does not yield sufficient volume for all required laboratory analytical testing (including quality control), a decision should be made to prioritize analyses based on contaminants of concern at the site. Analyses will be prioritized in the order of the parameters volatilization sensitivity. After volatile organics have been collected, field parameters

must be measured from the next sample collected. If a well takes longer than 24 hours to recharge, the Project Manager should be consulted.

2. Sampling equipment that is not disposable or dedicated to the well will be decontaminated in accordance with the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

3. Calibrate all field meters (i.e., pH/Eh, turbidity, specific conductance, dissolved oxygen, PID etc.) in accordance with the Roux Field Operating Procedure for Calibration and Maintenance of the specific field meter.

4. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Roux Field Operating Procedure for Groundwater Level Measurement and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Roux Field Operating Procedure for Non-disposable and Non-dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

5. Inspect the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form (sample attached). Specifically, inspect the integrity of the following: concrete surface seal, lock, protective casing and well cover, well casing and J-plug/cap. Report any irregular findings to the Project Manager.

6. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.

7. Calibrate the photoionization detector (PID) in accordance with the Roux Field Operating Procedure for Calibration and Maintenance of Portable Photoionization Detector.

8. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging. Record PID measurements on a well-specific Groundwater Field Form (sample attached).

9. Lower the e-line probe slowly into the monitoring well and record the measurement on a well-specific Groundwater Field Form (sample attached).

10. Groundwater samples will be collected directly from the sampling valve on the flow through cell (low-flow), discharge port of a standard pump assembly (peristaltic, pneumatic, submersible, or Waterra™ pump) or bailer (stainless steel, PVC or polyethylene) into appropriate laboratory provided containers. In low-yielding wells at which the flow through cell is not used, the samples may be collected using a disposable bailer. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.**

11. If disposable polyethylene bailers are used, the bailer should be lowered *slowly* below the surface of the water to minimize agitation and volatilization. For wells that are known to produce turbid samples (values greater than 50 NTU), the bailer should be lowered and retrieved at a rate that limits surging of the well.

12. Sampling data will be recorded on a Groundwater Field Form (sample attached).

13. Pre-label all sample bottles in the field using a waterproof permanent marker in accordance with the Roux Sample Labeling, Storage, and Shipment FOP. The following information, at a minimum, should be included on the label:

    - Project Number;
    - Sample identification code (as per project specifications);
    - Date of sample collection (mm, dd, yy);
    - Time of sample collection (military time only) (hh:mm);
    - Specify "grab" or "composite" sample type;
    - Sampler initials;
    - Preservative(s) (if applicable); and
    - Analytes for analysis (if practicable).

14. Collect a separate sample of approximately 200 ml into an appropriate container prior to collecting the first and following the last groundwater sample collected to measure the following field parameters:

Parameter	Units
Dissolved Oxygen	parts per million (ppm)
Specific Conductance	μmhos/cm or μS or mS
pH	pH units
Temperature	^{o}C or ^{o}F
Turbidity	NTU
Eh (*optional*)	mV
PID VOCs (*optional*)	ppm

Record all field measurements on a Groundwater Field Form (sample attached).

15. Collect samples into pre-cleaned bottles provided by the analytical laboratory with the appropriate preservative(s) added based on the volatilization sensitivity or suite of analytical parameters required, as designated in the **Sample Collection Order** section below.

16. Lower the e-line probe slowly into the monitoring well and record the measurement on a well-specific Groundwater Field Form (sample attached).

17. The samples will be labeled, stored, and shipped in accordance with the Roux Field Operating Procedure for Sample Labeling, Storage, and Shipment Procedures.

Domestic Supply Wells

1. Calculate or estimate the volume of water in the well. It is desirable to purge at least one casing volume before sampling. This is controlled, to some extent, by the depth of the well, well yield and the rate of the existing pump. If the volume of water in the well cannot be calculated, the well should be purged continuously for no less than 15 minutes.

2. Connect a sampling tap to an accessible fitting between the well and the pressure tank where practicable. A hose will be connected to the device and the hose discharge located 25 to 50 feet away. The well will be allowed to pump until the lines and one

well volume is removed. Flow rate will be measured with a container of known volume and a stopwatch.

3. Place a clean piece of polyethylene or Teflon™ tubing on the sampling port and collect the samples in the order designated below and in the sample containers supplied by the laboratory for the specified analytes. ***DO NOT*** use standard garden hose to collect samples.

4. Sampling results and measurements will be recorded on a Groundwater Field Form (sample attached) as described in the previous section.

5. Collect samples into pre-cleaned bottles provided by the analytical laboratory with the appropriate preservative(s) added based on the volatilization sensitivity or suite of analytical parameters required, as designated in the **Sample Collection Order** section below.

6. The samples will be labeled, stored, and shipped in accordance with the Roux Field Operating Procedure for Sample Labeling, Storage, and Shipment Procedures.

SAMPLE COLLECTION ORDER

All groundwater samples, from monitoring wells and domestic supply wells, will be collected in accordance with the following.

1. Samples will be collected preferentially in recognition of volatilization sensitivity. The preferred order of sampling if no free product is present is:

    - Field parameters
    - Volatile Organic Compounds (VOCs)
    - Purgeable organic carbons (POC)
    - Purgeable organic halogens (POH)
    - Total Organic Halogens (TOX)
    - Total Organic Carbon (TOC)
    - Extractable Organic Compounds (i.e., BNAs, SVOCs, etc.)
    - Total petroleum hydrocarbons (TPH) and oil and grease

- PCBs and pesticides
- Total metals (Dissolved Metals)
- Total Phenolic Compounds
- Cyanide
- Sulfate and Chloride
- Turbidity
- Nitrate (as Nitrogen) and Ammonia
- Preserved inorganics
- Radionuclides
- Unpreserved inorganics
- Bacteria
- Field parameters

2. Document the sampling procedures and related information in the Project Field Book and on a Groundwater Field Form (sample attached).
3. 1,4-dioxane will be analyzed via the 8270 SIM method.

DOCUMENTATION

The three words used to ensure adequate documentation for groundwater sampling are accountability, controllability, and traceability. Accountability is undertaken in the sampling plan and answers the questions who, what, where, when, and why to assure that the sampling effort meets its goals. Controllability refers to checks (including QA/QC) used to ensure that the procedures used are those specified in the sampling plan. Traceability is documentation of what was done, when it was done, how it was done, and by whom it was done, and is found in the field forms, Project Field Book, and chain-of-custody forms. At a minimum, adequate documentation of the sampling conducted in the field consists of an entry in the Project Field Book (with sewn binding), field data sheets for each well, and a chain-of-custody form.

As a general rule, if one is not sure whether the information is necessary, it should nevertheless be recorded, as it is impossible to over-document one's fieldwork. Years may go by before the documentation comes under close scrutiny, so the documentation must be capable of defending the sampling effort without the assistance or translation of the sampling crew.

The minimum information to be recorded daily with an indelible pen in the Project Field Book and/or field data sheets includes date and time(s), name of the facility, name(s) of the sampling crew, site conditions, the wells sampled, a description of how the sample shipment was handled, and a QA/QC summary. After the last entry for the day in the Project Field Book, the Field Team Leader should sign the bottom of the page under the last entry and then draw a line across the page directly under the signature.

PRECAUTIONS/RECOMMENDATIONS

The following precautions should be adhered to prior to and during sample collection activities:

- Field vehicles should be parked downwind (to avoid potential sample contamination concerns) at a minimum of 15 feet from the well and the engine turned off prior to PID vapor analysis and VOC sample collection.

- Ambient odors, vehicle exhaust, precipitation, or windy/dusty conditions can potentially interfere with obtaining representative samples. These conditions should be minimized and should be recorded in the field notes. Shield sample bottles from strong winds, rain, and dust when being filled.

- The outlet from the sampling device should discharge below the top of the sample's air/water interface, when possible. The sampling plan should specify

how the samples will be transferred from the sample collection device to the sample container to minimize sample alterations.

- The order of sampling should be from the least contaminated to the most contaminated well to reduce the potential for cross contamination of sampling equipment (see the Sampling Plan or Work Plan).

- Samples should not be transferred from one sampling container to another.

- Sampling equipment must not be placed on the ground, because the ground may be contaminated and soil contains trace metals. Equipment and supplies should be removed from the field vehicle only when needed.

- Smoking and eating should not be allowed until the well is sampled and hands are washed with soap and water, due to safety and possibly sample contamination concerns. These activities should be conducted beyond a 15-foot radius of the well.

- No heat-producing or electrical instruments should be within 15 feet of the well, unless they are intrinsically safe, prior to PID vapor analysis.

- Minimize the amount of time that the sample containers remain open.

- Do not touch the inside of sample bottles or the groundwater sample as it enters the bottle. Disposable gloves may be a source of phthalates, which could be introduced into groundwater samples if the gloves contact the sample.

- Sampling personnel should use a new pair of disposable gloves for each well sampled to reduce the potential for exposure of the sampling personnel to contaminants and to reduce sample cross contamination. In addition, sampling personnel should change disposable gloves between purging and sampling operations at the same well.

- Sampling personnel should not use perfume, insect repellent, hand lotion, etc., when taking groundwater samples. If insect repellent must be used, then sampling personnel should not allow samples or sampling equipment to contact the

repellent, and it should be noted in the documentation that insect repellent was used.

- Complete the documentation of the well. A completed assemblage of paperwork for a sampling event includes the completed field forms, entries in the Project Field Book (with a sewn binding), transportation documentation (if required), and possibly chain-of-custody forms.

ATTACHMENTS

Groundwater Field Form (sample)

REFERENCES

1. Wilson, Neal. *Soil Water and Ground Water Sampling*, 1995

Roux FOPs:

007 *Calibration and Maintenance of Portable Dissolved Oxygen Meter*
008 *Calibration and Maintenance of Portable Field pH/Eh Meter*
009 *Calibration and Maintenance of Portable Field Turbidity Meter*
011 *Calibration and Maintenance of Portable Photoionization Detector*
012 *Calibration and Maintenance of Portable Specific Conductance Meter*
022 *Groundwater Level Measurement*
023 *Groundwater Purging Procedures Prior to Sample Collection (optional)*
031 *Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedures (optional)*
040 *Non-Disposable and Non-Dedicated Sampling Equipment Decontamination*
046 *Sample Labeling, Storage and Shipment Procedures*

ROUX

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

SAMPLE

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:

FIELD OPERATING PROCEDURES

PFAS Groundwater/Surface Water Sample Collection Procedures

FOP 024.3

PFAS GROUNDWATER/ SURFACE WATER SAMPLE COLLECTION PROCEDURES

PURPOSE

This procedure describes the methods for collecting per-and polyfluoroalkyl substances (PFAS) groundwater samples from monitoring wells, following purging and sufficient recovery, and surface water locations. This procedure is specific to sites where PFAS sample analysis is required, and analysis specific collection and handling procedures are needed. PFAS sample analysis will be completed when Site analysis requires sampling of the full TAL/TCL analyte list. This field operating procedure (FOP) describes the personal protective equipment (PPE) and sampling equipment/materials appropriate for PFAS sample collection. PFAS laboratory analysis is performed using extremely low detection limits (parts per trillion). Therefore, cross contamination from potential sources (i.e., field equipment, consumer products) must be minimized to the extent possible.

PROCEDURE

Prior to sampling, discuss with the Site's Project Manager whether the monitoring wells that are to be sampled for the PFAS analytical parameters are new monitoring wells or existing monitoring wells. The specific handing and collection procedures for PFAS sampling are solely based on job preparation and sampling equipment used for the job. The standard practice of a 10 volume surge and purge of a newly installed monitoring well for development as discussed in Roux's FOP 036.0 – Monitoring Well Development Procedures and three volume well purge and/or low flow sampling that are discussed in Roux's FOP 023.1 – Groundwater Procedures Prior to Sample Collection remain the same. FOP 064.0 – Surface Water Sampling Procedures remains the same with the exceptions made in this FOP for PFAS sampling. The field sampling personnel must be prepared with appropriate clothing, equipment, and sampling containers for PFAS sampling as discussed below.

FIELD CLOTHING

Unacceptable Field Clothing

- No Gore-Tex®, this includes but not limited to boots, gloves, coveralls, hats, and coats.
- No Tyvex®, this includes but not limited to coveralls, boots, hoods and head coverings. Tyvex® is also found in everyday items such as envelopes, receipts, and adhesives.
- No clothes, jackets, boots, or gloves that have been pretreated with Teflon® water proofing. Teflon® can be found in everyday items such as scissors, plumbers' tape, adhesive tapes, Teflon ® paper for crafting and cookware utensils.
- No clothing that has been waterproofed with PFAS materials
- No brand-new unwashed cotton clothing.
- Clothing that has been washed with fabric softeners prior to sampling.

Acceptable Field Clothing

- Well-worn, washed clothes, jackets, hats, and coveralls without fabric softener usage.
- Rain Gear made from PVC, polyurethane, or rubber only (it cannot contain any of the products listed above).
- Disposable powder free nitrile gloves.

FIELD EQUIPMENT

Unacceptable Field Equipment

- Sampling Equipment containing Teflon® or Low-Density Polyethylene (LDPE). Sampling equipment that may contain these materials include submersible pumps, bailers, tubing, braided poly rope or cord, fishing line.

- No LDPE or glass lined sampling containers, or Teflon®-lined caps.
- Waterproof field books, binders, plastic clip boards, spiral hard cover notebooks.
- No adhesives or permanent markers can be used (i.e., Post-It® notes and Sharpies).
- No Aluminum foil or sampling tins.
- No blue ice packs
- Avoid using paper towels

Acceptable Field Equipment

- Sampling Equipment made from High Density Polyethylene (HDPE), stainless steel, acetate, silicon, or polypropylene.
- Sampling Containers made from HDPE polypropylene

Acceptable Field Equipment (continued)

- Sampling Equipment (i.e. bailers) made from Poly Vinyl Chloride (PVC)
- Nylon rope/twine
- Ice
- Alconox

ADDITIONAL PROCEDURES

- Keep all bottle ware in a dedicated cooler containing only PFAS sample containers.
- Avoid consumption of food or drink prior to and during the sampling event.
- Do not apply cosmetics or moisturizers prior to sampling.

- Do not use standard commercial sunscreen or insect repellents. Use only all natural or organic products.
- Collect PFAS sample from each location prior to collecting other samples for analysis to avoid contact with other sample containers and packing materials.
- New disposable nitrile gloves will be donned at each sampling location.
- Don new disposable nitrile gloves while handling empty sample containers, filling sampling containers, sealing sample containers, and placing containers into sampling coolers.
- Single use (dedicated) or disposable sampling equipment is preferred when multiple locations are sampled.
- Perform a standard two-step decontamination using Alconox detergent and laboratory provided PFAS-free water for all non-dedicated sampling equipment.
- Equipment blanks should be comprised of laboratory provided PFAS-free water. The water should be poured over and/or brought into direct contact with all sampling equipment (bailer, rope, tubing, gloves, water level meter, etc.). The equipment blank will then be sealed and returned to the sample cooler. One equipment blank will be collected each day PFAS samples are collected, or once every 20 samples, whichever is more frequent. Additional equipment blanks may be collected as needed.
- One field duplicate and one matrix spike/matrix spike duplicate (MS/MSD) will be collected for every 20 samples.
- Field blanks should be comprised of laboratory provided PFAS-free water. The field blank should be uncapped and placed near the field crew while purging/sampling preparations take place (i.e. prepare bottle set, calibrate groundwater quality meters, prepare bailers for sampling, etc.). The intent of the uncapped blank is to capture any ambient PFAS compounds that may emanate from the field crew or equipment during typical preparations associated with groundwater/surface water sampling. The field blank will then be capped and returned to the sample cooler.

ATTACHMENTS

Groundwater Field Form (sample)
Surface Water Quality Field Collection Log (Sample)

REFERENCES

Roux FOPs:
036.0 Monitoring Well Development Procedures
023.1 Groundwater Purging Procedures Prior to Sample Collection
064.0 Surface Water Sampling Procedures

ROUX

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

SAMPLE

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

ROUX

PREPARED BY:

ROUX

SURFACE WATER QUALITY FIELD COLLECTION LOG

PROJECT INFORMATION

Project Name:

Project No.:

Client:

SAMPLE DESCRIPTION

I.D.:

Matrix:

Location:

SAMPLE INFORMATION

Date Collected:

Time Collected:

Date Shipped to Lab:

Collected By:

Sample Collection Method:

LABORATORY ANALYSIS

SAMPLING INFORMATION

Weather:

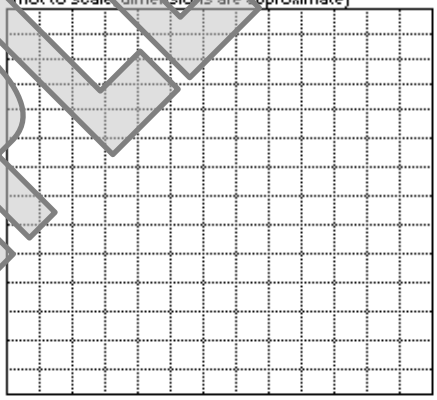
Air Temperature:

Depth of Sample:

Parameter	First	Last	Units
pH			units
Temp.			°C
Cond.			mS
Turbidity			NTU
Eh			mV
D.O.			ppm
Odor			olfactory
Appearance			visual

LOCATION SKETCH

(not to scale, dimensions are approximate)



EXACT LOCATION (if applicable)

Northing (ft)	Easting (ft)	Surface Elevation (fmsl)

SAMPLE

ADDITIONAL LABORATORY ANALYSIS:

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

FIELD OPERATING PROCEDURES

Hand Augering Procedures

FOP 025.0

HAND AUGERING PROCEDURES

PURPOSE

This guideline presents a method for hand augering, which enables the recovery of representative surface and shallow subsurface samples for classification and sample collection (ASTM D1452).

PROCEDURE

1. Review project objectives and the Project Health and Safety Plan (HASP).

2. Follow Roux's FOP: Drill Site Selection Procedure prior to implementing any hand augering activity.

3. Establish a central staging area for storage of augering supplies and for equipment decontamination (include plastic-covered work bench/table as necessary). Locate a secure storage area for augered samples.

4. Assemble auger and decontaminate in accordance with Roux's FOP: Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

5. Cover the area to be sampled with plastic sheeting, as determined by the Project Work Plan.

6. Make the auger boring through the plastic sheeting by rotating and advancing the auger to the desired depth below ground surface.

7. Withdraw the auger from the hole and remove soil for examination, soil classification, on-site testing (if applicable) and laboratory physical/chemical sample collection (if applicable) in accordance with specific Roux FOPs (Soil Description Procedures Using the Unified Soil Classification System; Composite Sample Collection Procedure for Non-Volatile Organic Analysis; and/or Soil Sample Handling for VOC Analysis) and as directed by the Project Work Plan.

8. Document all properties and sample locations in the Project Field Book and Hand Auger Borehole Log (sample attached). Specifically, total depth, borehole diameter, depth of sample collection, personnel, etc. should be recorded.

9. Place sample in appropriate container(s), label and store for future reference or ship to laboratory for analysis in accordance with Roux's Field Operating Procedure for Sample Labeling, Storage and Shipment.

10. Decontaminate auger in accordance with Roux's Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

11. Advance auger to next sample interval and repeat steps 7 through 12 as necessary.

12. Backfill auger holes in accordance with approved procedures outlined in the Project Work Plan.

ATTACHMENTS

Hand Auger Borehole Log (sample)

REFERENCES

Roux FOPs:

013 *Composite Sample Collection Procedure for Non-Volatile Organic Analysis*
017 *Drill Site Selection Procedure*
040 *Non-Disposable and Non-Dedicated Sampling Equipment Decontamination*
046 *Sample Labeling, Storage and Shipment*
054 *Soil Description Procedures Using the Unified Soil Classification System*
057 *Soil Sample Handling for Volatile Organic Compound Analysis – Encore Sampling*

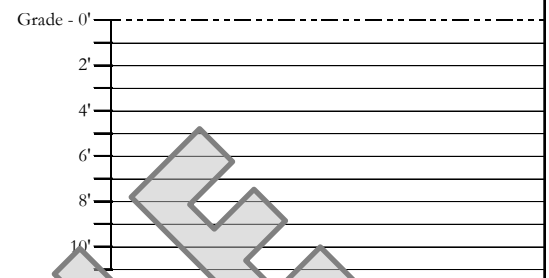
ROUX

HAND AUGER BOREHOLE LOG

Project:	BOREHOLE I.D.:
Project No.:	Excavation Date:
Client:	Excavation Method:
Location:	Logged / Checked By:

Hand Auger Location: *NOT TO SCALE*

Hand Auger Cross Section:



TIME	BOREHOLE DIMENSIONS	
Start:	Diameter:	(approx.)
End:	Depth:	(approx.)

Depth (fbgs)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other	PID Scan (ppm)	Photos Y / N	Samples Collected (fbgs)

SAMPLE

COMMENTS:			
GROUNDWATER ENCOUNTERED:	yes	no	If yes, depth to GW:
VISUAL IMPACTS:	yes	no	Describe:
OLFACTORY OBSERVATIONS:	yes	no	Describe:
NON-NATIVE FILL ENCOUNTERED:	yes	no	
OTHER OBSERVATIONS:	yes	no	Describe:
SAMPLES COLLECTED:	yes	no	Sample I.D.:
			Sample I.D.:
			Sample I.D.:

FIELD OPERATING PROCEDURES

Hollow Stem Auger Drilling Procedures

FOP 026.1

HOLLOW STEM AUGER (HSA) DRILLING PROCEDURES

PURPOSE

This guideline presents a method for drilling a borehole through unconsolidated materials, including soils or overburden, and consolidated materials, including bedrock.

PROCEDURE

The following procedure will be used to drill a borehole for sampling and/or well installation, using hollow-stem auger methods and equipment.

1. Follow Roux's Field Operating Procedure for Drill Site Selection Procedure prior to implementing any drilling activity.

2. Perform drill rig safety checks with the driller by completing the Drilling Safety Checklist form (sample attached).

3. Conduct tailgate health and safety meeting with project team and drillers by completing the Tailgate Safety Meeting Form.

4. Calibrate air-monitoring equipment in accordance with the appropriate Roux's Field Operating Procedures (i.e., PID, FID, combustible gas meter) or manufacturer's recommendations for calibration of field meters (i.e., DataRAM 4 Particulate Meter).

5. Ensure all drilling equipment (i.e., augers, rods, split-spoons) appear clean and free of soil prior to initiating any subsurface intrusion. Decontamination of drilling equipment should be in accordance with Roux's FOP: Drilling and Excavation Equipment Decontamination Procedures.

6. Mobilize the auger rig to the site and position over the borehole.

7. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned drilling location. If necessary, raise the jacks and adjust the rig position.

8. Place a metal or plywood auger pan over the borehole location to collect the auger cuttings. This auger pan will be equipped with a 12-inch nominal diameter hole for auger passage. As an alternative, a piece of polyethylene tarp may be used as a substitute.

9. Advance augers into the subsurface. For sampling or pilot-hole drilling, nominal 8-inch outside diameter (OD) augers should be used. The boring diameter will be approved by the Roux field supervisor.

10. Collect soil samples via split spoon sampler in accordance with Roux's Field Operating Procedure for Split Spoon Sampling.

11. Check augers periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.

12. Continue drilling until reaching the assigned total depth, or until auger refusal occurs. Auger refusal is when the drilling penetration drops below 0.1 feet per 10 minutes, with the full weight of the rig on the auger bit, and a center bit (not center plug) in place.

13. Plug and abandon boreholes not used for well installation in accordance with Roux's Field Operating Procedure for Abandonment of Borehole.

OTHER PROCEDURAL ISSUES

- Slip rings may be used for lifting a sampling or bit string. The string will not be permitted to extend more than 15 feet above the mast crown.

- Borings will not be over drilled (rat holed) without the express permission of the Roux field supervisor. All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

- Potable water may be placed in the auger stem if critically necessary for borehole control or to accomplish sampling objectives and must be approved by the Roux Project Manager and/or NYSDEC Project Manager. Upon approval, the potable

water source and quantity used will be documented in the Project Field Book and subsequent report submittal.

ATTACHMENTS

Drilling Safety Checklist (sample)
Tailgate Safety Meeting Form (sample)

REFERENCES

Roux FOPs:

001 *Abandonment of Borehole Procedures*
010 *Calibration and Maintenance of Portable Flame Ionization Detector*
011 *Calibration and Maintenance of Portable Photoionization Detector*
017 *Drill Site Selection Procedure*
018 *Drilling and Excavation Equipment Decontamination Procedures*
058 *Split Spoon Sampling Procedures*

ROUX

DRILLING SAFETY CHECKLIST

Project:	Date:
Project No.:	Drilling Company:
Client:	Drill Rig Type:

ITEMS TO CHECK	OK	ACTION NEEDED
"Kill switches" installed by the manufacturer are in operable condition and all workers at the drill site are familiar with their location and how to activate them?		
"Kill switches" are accessible to workers on both sides of the rotating stem? NOTE: Optional based on location and number of switches provided by the manufacturer.		
Cables on drill rig are free of kinks, frayed wires, "bird cages" and worn or missing sections?		
Cables are terminated at the working end with a proper eye splice, either swaged Coupling or using cable clamps?		
Cable clamps are installed with the saddle on the live or load side? Clamps should not be alternated and should be of the correct size and number for the cable size to which it is installed. Clamps are complete with no missing parts?		
Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation?		
Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load?		
Drive shafts, belts, chain drives and universal joints shall be guarded to prevent accidental insertion of hands and fingers or tools?		
Outriggers shall be extended prior to and whenever the boom is raised off its cradle. Hydraulic outriggers must maintain pressure to continuously support and stabilize the drill rig even while unattended.		
Outriggers shall be properly supported on the ground surface to prevent settling into the soil.		
Controls are properly labeled and have freedom of movement. Controls should not be blocked or locked in an inactive position.		
Safeties on any device shall not be bypassed or neutralized.		
Controls shall be operated smoothly and cables and lifting devices shall not be jerked or operated erratically to overcome resistance.		
Slings, chokers and lifting devices are inspected before using and are in proper working order? Damaged units are removed from service and are properly tagged?		
Shackles and clevises are in proper working order and pins and screws are fully inserted before placing under a load?		
High-pressure hoses have a safety (chain, cable or strap) at each end of the hose section to prevent whipping in the event of a failure?		
Rotating parts of the drill string shall be free of sharp projections or hooks, which could entrap clothing or foreign objects?		
Wire ropes should not be allowed to bend around sharp edges without cushion material.		
The exclusion zone is centered over the borehole and the radius is equal or greater than the boom height?		

SAMPLE

ITEMS TO CHECK	OK	ACTION NEEDED

DRILLING SAFETY CHECKLIST

Project: Date:

Project No.: Drilling Company:

Client: Drill Rig Type:

ITEMS TO CHECK	OK	ACTION NEEDED
The work area around the borehole shall be kept clear of trip hazards and walking surfaces should be free of slippery material.		
Workers shall not proceed higher than the drilling deck without a fall restraining device and must attach the device in a manner to restrict fall to less than 6 feet.		
A fire extinguisher of appropriate size shall be immediately available to the drill crew. The drill crew shall have received annual training on proper use of the fire extinguisher.		
29 CFR 1910.333 © (3) Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to, under, by, or near power lines only in accordance with the following: .333 © (3) (ii) 50 kV or less -minimum clearance is 10 ft. For 50 kV or over - 10ft. Plus ½ in. For each additional kV **Benchmark Policy: Maintain 20 feet clearance**		
29 CFR 1910.333 © (3) (iii) While the rig is in transit with the boom in the down position, clearance from energized power lines will be maintained as follows: Less than 50 kV - 4 feet 50 to 365 kV - 10 feet 365 to 720 kV - 16 feet		

SAMPLE

Name: (printed)

Signed: Date:

TAILGATE SAFETY MEETING FORM

Project Name: Date: Time:

Project Number: Client:

Work Activities:

HOSPITAL INFORMATION:

Name:

Address: *City:* *State:* *Zip:*

Phone No.: *Ambulance Phone No.*

SAFETY TOPICS PRESENTED:

Chemical Hazards:

Physical Hazards: Slips, Trips, Falls

PERSONAL PROTECTIVE EQUIPMENT:

Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D

New Equipment:

Other Safety Topic (s): Environmental Hazards (aggressive fauna)

Eating, drinking, use of tobacco products is prohibited in the Exclusion Zone (EZ)

ATTENDEES

Name Printed	Signatures

Meeting conducted by:

SAMPLE

FIELD OPERATING PROCEDURES

Low-Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedure

FOP 031.2

LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING & SAMPLING PROCEDURES

PURPOSE

This procedure describes the methods used for performing low flow (minimal drawdown) purging, also referred to as micro-purging, at a well prior to groundwater sampling to obtain a representative sample from the water-bearing zone. This method of purging is used to minimize the turbidity of the produced water. This may increase the representativeness of the groundwater samples by avoiding the necessity of filtering suspended solids in the field prior to preservation of the sample.

Well purging is typically performed immediately preceding groundwater sampling. The sample should be collected as soon as the parameters measured in the field (i.e., pH, specific conductance, dissolved oxygen, Eh, temperature, and turbidity) have stabilized.

PROCEDURE

Allow approximately 3 to 10 days following well development for groundwater to return to static conditions before performing low-flow purge and sample activities at any well location. Conversely, perform low-flow sampling as soon as purged groundwater has stabilized. If the well does not yield sufficient volume (i.e., cannot maintain a constant water level during purging) for low-flow purge and sampling, then an alternative method must be performed in accordance with Roux's Groundwater Purging Procedures Prior to Sample Collection FOP.

1. Water samples should not be taken immediately following well development. Sufficient time should be allowed to stabilize the groundwater flow regime in the vicinity of the monitoring well. This lag time will depend on site conditions and methods of installation but may exceed one week.

2. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Roux's Groundwater Level Measurement FOP and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Roux's Non-disposable and Non-dedicated Sampling Equipment Decontamination FOP. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

3. Calibrate all sampling devices and monitoring equipment in accordance with manufacturer's recommendations, the site Quality Assurance Project Plan (QAPP) and/or Field Sampling Plan (FSP). Calibration of field instrumentation should be followed as specified in Roux's Calibration and Maintenance FOP for each individual meter.

4. Inspect the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form (sample attached). Specifically, inspect the integrity of the following: concrete surface seal, lock, protective casing and well cover, well casing and J-plug/cap. Report any irregular findings to the Project Manager.

5. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.

6. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging.

7. Lower the e-line probe slowly into the monitoring well and record the initial water level in accordance with the procedures referenced in Roux's Groundwater Level Measurement FOP. Refer to the construction diagram for the well to identify the screened depth.

8. Decontaminate all non-dedicated pump and tubing equipment following the procedures referenced in the Roux's Non-disposable and Non-dedicated Sampling Equipment Decontamination FOP.

9. Lower the purge pump or tubing (i.e., low-flow electrical submersible, peristaltic, etc.) slowly into the well until the pump/tubing intake is approximately in the middle of the screened interval. Rapid insertion of the pump will increase the turbidity of well water, and can increase the required purge time. This step can be eliminated if dedicated tubing is already within the well.

   Placement of the pump close to the bottom of the well will cause increased entrainment of solids, which may have settled in the well over time. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval. The objective of low-flow purging is to maintain a purging rate, which minimizes stress (drawdown) of the water level in the well. Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen.

10. Lower the e-line back down the well as water levels will be frequently monitored during purge and sample activities.

11. Begin pumping to purge the well. The pumping rate should be between 100 and 500 milliliters (ml) per minute (0.03 to 0.13 gallons per minute) depending on site hydrogeology. Periodically check the well water level with the e-line adjusting the flow rate as necessary to stabilize drawdown within the well. If possible, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 feet or less). If the water level exceeds 2 feet below static and declining, slow the purge rate until the water level generally stabilizes. Record each pumping rate and water level during the event. If the water level continues to drop and will not stabilize, the monitoring location is not conducive to low-flow sampling and conventional purge and sample methods should be performed.

    The low flow rate determined during purging will be maintained during the collection of analytical samples. At some sites where geologic heterogeneities

are sufficiently different within the screened interval, high conductivity zones may be preferentially sampled.

12. Measure and record field parameters (pH, specific conductance, Eh, dissolved oxygen (DO), temperature, and turbidity) during purging activities. In lieu of measuring all of the parameters, a minimum subset could be limited to pH, specific conductance, and turbidity or DO. A reduction in the field parameter list must be approved by the Project Manager and/or the NYSDEC Project Manager.

    Water quality indicator parameters should be used to determine purging needs prior to sample collection in each well. Stabilization of indicator parameters should be used to determine when formation water is first encountered during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by Eh, DO and turbidity. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. An in-line flow through cell to continuously measure the above parameters may be used. The in-line device should be disconnected or bypassed during sample collection.

13. Purging will continue until parameters of water quality have stabilized or at least a minimum of three (3) well volumes have been removed. Record measurements for field indicator parameters (including water levels) at regular intervals during purging. The stability of these parameters with time can be used to guide the decision to discontinue purging. Proper adjustments must be made to stabilize the flow rate as soon as possible.

14. Record well purging and sampling data in the Project Field Book or on the Groundwater Field Form (sample attached). Measurements should be taken approximately every three to five minutes, or as merited given the rapidity of change.

15. Purging is complete when field indicator parameters stabilize. Stabilization is achieved after all field parameters have stabilized for three successive readings.

Three successive readings should be within ± 0.1 units for pH, ± 3% for specific conductance, ± 10 mV for Eh, and ± 10% for turbidity and dissolved oxygen. These stabilization guidelines are provided for rough estimates only, actual site-specific knowledge may be used to adjust these requirements higher or lower.

An in-line water quality measurement device (e.g., flow-through cell) should be used to establish the stabilization time for several field parameters on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

16. Collect all project-required samples from the discharge tubing at the flow rate established during purging in accordance with Roux's Groundwater Sample Collection Procedures FOP. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.** Continue to maintain a constant flow rate such that the water level is not drawn down as described above. Fill sample containers with minimal turbulence by allowing the ground water to flow from the tubing along the inside walls of the container.

17. If field filtration is recommended as a result of increased turbidity greater than 50 NTU, an in-line filter equipped with a 0.45-micron filter should be utilized. Collection of a filtered sample must be accompanied by an unfiltered sample.

18. Replace the dedicated tubing down the well taking care to avoid contact with the ground surface.

19. Restore the well to its capped/covered and locked condition.

20. Upon purge and sample collection completion, slowly lower the e-line to the bottom of the well/piezometer. Record the total depth to the nearest 0.01-foot and compare to the previous total depth measurement. If a significant discrepancy exists, re-measure the total depth. Record observations of purge

water to determine whether the well/piezometer had become silted due to inactivity or damaged (i.e., well sand within purge water). Upon confirmation of the new total depth and determination of the cause (i.e., siltation or damage), notify the Project Manager following project field activities.

ATTACHMENTS

Groundwater Field Form (sample)

REFERENCES

United States Environmental Protection Agency, 540/S-95/504, 1995. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures.*

Roux FOPs:

007 Calibration and Maintenance of Portable Dissolved Oxygen Meter
008 Calibration and Maintenance of Portable Field pH/Eh Meter
009 Calibration and Maintenance of Portable Field Turbidity Meter
011 Calibration and Maintenance of Portable Photoionization Detector
012 Calibration and Maintenance of Portable Specific Conductance Meter
022 Groundwater Level Measurement
024 Groundwater Sample Collection Procedures
040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination
046 Sample Labeling, Storage and Shipment Procedures

LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING & SAMPLING PROCEDURES

ROUX

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

SAMPLE

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:

FOP 032.2

MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

PURPOSE

The purpose of these guidelines is to ensure the proper holding, storage, transportation, and disposal of materials generated from field investigation activities that may contain hazardous wastes. Investigation-derived waste (IDW) includes the following:

- Drill cuttings, discarded soil samples, drilling mud solids, and used sample containers.
- Well development and purge waters and discarded groundwater samples.
- Decontamination waters and associated solids.
- Soiled disposable personal protective equipment (PPE).
- Used disposable sampling equipment.
- Used plastic sheeting and aluminum foil.
- Other equipment or materials that either contain or have been in contact with potentially impacted environmental media.

Because these materials may contain regulated chemical constituents, they must be managed as a solid waste. This management may be terminated if characterization analytical results indicate the absence of these constituents.

PROCEDURE

1. Contain all investigation-derived wastes in Department of Transportation (DOT)-approved 55-gallon drums, roll-off boxes, or other containers suitable for the wastes.

2. Contain wastes from separate borings or wells in separate containers (i.e. do not combine wastes from several borings/wells in a single container, unless it is a container used specifically for transfer purposes, or unless specific permission to do so has been provided by the Roux Field Team Leader. Unused samples from surface sample locations within a given area may be combined.

3. To the extent practicable, separate solids from drilling muds, decontamination waters, and similar liquids. Place solids within separate containers.

4. Transfer all waste containers to a staging area. Access to this area will be controlled. Waste containers must be transferred to the staging area as soon as practicable after the generating activity is complete.

5. Pending transfer, all containers will be covered and secured when not immediately attended.

6. Label all containers with regard to contents, origin, date of generation, using Roux's IDW container label (sample attached). Use indelible ink for all labeling.

7. Complete the Investigative Derived Waste Container Log (sample attached) as waste containers are labeled in order to track and inventory project waste. Leave a copy of the log with the site manager or fax copy to the owner/operator as necessary.

8. Collect samples for waste characterization purposes, or use boring/well sample analytical data for characterization.

9. For wastes determined to be hazardous in character, **be aware of accumulation time limitations**. Coordinate the disposal of these wastes with the plant manager/owner/operator, if applicable.

10. Upon NYSDEC Project Manager approval, dispose of investigation-derived wastes as follows:

- Soil, water, and other environmental media for which analysis does not detect organic constituents, and for which inorganic constituents are at levels that meet the Site's cleanup objectives, may be spread on the Property or otherwise treated as a non-waste material. Disposal quantity and on-site location will be documented on Project Field Books and in the project report submittal.

- Soil, water, and other environmental media in which organic compounds are detected or metals are present above the Site's cleanup objectives will be disposed off-site in accordance with applicable state and federal regulations. Disposal quantity and off-site location will be documented on Project Field Books and in the project report submittal.

- Personal protective equipment, disposable bailers, and similar equipment may be disposed as municipal waste, unless waste characterization results mandate otherwise.

WASTE STORAGE MANAGEMENT

Hazardous materials generated on site should be temporarily stored in a secure location that is under the control of the owner/operator or does not allow for vandalism (i.e., within a locked building structure or within a locked fenced in area). A waste-staging area should be designated on-site by the Project Manager in conjunction with the owner/operator.

ATTACHMENTS

Investigation Derived Waste Container Log (sample)
Investigation Derived Waste Container Label (sample)

REFERENCES

None

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

INVESTIGATION DERIVED WASTE CO

Project Name: Location:

Project Number: Personnel:

Container		Contents	Date		Staging Location	Date Sampled	Co
Number	Description		Started	Ended			

SAMPLE

Prepared By:

Signed:

IDW Container Label (sample):

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

Project Name:
Project Number:

Container I.D.:
Contents/Matrix:
Estimated Quantity:
Date of Generation:
Date of Sample Collection:

Contact Name:
Contact Phone Number:

FIELD OPERATING PROCEDURES

Monitoring Well Construction for Hollow Stem Auger Boreholes

FOP 033.0

MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

PURPOSE

Wells will be installed within selected boreholes for the purpose of evaluating groundwater characteristics. Well installation procedures depend upon the drilling method. This procedure describes well construction and installation for boreholes drilled using the hollow stem auger method. Refer to the Roux's Hollow Stem Auger Drilling Procedures FOP. Nominal dimensions and materials for the well are shown in the attached well construction diagram.

PROCEDURE

1. Advance borehole in accordance with the Roux's Hollow Stem Auger Drilling Procedure FOP to the required depth. The nominal inside diameter (ID) of the auger stem used should be at least 2 inches larger than the outside diameter (OD) of the riser and screen selected for the well installation. Record the monitoring well construction on the Field Borehole/Monitoring Well Installation Log (sample attached) (see Documentation Requirements for Drilling and Well Installation FOP).

2. Remove the drill rods and center bit/plug from the auger stem and verify borehole depth using weighted measuring tape.

3. In the event of an over drill (i.e. borehole depth is more than one foot greater than desired base of screen depth), use bentonite chips poured through the auger stem to seal the over drilled portion of the borehole. Be sure to note bentonite chip thickness on Field Borehole/Monitoring Well Installation Log.

4. Add a maximum of 6 inches of filter pack material through the auger stem to the base of the borehole. (Note: This step may be avoided if dense non-aqueous phase liquids are suspected to be present and it is desirable to have the screen and/or sump at the base of the borehole.)

5. Measure the length of the well string (i.e. riser and screen), and lower the well string into the well assembly to the desired depth. All measurements during the well installation process will be accurate to 0.1 foot.

6. Surface pour filter pack material into the annulus between the well and the auger stem as the augers are gradually withdrawn from the borehole. Use a weighted tape to confirm that the level of sand is maintained within the augers at all times. Record material volumes used.

7. After filter pack materials are brought to the required level, surface pour bentonite chips or pellets into the annulus between the well and the auger stem to form the filter pack seal. If necessary to avoid bridging, delayed hydration (coated) pellets may be used. Record the volume of material used.

8. Allow the bentonite chips/pellets to adequately hydrate for approximately 30 to 45-minutes. Cap or cover the well top of riser.

9. Mix cement/bentonite grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of water used.

10. Fill the remaining annulus between the well and the auger stem with grout by surface pouring or pumping, and begin withdrawal of the auger string. Periodically top the auger string off with additional grout. If groundwater is present within the annulus above the bentonite chip/pellet seal, cement/bentonite grout will be pressure tremie grouted from bottom to top in order to displace groundwater from the borehole.

11. When the auger string is withdrawn, center the upper portion of the well riser within the borehole, and place drums or barricades around the well for protection while the grout cures. Place and lock a security cap (i.e., J-plug) in the opening of the well riser.

12. Leave the well undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

13. Construct the surface completion as shown in the attached Typical Monitoring Well Detail (Figure 1). Select flush completions for all locations in active operational or high traffic areas, or in other areas where an above grade completion would be undesirable. Use aboveground completions in all other areas.

14. Place a dedicated lock on the well or protective casing, and keep well locked when not actively attended.

15. Permanently label the well with the appropriate well identifier as determined by the Project Manager or specified in the Work Plan.

16. Permanently mark a survey location on the north side at the top of the casing with a saw cut. Survey all wells for horizontal location and elevation, using a surveyor licensed by the State of New York. Coordinates and elevations will be provided in a coordinate system consistent with previous well surveys at the Site. Information obtained will include location (*x* and *y*) of the well, and elevation (*z*) of the ground surface, the pad, and the top of riser.

17. Develop the well as described in the Roux Field Operating Procedure for Monitoring Well Development.

18. Manage all waste materials generated during well installation and development as described in the Roux Field Operating Procedure for Management of Investigation Derived Waste.

ATTACHMENTS

Field Borehole/Monitoring Well Installation Log (sample)
Typical Monitoring Well Detail (Figure 1)

REFERENCES

Roux FOPs:

015 Documentation Requirements for Drilling and Well Installation
026 Hollow Stem Auger Drilling Procedures
032 Management of Investigation Derived Waste
036 Monitoring Well Development Procedures

MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

ROUX

FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

PROJECT:		**Log of Well No.:**		
BORING LOCATION:		ELEVATION AND DATUM:		
DRILLING CONTRACTOR:		DATE STARTED:		DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:		SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST:	COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:		
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:		REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

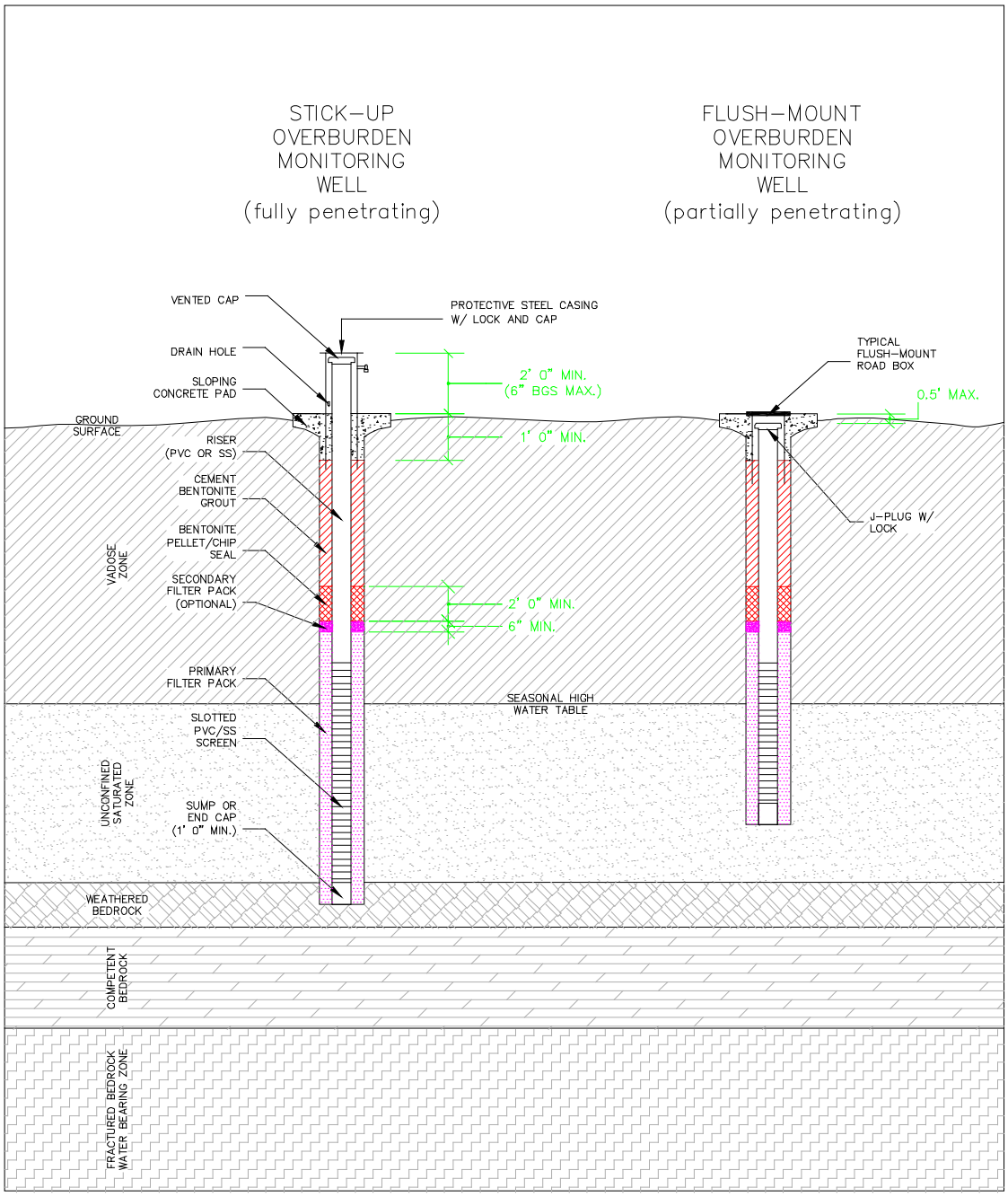
SAMPLE

Project No:	Roux Environmental Engineering and Geology, D.P.C.	Figure

FOP 033.0

MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

FIGURE 1



FIELD OPERATING PROCEDURES

Monitoring Well Development Procedures

FOP 036.0

MONITORING WELL DEVELOPMENT PROCEDURES

PURPOSE

This procedure describes the methods for the development of newly installed monitoring wells and re-development of existing monitoring wells that have been inactive for an extended period of time (i.e., one year or more). Monitoring wells are developed after installation in order to remove introduced water and drilling fluids, reduce the turbidity of the water, and improve the hydraulic communication between the well and the water-bearing formation. Well development will not commence until the annular grout seal has cured, but will be performed within ten calendar days of well installation.

PROCEDURE

1. All well development will include surge blocking or false bailing with one or more of the following fluid removal methods. Well development activities may include:

    - Bailing
    - Air Lifting
    - Submersible Pumping
    - Other methods as approved by the Roux Field Team Leader.
    - The appropriate water removal method will be selected based on water level depth and anticipated well productivity.

2. Assemble and decontaminate equipment (if necessary), and place in the well. Reference the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

3. Alternate the use of agitation methods with water removal methods, using the former to suspend solids in the well water, and the latter to remove the turbid water. For example, use a vented surge block to agitate the well, moving up and down within the screened interval and then use a pump to clear the well. A bailer may be used for both purposes, by surging with the bailer (false

bailing) for a period within the screened interval, then bailing a volume of water from the well.

4. When using surging methods, initiate this activity gradually, with short (2 to 3 feet) strokes. After several passes across the screened interval, increase the speed and length of the surge strokes.

5. Continue development until the following objectives are achieved:

   - Field parameters stabilize to the following criteria:
     - Dissolved Oxygen: ± 0.3 mg/L
     - Turbidity: ± 10%
     - Specific Conductance: ± 3%
     - ORP: ± 10 mV
     - pH: ± 0.1 units
   - The well will generate non-turbid water during continued pumping typically less than 50 NTU.
   - A minimum of 10 well volumes has been evacuated from the well.
   - In the case of lost water during drilling activities, the volume of water removed exceeds twice the volume of water lost to the formation during the drilling process, as indicated by the water balance.

6. Document the development methods, volumes, field parameter measurements, and other observations on the attached Roux Groundwater Well Development Log (sample attached).

ATTACHMENTS

Groundwater Well Development Log (sample)

REFERENCES

Roux FOPs:
040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination

ROUX

GROUNDWATER WELL DEVELOPMENT LOG

Project Name:	WELL NUMBER:
Project Number:	Sample Matrix:
Client:	Weather:

WELL DATA: DATE: TIME:

Casing Diameter (inches):	Casing Material:
Screened interval (fbTOR):	Screen Material:
Static Water Level (fbTOR):	Bottom Depth (fbTOR):
Elevation Top of Well Riser (fmsl):	Datum Ground Surface: Mean Sea Level
Elevation Top of Screen (fmsl):	Stick-up (feet):

PURGING DATA: DATE: START TIME: END TIME:

VOLUME CALCULATION:

(A) Total Depth of Well (fbTOR):	
(B) Casing Diameter (inches):	
(C) Static Water Level (fbTOR):	
One Well Volume (V, gallons): $V = 0.0408 [(B)^2 \times \{ (A) - (C) \}]$	

*Use the table to the right to calculate one well volume.

Volume Calculation

Well Diameter	Volume gal/ft
1"	0.041
2"	0.163
3"	0.367
4"	0.653
5"	1.020
6"	1.469
8"	2.611

Stabilization Criteria

Parameter	Criteria
DO	+/- 0.3 mg/L
Turbidity	+/- 10%
SC	+/- 3%
ORP	+/- 10 mV
pH	+/- 0.1 unit

Field Personnel:

EVACUATION STABILIZATION TEST DATA:

Time	Water Level (fbTOR)	Accumulated Volume (gallons)	pH (units)	Temperature (degrees C)	Specific Conductance (uS/cm)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor

REMARKS:

PREPARED BY:

SAMPLE

FIELD OPERATING PROCEDURES

Non-Aqueous Phase Liquid (NAPL) Detection and Sample Collection Procedure

FOP 039.1

NON-AQUEOUS PHASE LIQUID DETECTION AND SAMPLE COLLECTION PROCEDURE

PURPOSE

This procedure describes the methods to detect the presence and sample collection of Non-Aqueous Phase Liquid (NAPL) in groundwater monitoring wells prior to purging activities. If NAPL is suspected, all activities should be performed with proper personnel protective equipment (PPE).

DETECTION PROCEDURE

Groundwater monitoring wells suspected of containing NAPL will be sounded with an interface probe, or similar device, in accordance with the following.

1. Inspect the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form (sample attached). Specifically, inspect the integrity of the following: concrete surface seal, lock, protective casing and well cover, well casing and J-plug/cap. Report any irregular findings to the Project Manager.

2. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.

3. Calibrate the photoionization detector (PID) in accordance with the Roux Field Operating Procedure for Calibration and Maintenance of Portable Photoionization Detector.

4. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging. Record PID measurements on the Groundwater Field Form (sample attached).

5. Slowly lower the interface probe down the well, avoiding contact with the well casing. Upon contact with the static liquid level in the well, the interface

probe will signal contact with an audible tone and/or a visible light mounted inside the reel.

Note:

- If the signal is constant, the probe is in contact with groundwater; and
- If the signal oscillates, the probe is in contact with NAPL.

6. Record the depth, type of liquid encountered (if applicable) and any other related information in the Project Field Book and on a Groundwater Field Form (sample attached).

7. Slowly lower the interface probe to the well bottom. Record the depth(s) and type(s) of any additional phases encountered.

8. Slowly raise the interface probe to the surface, avoiding contact with the well casing.

9. Place the interface probe and storage reel in a plastic bag for subsequent decontamination in accordance with the Roux's Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

SAMPLE COLLECTION PROCEDURE

All NAPL samples collected from groundwater monitoring wells will be collected in accordance with the following.

1. Place plastic sheeting on the ground around the well to prevent equipment from coming in contact with soil and also to prevent the surface transmission of NAPL.

2. All sampling personnel will don the appropriate PPE in accordance with the site health and safety plan.

3. Measure the static water level and NAPL level(s) using an interface probe as described in the previous section.

4. Determine depth to NAPL layer and thickness. Record appropriate data in the Project Field Book and on a Groundwater Sample Collection Log form (sample attached).

DNAPL SAMPLE COLLECTION

The following procedure should be used in sampling dense, heavier than water NAPL (i.e., with a high specific gravity) (DNAPL).

1. Collect samples using a translucent double check valve bailer (i.e., a bailer with a ball valve on both the top and bottom) constructed of Teflon, polyethylene or PVC which is connected to polypropylene rope for lowering into the well. All non-dedicated equipment shall be decontaminated in accordance with the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

2. Remove wrapping (i.e., aluminum foil, manufacturers packaging etc.), attach bailer to new polypropylene rope and slowly lower the bailer until it contacts the well bottom.

3. Slowly raise and lower the bailer to create a gentle surging action thereby inducing DNAPL into the bailer past the bottom ball valve.

4. Slowly raise the bailer to the surface. Avoid contact of the bailer line with the well casing and/or ground surface.

5. Observe the DNAPL through the translucent wall of the bailer and check if the immiscible phases have separated. If not, allow the bailer to stand upright until the phases have separated.

6. Carefully attach a bottom-emptying device with stopcock to the bottom of the bailer and discharge the DNAPL gently down the side of the sample bottle to minimize turbulence.

7. Repeat steps 2 through 6 until a sufficient sample volume is obtained.

8. Cap the sample bottle and label, preserve and ship samples in accordance with the Roux Field Operating Procedure for Sample Labeling, Storage and Shipment Procedures.

9. Place the used plastic sheeting, bailer and polyethylene rope in a plastic bag for subsequent decontamination or disposal.

10. Document the sampling procedures and related information in the Project Field Book and on a Groundwater Sample Collection Log form (sample attached).

LNAPL SAMPLE COLLECTION

The following procedure should be used in sampling lighter than water NAPL (i.e., with a low specific gravity) (LNAPL).

1. Collect samples using a translucent double check valve bailer (i.e., a bailer with a ball valve on both the top and bottom) constructed of Teflon, polyethylene or PVC which is connected to polypropylene rope for lowering into the well. All non-dedicated equipment shall be decontaminated in accordance with the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

2. Remove wrapping (i.e., aluminum foil, manufacturers packaging etc.), attach bailer to new polypropylene rope and slowly lower the bailer down the well into the immiscible phase of LNAPL. Care should be taken to lower the bailer just through the LNAPL layer, but not significantly down into the underlying groundwater.

3. Slowly raise the bailer to the surface. Avoid contact of the bailer line with the well casing and/or ground surface.

4. Observe the LNAPL through the translucent wall of the bailer and check if the immiscible phases have separated. If not, allow the bailer to stand upright until the phases have separated.

5. Carefully attach a bottom-emptying device with stopcock to the bottom of the bailer and decant the denser groundwater portion of the bailer contents into a DOT-approved 55-gallon drum for proper disposal.

6. Discharge the LNAPL gently down the side of the sample bottle to minimize turbulence.

7. Repeat steps 2 through 6 until a sufficient sample volume is obtained.

8. Cap the sample bottle and label, preserve and ship samples in accordance with the Roux Field Operating Procedure for Sample Labeling, Storage and Shipment Procedures.

9. Place the used plastic sheeting, bailer and polyethylene rope in a plastic bag for subsequent decontamination or disposal.

10. Document the sampling procedures and related information in the Project Field Book and on a Groundwater Sample Collection Log form (sample attached).

ATTACHMENTS

Groundwater Well Purge & Sample Collection Log (sample)

REFERENCES

Roux FOPs:

010 *Calibration and Maintenance of Portable Flame Ionization Detector*
011 *Calibration and Maintenance of Portable Photoionization Detector*
040 *Non-Disposable and Non-Dedicated Sampling Equipment Decontamination*
046 *Sample Labeling, Storage and Shipment Procedures*

NON-AQUEOUS PHASE LIQUID DETECTION AND SAMPLE COLLECTION PROCEDURE

ROUX

GROUNDWATER WE
PURGE & SAMPLE COLLECTION L

Project Name:	WELL NUMBER:
Project Number:	Sample Matrix:
Client:	Weather:

WELL DATA: DATE: TIME:

Casing Diameter (inches):	Casing Material:
Screened interval (fbTOR):	Screen Material:
Static Water Level (fbTOR):	Bottom Depth (fbTOR):
Elevation Top of Well Riser (fmsl):	Ground Surface Elevation (fmsl):
Elevation Top of Screen (fmsl):	Stick-up (feet):

PURGING DATA: DATE: START TIME: END TIME:

Method:	Is purge equipement dedicated to sample location? yes
No. of Well Volumes Purged:	Was well purged to dryness? yes
Standing Volume (gallons):	Was well purged below top of sand pack? yes
Volume Purged (gallons):	Condition of Well:
Purge Rate (gal/min):	Field Personnel:

VOLUME CALCULATION:

(A) Total Depth of Well (fbTOR):	
(B) Casing Diameter (inches):	
(C) Static Water Level (fbTOR):	
One Well Volume (V, gallons): V = 0.0408 [$(B)^2$ x { (A) - (C) }]	

* Use the table to the right to calculate one well volume by subtracting C from A, then multiplying by the volume calculation in the table per well diamter

Volume Calculation

Well Diameter	Volume gal/ft
1"	0.041
2"	0.163
3"	0.367
4"	0.653
5"	1.020
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	+/- 0.1 un
SC	+/- 3%
Turbidity	+/- 10%
DO	+/- 0.3 m
ORP	+/- 10 mV

EVACUATION STABILIZATION TEST DATA:

Time	Water Level (fbTOR)	Accumulated Volume (gallons)	pH (units)	Temperature (degrees C)	Specific Conductance (uS/cm)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance Odor
		initial							

SAMPLING DATA: DATE: START TIME: END TIME:

Method:	Is sampling equipement dedicated to sample location? yes
Initial Water Level (fbTOR):	Was well sampled to dryness? yes
Final Water Level (fbTOR):	Was well sampled below top of sand pack? yes
Air Temperature (°F):	Field Personnel:
Source and type of water used in the field for QC purposes:	

PHYSICAL & CHEMICAL DATA:

DESCRIPTION OF WATER SAMPLE		
Odor		
Color		
NAPL		
Contains Sediment?	yes	no

WATER QUALITY MEASUREMENTS							
Sample	Time	pH (units)	TEMP. (°C)	SC (uS)	TURB. (NTU)	DO (ppm)	ORP (mV)
initial							
final							

REMARKS:

PREPARED BY:

SAMPLE

FOP 040.1

NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

PURPOSE

This procedure is to be used for the decontamination of non-disposable and non-dedicated equipment used in the collection of environmental samples. The purpose of this procedure is to remove chemical constituents from previous samples from the sampling equipment. This prevents these constituents from being transferred to later samples, or being transported out of controlled areas.

HEALTH AND SAFETY

Nitric acid is a strong oxidizing agent as well as being extremely corrosive to the skin and eyes. Solvents such as acetone, methanol, hexane and isopropanol are flammable liquids. Limited contact with skin can cause irritation, while prolonged contact may result in dermatitis. Eye contact with the solvents may cause irritation or temporary corneal damage. Safety glasses with protective side shields, neoprene or nitrile gloves and long-sleeve protective clothing must be worn whenever acids and solvents are being used.

PROCEDURE – GENERAL EQUIPMENT

Bailers, split-spoons, steel or brass split-spoon liners, Shelby tubes, submersible pumps, soil sampling knives, and similar equipment will be decontaminated as described below.

1. Wash equipment thoroughly with non-phosphate detergent and potable-quality water, using a brush where possible to remove any particulate matter or surface film. If the sampler is visibly coated with tars or other phase-separated hydrocarbons, pre-wash with acetone or isopropanol, or by steam cleaning. Decontamination will adhere to the following procedure:

a. Rinse with potable-quality water; if the sampling equipment is very oily and use of a solvent is necessary, rinse with pesticide-grade isopropanol.

b. Rinse with potable-quality water;

c. Rinse with deionized water demonstrated analyte-free, such as distilled water;

d. Air dry; and

e. Store in a clean area or wrap in aluminum foil (shiny side out) or new plastic sheeting as necessary to ensure cleanliness.

2. All non-dedicated well evacuation equipment, such as submersible pumps and bailers, which are put into the well, must be decontaminated following the procedures listed above. All evacuation tubing must be dedicated to individual wells (i.e., tubing cannot be reused). However, if submersible pump discharge tubing must be reused, the tubing and associated sample valves or flow-through cells used in well purging or pumping tests will be decontaminated as described below:

a. Pump a mixture of potable water and a non-phosphate detergent through the tubing, sample valves and flow cells, using the submersible pump.

b. Steam clean or detergent wash the exterior of the tubing, sample valves, flow cells and pump.

c. Pump potable water through the tubing, sample valve, and flow cell until no indications of detergent (e.g. foaming) are observed.

d. Double rinse the exterior of the tubing with potable water.

e. Rinse the exterior of the tubing with distilled water.

f. Store in a clean area or wrap the pump and tubing assembly in new plastic sheeting as necessary to ensure cleanliness until ready for use.

3. All unused sample bottles and sampling equipment must be maintained in such a manner that there is no possibility of casual contamination.

4. Manage all waste materials generated during decontamination procedures as described in the Roux Field Operating Procedure for Management of Investigation Derived Waste.

PROCEDURE – SUBMERSIBLE PUMPS

Submersible pumps used in well purging or purging tests will be decontaminated thoroughly each day before use as well as between well locations as described below:

Daily Decontamination Procedure:

1. Pre-rinse: Operate the pump in a basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

2. Wash: Operate the pump in 8 to 10 gallons of non-phosphate detergent solution (i.e., Alconox) for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes.

3. Rinse: Operate the pump in a basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

4. Disassemble pump.

5. Wash pump parts with a non-phosphate detergent solution (i.e., Alconox). Scrub all pump parts with a test tube brush or similar device.

6. Rinse pump with potable water.

7. Rinse the inlet screen, the shaft, the suction interconnection, the motor lead assembly, and the stator housing with distilled/deionized water.

8. Rinse the impeller assembly with 1% nitric acid (HNO_3).

9. Rinse the impeller assembly with isopropanol.

10. Rinse the impeller assembly with distilled/deionized water.

Between Wells Decontamination Procedure:

1. Pre-rinse: Operate the pump in a basin containing 8 to 10 gallons of potable water for 5 minutes.

2. Wash: Operate the pump in 8 to 10 gallons of non-phosphate detergent solution (i.e., Alconox) for 5 minutes.

3. Rinse: Operate the pump in a basin of potable water for 5 minutes.

4. Final rinse the pump in distilled/deionized water.

ATTACHMENTS

None

REFERENCES

Roux FOPs:
032 Management of Investigation-Derived Waste

FIELD OPERATING PROCEDURES

Overburden Casing Installation Procedure

FOP 041.0

OVERBURDEN CASING INSTALLATION PRCEDURES

PURPOSE

This guideline presents a method for the installation of casing to prevent downhole contamination of hazardous compounds from shallow overburden material. This method is particularly applicable where contaminated strata overlie uncontaminated strata of lower permeability. The method can be used with hollow stem auger drilling or rotary wash drilling (where temporary casing is used). This guideline also presents a method for the evaluation of the integrity of the grout seal around an overburden casing, which has been positioned into a confining layer.

CASING INSTALLATION PROCEDURE

1. Advance boring by appropriate drilling methods, through the contaminated strata a short distance (1 to 2 feet) into an underlying lower permeable unit.

2. Calculate the volume of the borehole base on the bit/auger head or steel casing diameter plus 10% and determine the volume of grout to be emplaced. Generally, the total mixed volume is the borehole volume plus 20%.

3. Identify the equipment to be used for the preparation and mixing of the grout. Ensure the volume of the tanks to be used for mixing has been measured adequately. Document these volumes on the Field Borehole/Monitoring Well Installation Log (sample attached).

4. Identify the source of the water to be used for the grout and determine its suitability for use. In particular, water with high sulfate, or chloride levels or heated water should not be used. These types of waters can cause operational difficulties or modify the set-up for the grout.

5. Identify the equipment to be used for emplacing the grout. Ensure that the pump to be used has adequate pressure to enable complete return to surface.

6. Identify the volumes to be pumped at each stage or in total if only one stage is to be used.

7. Begin mixing the grout to be emplaced. Grout specifications generally have mixture ratios as follows:

Grout Slurry Composition (% Weight)		
1.5 to 3.0%	-	Bentonite (Quick Gel)
40 to 60 %	-	Cement (Portland Type I)
40 to 60 %	-	Potable Water

8. Record the type and amount of materials used during the mixing operation. Ensure the ratios are within specifications tolerance.

9. Begin pumping the grout through the return line bypass system to confirm all pump and surface fittings are secure.

10. Remove drill rods and center plug (or clean out temporary casing) and insert a tremie pipe to the bottom of the boring. Pump the cement/bentonite grout slurry through the tremie pipe until grout return is observed at grade and no bridging of the slurry is evident. Slowly withdraw the augers (or casing) from the boring while maintaining the grout level at grade. Record the times and volumes emplaced on the Field Borehole/Monitoring Well Installation Log (sample attached).

11. Document the return circulation of grout. This may be facilitated by using a colored dye or other tagging method if a mudded borehole condition exists prior to grout injection.

12. Place a drillable plug (preferably untreated wood) at the downhole end of black steel or other appropriate casing, insert the casing through the slurry, and seat it into the underlying formation.

13. Allow grout to set for 24 to 48 hours.

HYDROSTATIC TESTING OF CASING PROCEDURE

1. Following adequate setting time for the grout, drill through the grout inside the casing until the top of the confining layer has been reached (refer to Field Borehole/Monitoring Well Installation Log during casing installation).

2. Fill the casing with potable water and measure the water level within the casing with a water level indicator to the nearest 0.01-foot and record the measurement on the Pipe Leakage Testing Log (sample attached).

3. Monitor the water level for 30 minutes and record the final water level within the casing with a water level indicator to the nearest 0.01-foot and record the measurement on the Pipe Leakage Testing Log (sample attached).

4. Should the water level drop more than the allowable volume calculated using the following equation, the seal shall be regrouted at the Subcontractor's expense.

$$Q_{(allowable)} = 2.75\ DKH$$

Where:
$Q_{(allowable)}$ = Flow rate during a 30 minute test
D = Inside diameter of overburden casing
K = Confining layer hydraulic conductivity (see Table 1)
H = Head of water applied

Note: Be sure to use consistent units of measure.

ATTACHMENTS

Field Borehole/Monitoring Well Installation Log (sample)
Pipe Leakage Testing Log (sample)

Table 1 – Range of Values of Hydraulic Conductivity and Permeability

REFERENCES

Freeze, R.A. and J.A. Cherry. 1979. *Groundwater*. Prentice-Hall, Inc., Englewood, New Jersey, 604 p.

Roux FOPs:
018 Drilling and Excavation Equipment Decontamination Protocols

ROUX

FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

PROJECT:		**Log of Well No.:**	
BORING LOCATION:		ELEVATION AND DATUM:	
DRILLING CONTRACTOR:		DATE STARTED:	DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST: / COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

SAMPLE

Project No:	Benchmark Environmental Engineering & Science, PLLC	Figure

PIPE LEAKAGE TESTING LOG

Project: Location:

Client: Date:

Job No: Roux Personnel:

Location Description	Test Procedure (Air or Hydrostatic)	QC Initials	Readings				Elapsed Time (minutes)	Change in Pressure/ Water Level (psi/fbMP)	Pass/Fail	Passing Retest Date	Comments/Notes
			Start		End						
			Pressure or Water Level	Time	Pressure or Water Level	Time					

SAMPLE

Prepared By: Date:

TABLE 1: (From Freeze and Cherry, page 29.)

Table 2.2 Range of Values of Hydraulic Conductivity and Permeability

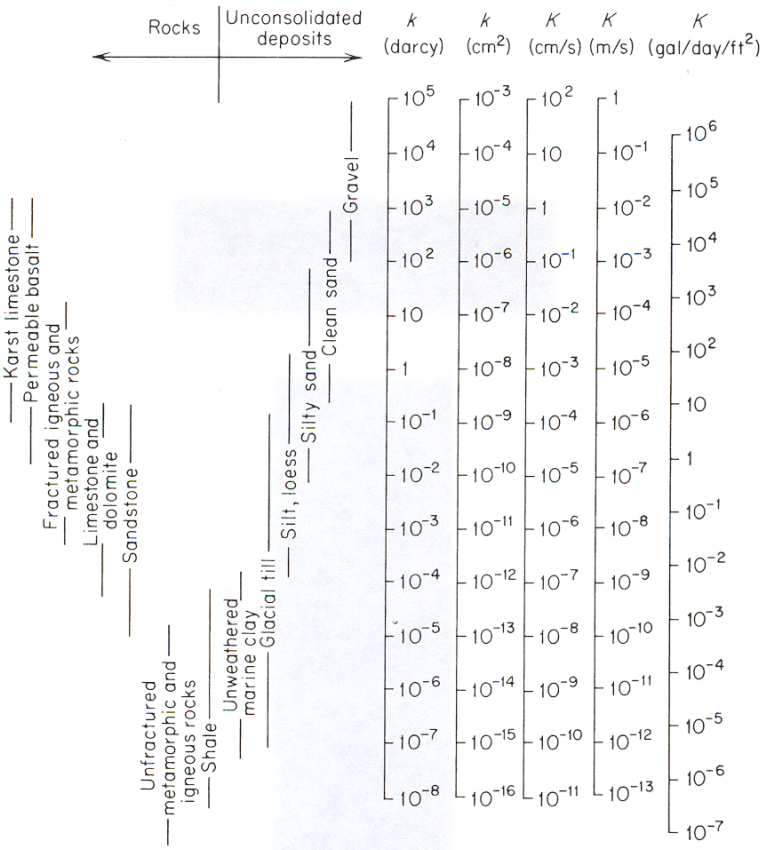


Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k*			Hydraulic conductivity, K		
	cm^2	ft^2	darcy	m/s	ft/s	U.S. gal/day/ft^2
cm^2	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft^2	9.29×10^{2}	1	9.42×10^{10}	9.11×10^{5}	2.99×10^{6}	1.71×10^{12}
darcy	9.87×10^{-9}	1.06×10^{-11}	1	9.66×10^{-6}	3.17×10^{-5}	1.82×10^{1}
m/s	1.02×10^{-3}	1.10×10^{-6}	1.04×10^{5}	1	3.28	2.12×10^{6}
ft/s	3.11×10^{-4}	3.35×10^{-7}	3.15×10^{4}	3.05×10^{-1}	1	6.46×10^{5}
U.S. gal/day/ft^2	5.42×10^{-10}	5.83×10^{-13}	5.49×10^{-2}	4.72×10^{-7}	1.55×10^{-6}	1

*To obtain k in ft^2, multiply k in cm^2 by 1.08×10^{-3}.

FIELD OPERATING PROCEDURES

Sample Labeling, Storage, and Shipment Procedures

FOP 046.1

SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

PURPOSE

The collection and analysis of samples of environmental media, including soils, groundwater, surface water, and sediment, are the central activities of the field investigation. These samples must be properly labeled to preserve its identity, and properly stored and shipped in a manner that preserves its integrity and chain of custody. This procedure presents methods for these activities.

SAMPLE LABELING PROCEDURE

1. Assign each sample retained for analysis a unique 9-digit alphanumeric identification code or as indicated in the Project Work Plan. Typically, this code will be formatted as follows:

Sample I.D. Example: GW051402047	
GW	**Sample matrix** GW = groundwater; SW = surface water; SUB = subsurface soil; SS = surface soil; SED = sediment; L = leachate; A = air
05	Month of sample collection
14	Day of sample collection
02	Year of sample collection
047	Consecutive sample number

2. Consecutive sample numbers will indicate the individual sample's sequence in the total set of samples collected during the investigation/sampling event. The sample number above, for example, would indicate the 47th sample retained for analysis during the field investigation, collected on May 14, 2002.

3. Affix a non-removable (when wet) label to each sample container. The following information will be written on the label with black or blue ink that will not smudge when wet:

   - Project number
   - Sample ID (see Step 1 above)
   - Date of sample collection
   - Time of sample collection (military time only)
   - Specify "grab" or "composite" sample with an "X"
   - Sampler initials
   - Preservative(s) (if applicable)
   - Analytes for analysis (if practicable)

4. Record all sample label information in the Project Field Book and on a Sample Summary Collection Log (see attached samples), keyed to the sample identification number. In addition, add information regarding the matrix, sample location, depth, etc. to provide a complete description of the sample.

SAMPLE STORAGE PROCEDURE

1. Immediately after collection, placement in the proper container, and labeling, place samples to be retained for chemical analysis into resealable plastic bags.

2. Place bagged samples into an ice chest filled approximately half-full of double bagged ice. Blue ice is not an acceptable substitute for ice.

3. Maintain samples in an ice chest or in an alternative location (e.g. sample refrigerator) as approved by the Roux Field Team Leader until time of shipment. Periodically drain melt-water off coolers and replenish ice as necessary.

4. Ship samples on a daily basis, unless otherwise directed by the Roux Field Team Leader.

5. Maintain appropriate custody procedures on coolers and other sample storage containers at all times. These procedures are discussed in detail in the Project Quality Assurance Project Plan, Monitoring Plan or Work Plan.

6. Samples shall be kept in a secure location locked and controlled (i.e., locked building or fenced area) so that only the Project Field Team Leader has access to the location or under the constant visual surveillance of the same.

SAMPLE SHIPPING PROCEDURE

1. Fill out the chain-of-custody form completely (see attached sample) with all relevant information. The white original goes with the samples and should be placed in a resealable plastic bag and taped inside the sample cooler lid; the sampler should retain the copy.

2. Place a layer of inert cushioning material such as bubble pack in the bottom of cooler.

3. Place each bottle in a bubble wrap sleeve or other protective wrap. To the extent practicable, then place each bottle in a resealable plastic bag.

4. Open a garbage bag (or similar) into a cooler and place sample bottles into the garbage bag (or similar) with volatile organic analysis (VOA) vials near the center of the cooler.

5. Pack bottles with ice in plastic bags. At packing completion, cooler should be at least 50 percent ice, by volume. Coolers should be completely filled, so that samples do not move excessively during shipping.

6. Duct tape (or similar) cooler drain closed and wrap cooler completely in two or more locations to secure lid, specifically covering the hinges of the cooler.

7. Place laboratory label address identifying cooler number (i.e., 1 of 4, 2 of 4 etc.) and overnight delivery waybill sleeves on cooler lid or handle sleeve (Federal Express).

8. Sign the custody seal tape with an indelible soft-tip marker and place over the duct tape across the front and back seam between the lid and cooler body.

9. Cover the signed custody seal tape with an additional wrap of transparent strapping tape.

10. Place "Fragile" and "This Side Up" labels on all four sides of the cooler. "This Side Up" labels are yellow labels with a black arrow with the arrowhead pointing toward the cooler lid.

11. For coolers shipped by overnight delivery, retain a copy of the shipping waybill, and attach to the chain-of-custody documentation.

ATTACHMENTS

Soil/Sediment Sample Summary Collection Log (sample)
Groundwater/Surface Water Sample Summary Collection Log (sample)
Wipe Sample Summary Collection Log (sample)
Air Sample Summary Collection Log (sample)
Chain-Of-Custody Form (sample)

REFERENCES

None

ROUX

SOIL/SEDIMENT
SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Depth (feet)		Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, depth changes, important matrix observations or description, gravel thickness, etc.)
			from	to						

Equipment Rinsate Blanks *- Pour clean deionized water over or through decontaminated sampling equipment into sample containers. Collect at a frequency of 1 per 20 samples of each matrix when non-dedicated equipment is utilized in accordance with DER-10.*

MS/MSD *- Collect at a frequency of 1 per 20 samples of each matrix in accordance with DER-10.*

Field Blank *- Pour clean deionized water (used as final decon rinse water) into sample containers while at the sampling site. Collect field blanks at a frequency of 1 per 20 samples of each matrix.*

Investigation Derived Waste (IDW) Characterization samples *- Collect composite samples from all drums of decon fluids and soil at the frequency required by the disposal facility. Please note number of drums and labels on collection log.*

Notes:
1. See QAPP for sampling frequency and actual number of QC samples.
2. MS/MSD - Matrix Spike, Matrix Spike Duplicate, Matrix Spike Blank.
3. BD - Blind Duplicate - indicate location of duplicate.

SAMPLE

Sample Summary Collection Logs - soil and sediment-REV.xlsx Page ____ of ____ Prepared By: _____

ROUX

GROUNDWATER/SURFACE WATER SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Depth (feet)		Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, depth changes, important matrix observations or description, gravel thickness, etc.)
			from	to						

Equipment Rinsate Blanks - Pour clean deionized water over or through decontaminated sampling equipment into sample containers. Collect at a frequency of 1 per 20 samples of each matrix when non-dedicated equipment is utilized in accordance with DER-10.

MS/MSD - Collect at a frequency of 1 per 20 samples of each matrix in accordance with DER-10.

Field Blank - Pour clean deionized water (used as final decon rinse water) into sample containers while at the sampling site. Collect field blanks at a frequency of 1 per 20 samples of each matrix.

Investigation Derived Waste (IDW) Characterization samples - Collect composite samples from all drums of decon fluids and soil at the frequency required by the disposal facility. Please note number of drums and labels on collection log.

Notes:
1. See QAPP for sampling frequency and actual number of QC samples.
2. MS/MSD - Matrix Spike, Matrix Spike Duplicate, Matrix Spike Blank
3. BD - Blind Duplicate - indicate location of duplicate.

SAMPLE

Sample Summary Collection Logs - GW and SW-REV 2025.xls Page ____ of ____ Prepared By: _____

ROUX

WIPE SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, important observations or descriptions, etc.)

Notes:

1. See QAPP for sampling frequency and actual number of QC samples.
2. No Matrix Spike or Matrix Spike Duplicate for wipe samples.
3. Equipment Blanks should be taken at a rate of 1 per 20 samples when non-dedicated equipment is utilized in accordance with DER-10.
4. Wipe sample field blanks collected by wiping unused glove (and any other sampling equipment coming into contact with sampled surface) with prepared gauze pad and place in sample jar. Take at a rate of 1 FB per 20 samples.
5. Wipe sample field duplicates taken adjacent to original sample at a rate of 1 field duplicate per 20 samples.

SAMPLE

Copy of Sample Summary Collection Logs - wipe-REV 2025.xls Page ____ of ____ Prepared By: _____

ROUX

AIR SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, important observations or descriptions, etc.)

SAMPLE

Notes:

1. See QAPP for sampling frequency and actual number of QC samples.
2. No Matrix Spike, Matrix Spike Duplicate, Field Duplicates, Field Blanks or Rinsates collected for air samples.

Sample Summary Collection Logs - air-REV 2025.xls Page ____ of ____ Prepared By: _____

CHAIN OF CUSTODY RECORD

Project No.			Project Name			Number of Containers	VOCs	SVOCs	Metals					REMARKS
Samplers (Signature)														
No.	Date	Time	comp	grab	Sample Identification									

Possible Hazard Identification:
☐ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal:
Return to Client ☐ Disposal by Lab ☐ Archive _____(mos.)

Turnaround Time Required:
Normal ☐ Rush ☐

QC Level:
I. ☐ II. ☐ III. ☐ Project Specific (specify):_____

Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	REMARKS:
Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	

SAMPLE

FIELD OPERATING PROCEDURES

Screening of Soil Samples for Organic Vapors During Drilling Activities

FOP 047.0

SCREENING OF SOIL SAMPLES FOR ORGANIC VAPORS DURING DRILLING ACTIVITIES

PURPOSE

This procedure is used to screen soil samples for the presence of volatile organic constituents (VOCs) using a field organic vapor meter. These meters will be either photoionization detector (PID) or flame-ionization detector (FID) type. This screening is performed at the drilling and sampling location as a procedure for ensuring the health and safety of personnel at the site and to identify potentially contaminated soil samples for laboratory analysis. All soil samples will be field screened to provide a vertical profile of soil contamination by volatile organic substances.

PROCEDURE

1. Calibrate air-monitoring equipment in accordance with the appropriate Roux's Field Operating Procedures or manufacturers recommendations for calibration of field meters.

2. Collect split-spoon (or other sampler) samples in accordance with Roux's Split Spoon Sampling Procedure FOP.

3. When the split-spoon or other sampler is opened or accessed, shave a thin layer of material from the entire length of the core.

4. Scan the core visually and with the PID or FID noting stratification, visible staining, or other evidence of contamination.

5. Based on this initial scan of the sample, collect approximately 100 milliliters (ml) of soil using a decontaminated or dedicated stainless steel spatula, scoop, or equivalent. Place this soil into a labeled wide-mouth glass jar approximately ½ to ¾ full and seal with aluminum foil and a screw top cap. Alternatively, the soil may be placed into a clean, re-sealable plastic bag and sealed. Be sure to leave some headspace above the soil sample within the sealed container.

6. Place field screening sample (i.e., jar or bag) in a location where the ambient temperature is at least 70° Fahrenheit.

7. Leave the field screening sample bag for at least 30 minutes, but no more than 60 minutes.

8. Carefully remove the screw top cap from the jar and slowly insert the tip of the organic vapor meter (PID or FID) through the aluminum foil seal making the smallest hole possible. Alternatively, unseal a portion of the plastic bag just big enough to insert the probe of a calibrated PID.

9. Record the maximum reading in parts per million by volume (ppmv) on the Field Borehole Log or Field Borehole/Monitoring Well Installation Log form (see attached samples) (see Documentation Requirements for Drilling and Well Installation FOP), at the depth interval corresponding to the depth of sample collection.

ATTACHMENTS

Field Borehole Log (sample)
Field Borehole/Monitoring Well Installation Log (sample)

REFERENCES

Roux FOPs:

010 *Calibration and Maintenance of Portable Flame Ionization Detector*
011 *Calibration and Maintenance of Portable Photoionization Detector*
015 *Documentation Requirements for Drilling and Well Installation*
058 *Split Spoon Sampling Procedures*

SCREENING OF SOIL SAMPLES FOR ORGANIC VAPORS DURING DRILLING ACTIVITIES

ROUX

FIELD BOREHOLE LOG

PROJECT:		**Log of Boring No.:**	
BORING LOCATION:		ELEVATION AND DATUM:	
DRILLING CONTRACTOR:		DATE STARTED:	DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST: / COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	REMARKS

SAMPLE

ABANDONMENT:

Volume of cement/bentonite grout required:	$V = \pi r^2 \times 7.48 =$ gallons	borehole depth =	ft.
Volume of cement/bentonite grout installed:	gallons	borehole diameter =	ft.
Has bridging of grout occurred?	☐ yes ☐ no	borehole radius =	ft.
If yes, explain resolution:			
Method of installation:			
Project No:	Roux Environmental Engineering and Geology, D.P.C.	Figure	

SCREENING OF SOIL SAMPLES FOR ORGANIC VAPORS DURING DRILLING ACTIVITIES

ROUX

FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

PROJECT:		**Log of Well No.:**	
BORING LOCATION:		ELEVATION AND DATUM:	
DRILLING CONTRACTOR:		DATE STARTED:	DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST: / COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

SAMPLE

Project No:	**Roux Environmental Engineering and Geology, D.P.C.**	Figure

FIELD OPERATING PROCEDURES

Soil Description Procedures Using The Visual-Manual Method

FOP 054.2

SOIL DESCRIPTION PROCEDURES USING THE VISUAL-MANUAL METHOD

PURPOSE

This guideline presents a means for insuring consistent and proper field identification and description of collected soils during a project (via, split-spoon (barrel) sampler, hand auger, test pit etc.). The lithology and moisture content of each soil sample will be physically characterized by visual-manual observation in accordance with ASTM Method D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). When precise classification of soils for engineering purposes is required, the procedures prescribed in ASTM Method D2487 (Standard Practice for Classification of Soils for Engineering Purposes [Unified Soil Classification System, USCS]) will be used. The method of soil characterization presented herein describes soil types based on grain size, liquid and plastic limits, and moisture content based on visual examination and manual tests. When using this FOP to classify soil, the detail of description provided for a particular material should be dictated by the complexity and objectives of the project. However, more often than not, "after the fact" field information is required later in the project, therefore, every attempt to describe the soil as completely as possibly should be made.

Intensely weathered or decomposed rock that is friable and can be reduced to gravel size or smaller by normal hand pressure should be classified as a soil. The soil classification would be followed by the parent rock name in parenthesis. Projects requiring depth to bedrock determinations should always classify weathered or decomposed bedrock as bedrock (i.e., landfill siting). The project manager should always be consulted prior to making this determination.

PROCEDURE

Assemble necessary equipment and discuss program requirements with drilling contractor.

1. Calibrate air-monitoring equipment in accordance with the appropriate Roux's Field Operating Procedures or manufacturers recommendations for calibration of field meters.

2. Collect desired soil sample in accordance with appropriate Roux FOP (i.e., split-spoon sampling, hand augering, test pitting etc.).

3. Shave a thin layer off the entire length of the sample to expose fresh sample.

4. Photograph and scan the sample with a photoionization detector (PID) at this time, if applicable, in accordance with Roux's Screening of Soil Samples for Organic Vapors During Drilling Activities FOP.

5. Describe the sample using terminology presented in the Descriptive Terms section below.

6. Record all pertinent information in the Project Field Book and Field Borehole Log (sample attached) or Field Borehole/Monitoring Well Installation Log (sample attached).

7. After the sample has been described, place a representative portion of the sample in new, precleaned jars or self-sealing plastic bags for archival purposes (if required). Label the jar or bag with the sample identification number, sample interval, date, project number and store in a secure location.

8. If the soil is to be submitted to a laboratory for analysis, collect the soil sample with a dedicated stainless steel sampling tool, place the sample into the appropriate laboratory-supplied containers, and store in an ice-chilled cooler staged in a secure location in accordance with Roux's Sample Labeling, Storage and Shipment Procedures FOP.

9. All remaining soil from soil sample collection activities shall be containerized in accordance with Roux's Management of Investigative-Derived Waste (IDW) FOP and/or the Project Work Plan.

DESCRIPTIVE TERMS

All field soil samples will be described using the Unified Soil Classification System (USCS) presented in Figures 1 and 2 (attached). In addition to ASTM Method D2488, Method D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils (a.k.a., Standard Penetration Test, STP), when implemented, can also be used to classify the resistance of soils. In certain instances, it is desirable to supplement the USCS classification with a geologic interpretation of the soil sample that is supported by the soil descriptive terms presented in this section. The project manager should be consulted when making any geologic interpretation. Field test methods are provided to assist field personnel in classifying soil and are identified by a bold blue **FTM** and shaded. Classification of sampled soils will use the following ASTM descriptive terms and criteria:

- **Group Name** (USCS, see Figure 2)
- **Group Symbol** (USCS, see Figure 2) – only use if physical laboratory testing has been performed to substantiate. The USCS can be applied to most unconsolidated materials, and is represented by a two-letter symbol, except Peat (Pt).
  - The first letter includes: G (gravel), S (sand), M (silt), C (clay), and O (organic).
  - The second letter includes: P (poorly graded or uniform particle sizes), W (well graded or diversified particle sizes), H (high plasticity), and L (low plasticity).
  - Examples:
    - GW = well graded gravels and gravel-sand mixtures, little or no fines
    - GP = poorly graded gravels and gravel-sand mixtures, little or no fines
    - GM = silty gravels, gravel-sand-silt mixtures

- GC = clayey gravels, gravel-sand-clay mixtures
- SW = well graded sands and gravelly sands, little or no fines
- SP = poorly graded sands and gravelly sands, little or no fines
- SM = silty sand, sand-silt mixtures
- SC = clayey sand sand-clay mixtures
- ML = inorganic silts, very fine sands, rock flour, silty or clayey fine sands
- CL = inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
- OL = organic silts and organic silty clays of low plasticity
- MH = inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts (very rare)
- CH = inorganic clays of high plasticity, fat clays
- OH = organic clays of medium to high plasticity
- Pt = peat, muck, and other highly organic soils

- **Angularity** (ASTM D2488; Table 1)
  - Angular – particles have sharp edges and relatively planar sides with unpolished surfaces
  - Subangular – particles are similar to angular description but have rounded edges
  - Subrounded – particles have nearly planar sides but have well-rounded corners and edges
  - Rounded – particles have smoothly curved sides and no edges
- **Particle Shape** (ASTM D2488; Table 2)
  - Flat – particles with width/thickness > 3
  - Elongated – particles with length/width > 3
  - Flat and Elongated – particles meet criteria for both flat and elongated
- **Moisture Condition** (ASTM D2488; Table 3)
  - Dry – absence of moisture, dusty, dry to the touch
  - Moist – damp, but no visible water
  - Wet – visible free water, usually soil is below water table
- **Reaction with Hydrochloric Acid (HCL)** (ASTM D2488; Table 4)
  - None – no visible reaction

- Weak – some reaction, with bubbles forming slowly
- Strong – violent reaction, with bubbles forming immediately

- **Consistency of Cohesive Soils** (ASTM D2488; Table 5)
  - Very soft – squeezes between fingers when fist is closed; easily penetrated several inches by fist (SPT = 2 or less)
  - Soft – easily molded by fingers; easily penetrated several inches by thumb (SPT = 2 to 4)
  - Firm – molded by strong pressure of fingers; can be penetrated several inches by thumb with moderate effort (SPT = 4 to 8)
  - Stiff – dented by strong pressure of fingers; readily indented by thumb but can be penetrated only with great effort (SPT = 8 to 15)
  - Very stiff – readily indented by thumbnail (SPT = 15 to 30)
  - Hard – indented with difficultly by thumbnail (SPT >30)
- **Cementation** (ASTM D2488; Table 6)
  - Weak – crumbles or breaks with handling or slight finger pressure
  - Moderate – crumbles or breaks with considerable finger pressure
  - Strong – will not crumble or break with finger pressure
- **Structure (Fabric)** (ASTM D2488; Table 7)
  - Varved – alternating 1 mm to 12 mm (0.04 – 0.5 inch) layers of sand, silt and clay
  - Stratified – alternating layers of varying material or color with the layers less than 6 mm (0.23 inches) thick; note thickness
  - Laminated – alternating layers of varying material or color with the layers less than 6 mm (0.23 inches) thick; note thickness
  - Fissured – contains shears or separations along planes of weakness
  - Slickensided – shear planes appear polished or glossy, sometimes striated

- Blocky – cohesive soil that can be broken down into small angular lumps which resist further breakdown
- Lensed – inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
- Homogeneous or Massive – same color and appearance throughout

- **Inorganic Fine-Grained Soil Characteristics** (ASTM D2488; Table 12)

  Several field tests can be performed to determine the characteristics of fine-grained soils (material passing the No. 40 sieve), such as dry strength, dilatency, and toughness. These field testing methods are described below.

  - **Dry Strength** (ASTM D2488; Table 8)

    FTM (Dry Strength): Select enough material and moisten with water until it can be molded or shaped without sticking to your fingers (slightly below the sticky limit) into a ball about 1 inch in diameter. From this ball, form three balls about ½ inch in diameter and allow to dry in air, or sun, or by artificial means (temperature not to exceed 60° C (140° F). Soil containing natural dry lumps about ½ inch in diameter may be used in place of molded balls, however the dry strengths are usually lower. Test the strength by crushing the dry balls or lumps between your fingers using the descriptions below.

    - None – the dry specimen crumbles with the slightest pressure of handling
    - Low – the dry specimen crumbles with some finger pressure
    - Medium – the dry specimen breaks into pieces or crumbles with considerable finger pressure
    - High – the dry specimen cannot be broken with finger pressure. The specimen will break into pieces between the thumb and a hard surface.
    - Very High – the dry specimen cannot be broken between the thumb and a hard surface

  - **Dilatency** (ASTM D2488; Table 9)

    FTM (Dilatency): Place enough material in your hand to form a ball approximately ½ inch in diameter and moisten with water until it can be

molded or shaped without sticking to your fingers (slightly below the sticky limit). Smooth the ball in the palm of one hand with the blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other several times. Note the reaction of water appearing on the surface of the soil. The soil is said to have given a reaction to this test if, when it is shaken, water comes to the surface of the sample producing a smooth, shiny appearance. Squeeze the sample between the thumb and forefinger and note the reaction as follows:

- None – no visible change in the specimen
- Slow – water slowly appears on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
- Rapid – water quickly appears on the surface of the specimen during shaking and disappears upon squeezing

- **Toughness** (ASTM D2488; Table 10)

FTM (Toughness): Following the dilatency test above, shape the test specimen into an elongated pat and roll by hand on a smooth surface or between palms into a thread about 1/8 inch in diameter. Fold the sample threads and re-roll repeatedly until the thread crumbles at a diameter of about 1/8 inch (e.g., near the plastic limit). Note the pressure required to roll the thread near the plastic limit as well as the strength of the thread. After the thread crumbles, lump the pieces together and knead the lump until it crumbles. Describe the toughness as follows:

- Low – only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and very soft.
- Medium – medium pressure is required to roll the thread to near the plastic limit. The thread and the lump are soft.
- High – considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump are firm.

Using the results of the dry strength, dilatency, and toughness test described above, classify the soil according to the following:

Soil Symbol	Dry Strength	Dilatency	Toughness
Silt (ML)	None to low	Slow to rapid	Low or thread cannot be formed
Lean clay (CL)	Medium to high	None to slow	Medium
Elastic Silt (MH)	Low to medium	None to slow	Low to medium
Fat Clay (CH)	High to very high	None	Low to medium high

- **Plasticity** (ASTM D2488; Table 11)

  Two field test methods can be used to determine plasticity of fine-grained soils (material passing the No. 40 sieve): the roll or thread test and the ribbon test. Each test is described below.

  FTM (Roll or Thread Test): As with the toughness test above, mix a representative portion of the soil sample with water until it can be molded or shaped without sticking to your fingers (slightly below the sticky limit). Place an elongated cylindrical sample on a nonabsorbent rolling surface (e.g., glass or was paper on a flat surface) and attempt to roll it into a thread approximately 1/8 inch in diameter. The results of this test are defined below (non-plastic to high plasticity).

  FTM (Ribbon Test): Form a roll from a handful of moist soil (slightly below the sticky limit) about ½ to ¾ inches in diameter and about 3 to 5 inches long. Place the material in the palm of your hand and, starting at one end, flatten the roll between your thumb and forefinger to form the longest and thinnest ribbon possible that can be supported by the cohesive properties of the material before breaking. If the soil sample holds together for a length of 6 to 10 inches without breaking, the material is considered to be both highly plastic and highly compressive (Fat Clay, CH). If the soil cannot be ribboned, it is non-plastic (Silt, ML or MH). If it can be ribboned only with difficulty into short lengths, it has low plasticity (Lean Clay, CL). Use the following terms to describe the plasticity of soil:

- Nonplastic (ML or MH) – a 3 mm (0.12 inches) thread cannot be rolled at any water content
- Low Plasticity (CL, ML, or MH) – the thread can barely be rolled, and crumbles easily
- Medium Plasticity (CL) – the thread is easy to roll and not much time is required to reach the plastic limit before crumbling
- High Plasticity (CH) – it takes considerable time rolling and kneading to reach the plastic limit; the thread can be rolled several times before crumbling

Note: A soil with as little as 20% clay will behave as a clayey soil. A soil needs 45% to over 60% medium to coarse sand to behave as a sandy soil. In a soil with 20% clay and 80% sand, the soil will behave as a clayey soil.

- **Relative Density of Cohesionless (Granular) Soils**
  - Very loose – easily penetrated 30 cm (1.2 inches) with 13 mm (0.5 inch) rebar pushed by hand (SPT = 0 to 4)
  - Loose – easily penetrated several cm with 13 mm (0.5 inch) rebar pushed by hand (SPT = 4 to 10)
  - Medium dense – easily to moderately penetrated with 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = 10 to 30)
  - Dense – penetrated 0.3 m (1 foot) with difficulty using 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = 30 to 50)
  - Very dense – penetrated only a few cm with 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = >50)
- **Color** (use Munsel® Color System, as necessary)
- **Particle Size** (see Figure 3)
  - Boulder – larger than a basketball
  - Cobble – grapefruit, orange, volleyball
  - Coarse Gravel – tennis ball, grape

- Fine Gravel – pea
- Coarse Sand – rock salt
- Medium Sand – opening in window screen
- Fine Sand – sugar, table salt
- Fines (silt and clay) – cannot visually determine size (unaided)

- **Gradation**
  - Well Graded (GW, SW) – full range and even distribution of grain sizes present
  - Poorly-graded (GP, SP) – narrow range of grain sizes present
  - Uniformly-graded (GP, SP) – consists predominantly of one grain size
  - Gap-graded (GP-SP) – within the range of grain sizes present, one or more sizes are missing

- **Organic Material** – Organic soils usually have a dark brown to black color and may have an organic odor. Often, organic soils will change color, for example, black to brown, when exposed to the air. Some organic soils will lighten in color significantly when air-dried. Organic soils normally will not have a high toughness or plasticity. The thread of the toughness test will be spongy.
  - PEAT – 50 to 100 percent organics by volume, primary constituent
  - Organic (soil name) – 15 to 50 percent organics by volume, secondary organic constituent
  - (Soil name) with some organics – 5 to 15 percent organics by volume, additional organic constituents

- **Fill Materials** – All soils should be examined to see if they contain materials indicative of man-made fills. Man-made fill items should be listed in each of the soil descriptions. Common fill indicators include glass, brick, dimensioned lumber, concrete, pavement sections, asphalt, metal, plastics, plaster etc. Other items that could suggest fill include buried vegetation mats, tree limbs, stumps etc. The soil description for a fill material should be followed by the term "FILL", i.e., for a sandy silt with some brick fragments the description would be "SANDY

SILT (ML), with brick fragments (Fill)". The size and distribution of fill indicators should be noted. The limits (depth range) of fill material should be determined and identified at each exploration location.

- **Other Constituents/Characteristics**
  - Additional constituents and/or pertinent soil characteristics not included in the previous categories should be described depending on the scope and objectives of the project. Observations that may be discussed include:
    - Oxide staining
    - Odor
    - Origin
    - Presence of root cast
    - Presence of mica
    - Presence of gypsum
    - Presence of calcium carbonate
    - Percent by volume of cobbles & boulders with size description and appropriate rock classification
  - Other pertinent information from the exploratory program should be recorded, if it would be useful from a biddability/constructability perspective. The conditions that should be listed include caving or sloughing, difficulty in drilling and groundwater infiltration.

SOIL DESCRIPTIONS

Generally, soil descriptions collected during most investigations are not intended for civil engineering (construction) purposes, but rather for hydrogeologic and contaminant transport purposes. As such, the ASTM visual-manual assessments are somewhat limited in that they are only performed in order to indicate important information about potential hydraulic properties of a soil. Soil descriptions should be concise, stressing major constituents and

characteristics, and should be given in a consistent order and format. The following order is recommended:

- Soil name. The basic name of the predominant grain size and a single-word modifier indicating the major subordinate grain size (i.e., mostly clay with some silt). The feel test can be used to determine the texture of the soil by rubbing some moist soil between your fingers; sand feels gritty, silt feels smooth, and clays feel sticky. The terms representing percentages of grain size to be used include:
    - Trace – particles are present, but estimated to be less than 5%
    - Few – 5 to 10%
    - Little – 15 to 25%
    - Some – 30 to 45%
    - Mostly – 50 to 100%
- Color (using Munsell® charts, as necessary). Color is an important property in identifying organic soils, and within a given locality it may also be useful in identifying materials of similar geologic origin. It the sample contains layers or patches of varying colors (e.g., mottled), this shall be noted and all representative colors shall be described. The color shall be described for moist samples, however if the color represents a dry condition, it must be stated as such in the log. Generally, colors become darker as the moisture content increases and lighter as the soil dries. Examples include:
    - Some fine-grained soils (OL, OH) with dark drab shades of brown or gray, including almost black, contain organic colloidal matter.
    - In contrast, clean, bright looking shades of gray, olive green, brown, red, yellow, and white are associated with inorganic soils.
    - Gray-blue or gray- and yellow-mottled colors frequently result from poor drainage.
    - Red, yellow, and yellowish brown result from the presence of iron oxides.

  - White to pink may indicate considerable silica, calcium carbonate, or aluminum compounds.

- Field moisture condition as dry, moist, or wet;
- Gradation or Plasticity. Granular soils (i.e., sands or gravels) should be described as well-graded, poorly graded, uniform, or gap-graded, depending on the gradation of the minus 3-inch fraction. Cohesive soils (i.e., silts and clays) should be described as non-plastic, low, medium, or high, depending on the results of the manual evaluation for dry strength, dilatency, toughness, and plasticity discussed previously.
- Consistency/Density. An estimate of consistency of a cohesive soil or density of a granular soil, usually based on the SPT results (see Descriptive Terms section of this FOP);
- Soil Structure or Mineralogy. Description of discontinuities, inclusions, and structures, including joints, fissures, and slickensides.
- Odor. Describe the odor if organic or unusual. Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation. This is especially apparent in fresh samples, but if the samples are dried, the odor may often be revived by heating a moistened sample. If the odor is unusual (petroleum, chemical, etc.), it should be noted in the log.
- Other important geologic information such as consolidation, gravel size and shape, visible internal structure, root holes, mica, odors, etc.

The first step when describing soil is to determine if the sample is predominantly fine-grained or coarse-grained (see Figures 3 and 4). Coarse-grained soils are relatively easy to identify, however descriptions of fine-grained soils can be more difficult, requiring additional field tests to assist the field geologist arrive at the proper soils classification (see **FTMs** under Descriptive Terms above). These tests are explained in detail in the ASTM Standard D2488 and briefly herein. Generally, the differentiation between silt and clay is based on plasticity and "texture". However, tests for dry strength and dilatency, along with plasticity,

can be very helpful and are recommended in the ASTM Standard. If additional tests are performed, in addition to plasticity, to classify the fines, record them with the soil description on the logs. Doing this will assist the reader (i.e., Project Manager) to follow the logic used to describe a soil (e.g., medium plasticity, low dry strength = elastic silt [MH]; not a lean clay [CL]).

Fines described in the classification should be modified by their plasticity (e.g., non-plastic fines, low plasticity fines, etc.) reserving the words "silt" and "clay" for the soil name.

In summary, adhering to the ASTM Standard and the guidelines outlined in this FOP will provide uniformity in soil descriptions provided by all field personnel. Prior to mobilization to the field, field staff should make sure to have laminated copies of the ASTM Standard flow charts and tables as well as this FOP (as necessary). Some examples of complete soil descriptions are as follows:

Coarse-grained Soil

POORLY GRADED FINE SAND w/ SILT: Dark grey, wet, mostly fine sand with some non-plastic fines, some iron-stained mottling, laminated, medium dense

Fine-grained Soil

LEAN CLAY: Dark reddish/brown, moist, mostly fines, medium plasticity, firm, no dilatency, medium dry strength, root holes.

Soil/Fill (option 1) – visual evidence of fill

FILL: Black, moist, mostly fines with some fine sand, slag, cinders, metal, brick, non-plastic, loose when disturbed, strong odor

Soil/Fill (option 2) – no visual evidence of fill, suspected reworked material

FILL (reworked): Black, moist, mostly fines with some fine sand and few coarse angular gravel, non-plastic, hard, loose when disturbed, mild odor

BORING AND MONITORING WELL INSTALLATION LOGS

Currently, Roux utilizes WinLoG software to construct subsurface logs and a template of the log is included in this FOP as an example. One of the most important functions of a boring/monitoring well installation log, besides transmitting the soil description, is to indicate where the "data" (soil samples) were collected, giving the reader an idea of how reliable or representative the description is. On each sample log, depths of attempted and recovered or non-recovered interval are shown. Odor, if noted, should be considered subjective and not necessarily indicative of specific compounds or concentrations.

Remember: all field logs should be NEAT, ACCURATE, and LEGIBLE. Don't forget that the well completion diagram completed for each well requires details of the surface completion (i.e., flush-mount, stick-up etc.). It is the responsibility of the field staff to double-check each log (i.e., soil names, classifications, well construction details etc.) prior to implementing into a final report. A registered professional (i.e., professional engineer, PE or professional geologist, PG) must review each log and will be ultimately responsible for its content and accuracy.

REQUIRED EQUIPMENT

- Knife
- Engineer's rule/measuring tape

- Permanent marker
- Pre-cleaned wide-mouth sample jars (typically provided by the driller)
- Pre-cleaned wide-mouth laboratory sample jars (provided by the laboratory)
- Stainless steel sampling equipment (i.e., spoons, spatulas, bowls etc.)
- 10x hand lens
- Hydrochloric acid
- ASTM D2488 flow charts (preferably laminated)
- ASTM D2488 test procedures (Tables 1 through 12) (preferably laminated)
- Camera (disposable, 35 mm or digital)
- Munsell soil color chart (as necessary)
- Project Field Book/field forms

ATTACHMENTS

Figure 1; Field Guide for Soil and Stratigraphic Analysis
Figure 2; USCS Soil Classification Flow Chart (modified from ASTM D2488)
Figure 3; Illustration of Particle Sizes
Figure 4; Grain-Size Scale (Modified Wentworth Scale)

Field Borehole Log (sample)

REFERENCES

American Society for Testing and Materials, 2008a. *ASTM D1586: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.*

American Society for Testing and Materials, 2010. *ASTM D2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).*

American Society for Testing and Materials, 2009a. *ASTM D2488: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).*

State of California, Department of Transportation, Engineering Service Center, Office of Structural Foundations, August 1996. *Soil & Rock Logging Classification Manual (Field Guide), by Joseph C. de Larios.*

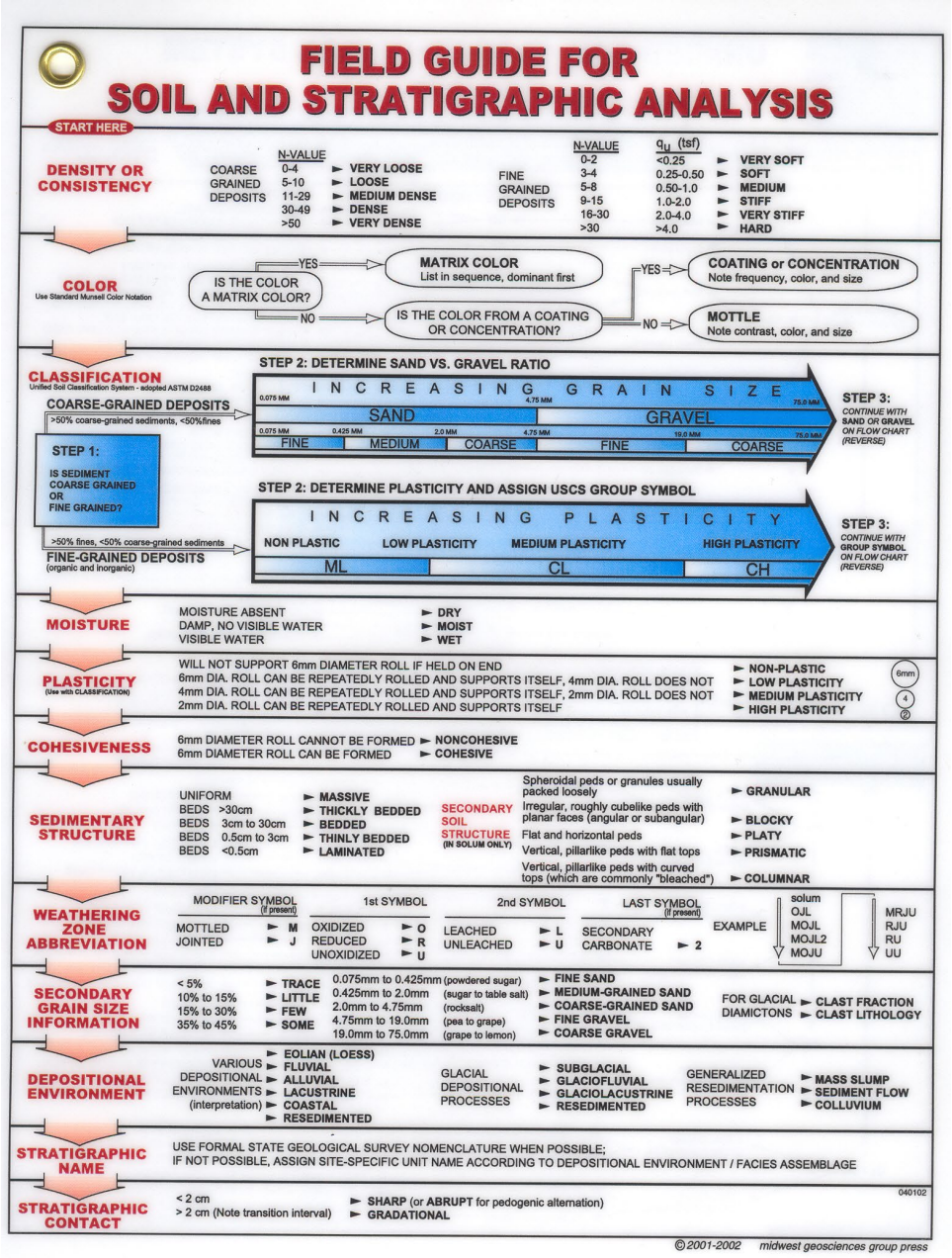
Roux FOPs:

010 *Calibration and Maintenance of Portable Flame Ionization Detector*
011 *Calibration and Maintenance of Portable Photoionization Detector*
015 *Documentation Requirements for Drilling and Well Installation*
025 *Hand Augering Procedures*
032 *Management of Investigation-Derived Waste*
046 *Sample Labeling, Storage and Shipment Procedures*
047 *Screening of Soil Samples for Organic Vapors During Drilling Activities*
058 *Split-Spoon Sampling Procedures*
065 *Test Pit Excavation and Logging Procedures*

SOIL DESCRIPTION PROCEDURES USING THE VISUAL-MANUAL METHOD

FIGURE 1

FIELD GUIDE FOR SOIL AND STRATIGRAPHIC ANALYSIS



SOIL DESCRIPTION PROCEDURES USING THE VISUAL-MANUAL METHOD

FIGURE 2

USCS SOIL CLASSIFICATION FLOW CHART (MODIFIED FROM ASTM D2488)

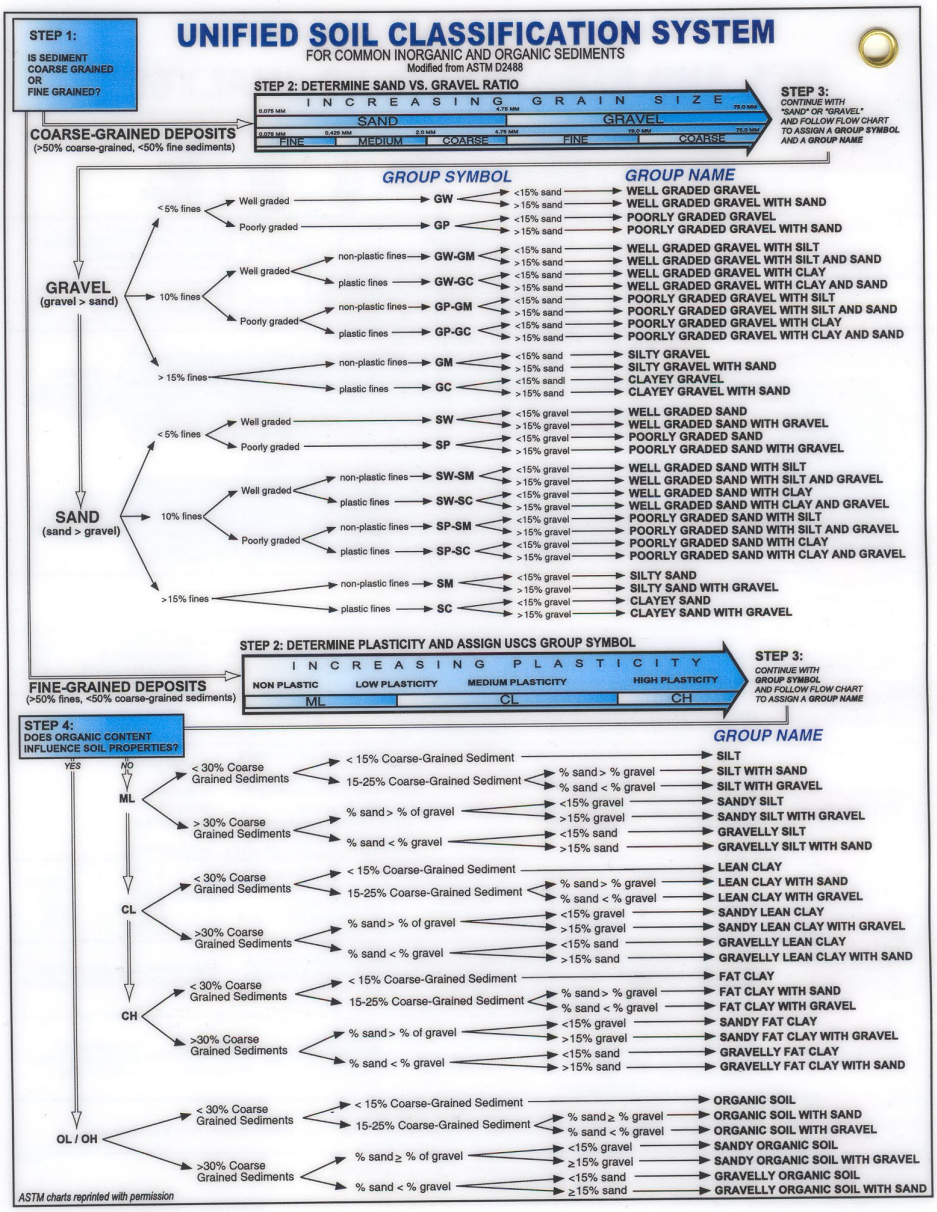


FIGURE 3

ILLUSTRATION OF PARTICLE SIZES

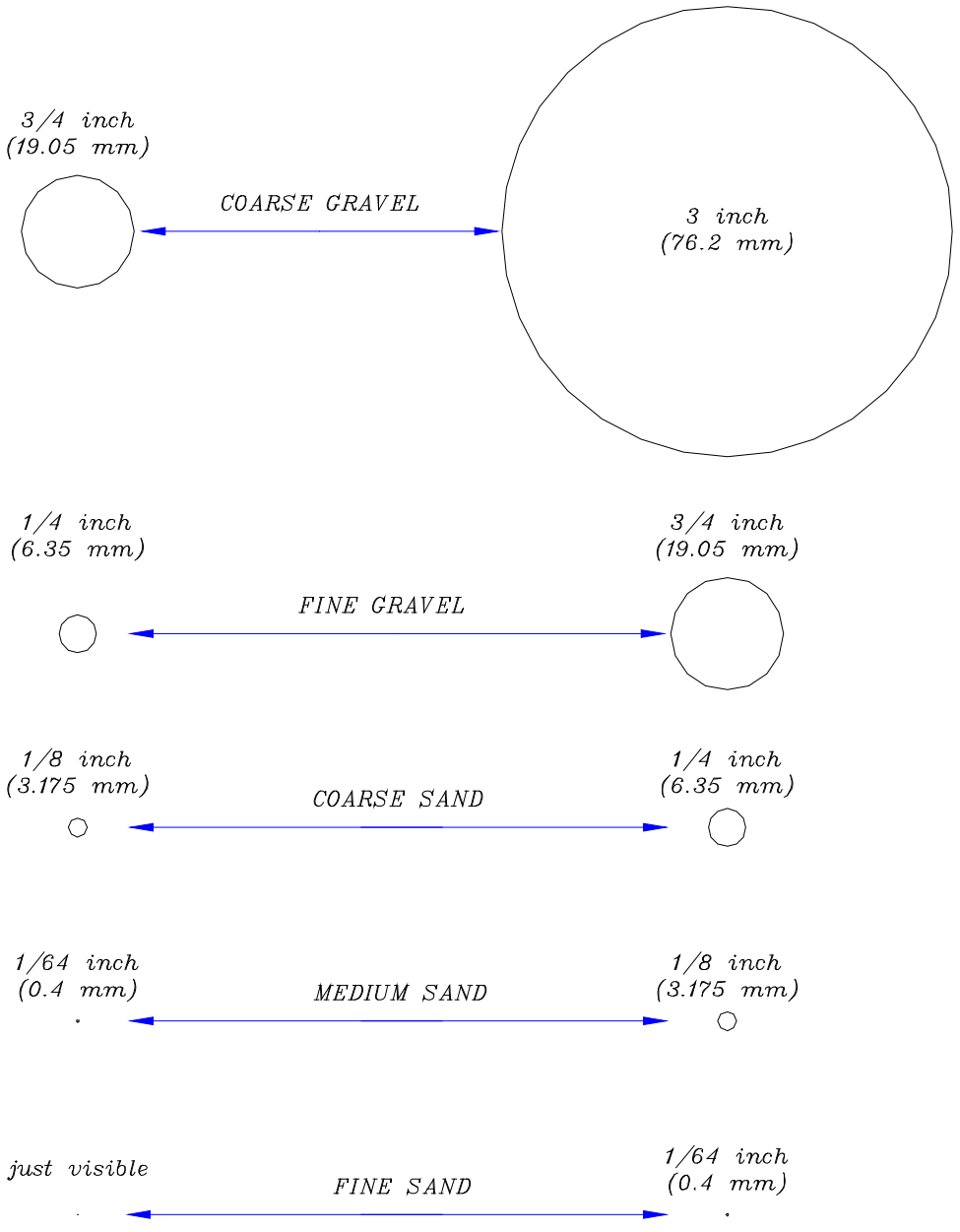


FIGURE 4

GRAIN-SIZE SCALE (MODIFIED WENTWORTH SCALE)

Grain size refers to the physical dimensions of particles of rock or other solid. This is different from the crystallite size, which is the size of a single crystal inside the solid (a grain can be made of several single crystals). Grain sizes can range from very small colloidal particles, through clay, silt, sand, and gravel, to boulders. Size ranges define limits of classes that are given names in the Wentworth scale used in the United States. The Krumbein *phi* (φ) scale, a modification of the Wentworth scale created by W. C. Krumbein, is a logarithmic scale computed by the equation: $\varphi = -\log_2(\text{grain size in mm})$.

φ scale	Size range (metric)	Size range (approx. inches)	Aggregate name (Wentworth Class)
< −8	> 256 mm	> 10.1 in	Boulder
−6 to −8	64–256 mm	2.5–10.1 in	Cobble
−5 to −6	32–64 mm	1.26–2.5 in	Very coarse gravel
−4 to −5	16–32 mm	0.63–1.26 in	Coarse gravel
−3 to −4	8–16 mm	0.31–0.63 in	Medium gravel
−2 to −3	4–8 mm	0.157–0.31 in	Fine gravel
−1 to −2	2–4 mm	0.079–0.157 in	Very fine gravel
0 to −1	1–2 mm	0.039–0.079 in	Very coarse sand
1 to 0	½–1 mm	0.020–0.039 in	Coarse sand
2 to 1	¼–½ mm	0.010–0.020 in	Medium sand
3 to 2	125–250 µm	0.0049–0.010 in	Fine sand
4 to 3	62.5–125 µm	0.0025–0.0049 in	Very fine sand
8 to 4	3.90625–62.5 µm	0.00015–0.0025 in	Silt
> 8	< 3.90625 µm	< 0.00015 in	Clay
<10	< 1 µm	< 0.000039 in	Colloid

In some schemes "gravel" is anything larger than sand (>2.0 mm), and includes "granule", "pebble", "cobble", and "boulder" in the above table. In this scheme, "pebble" covers the size range 4 to 64 mm (−2 to −6 φ).

SOIL DESCRIPTION PROCEDURES USING THE VISUAL-MANUAL METHOD

Project No: **Borehole Number:**

Project:

Client: *Logged By:*

Site Location: *Checked By:*

Roux Environmental Engineering & Geology, D.P.C.
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE			SAMPLE						
Elev. /Depth	Symbol	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	PID VOCs ppm 0 25 50	Lab Sample	Well Completion Details or Remarks
0.0 / 0.0		Ground Surface							

SAMPLE

Drilled By: *Hole Size:*
Drill Rig Type: *Stick-up:*
Drill Method: *Datum:*

Drill Date(s): *Sheet: 1 of 1*

FIELD OPERATING PROCEDURES

Soil Sample Collection for VOC Analysis (EnCore Sampling)

FOP 057.0

SOIL SAMPLE COLLECTION FOR VOC ANALYSIS – ENCORE SAMPLING

BACKGROUND AND PURPOSE

This procedure describes the methods for collecting soil samples for VOC analysis to ensure that the sample adequately represents the VOC concentrations in the soil in accordance with SW-846 Method 5035A (effective July 1, 2002). These compounds tend to volatilize from the soil after disturbance or introduction to the atmosphere. Therefore, care must be exercised to ensure that the sample collected is not altered during the collection and storage procedures. A variety of sampling options are allowed and Appendix A of Method 5035A provides details regarding the many options available for sample collection. The collection and preservation procedures are intended to prevent loss of VOCs during sample transport, handling and analysis.

Method 5035A is a method designed for volatile sample collection and analysis of soils and solid wastes for volatile organic compounds. This method is described in Update III to the Third Edition of SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, and is required for all analytical methods using purge and trap techniques (8021, 8015B, and 8260B). Alternative protocols may be used in some states (including New York), however this method is strongly recommended.

The volatile analysis is performed over two ranges:

	GC/MS (µg/kg)	GC (µg/kg)
Low Level	5 – 300	Not Available
High Level	>250	>20

The different levels require different sampling techniques. The low level method can only handle samples within a specific concentration range (these samples CANNOT be diluted), therefore a high level sample MUST be collected to ensure that all the target analytes can be quantified.

Naturally occurring carbonates in some soils may cause effervescence (foaming) on contact with the sodium bisulfate (NaHSO4) solution used as preservative for the low-level preparation. This interference makes it necessary for the laboratory to use the high-level prep or an alternative technique for low level. Check with the NYSDEC to discuss acceptable options.

Typically, analytical laboratories will support the following options for the two levels:

Option	No. of Containers	Sample Size (g)	Holding Time (days)
A – Low Level EnCore™ Samplers	3*	5	14**
B – High Level EnCore™ Sampler	1*	5	14**
C – High Level Methanol vial w/syringe	1	10	14

* Additional EnCore™ Samplers are required for MS/MSD.

** The sample MUST be extracted and preserved in sodium bisulfate or methanol within 48 hours of collection.

NOTE: The EnCore™ Sampler is disposable – it can only be used ONCE. It CANNOT be cleaned and/or reused. The samplers MUST be used in conjunction with an EnCore™ T-handle.

PROCEDURE

The preferred method for collecting and storing a soil sample for VOC analysis is using the EnCore™ method. This field procedure is described in this FOP.

1. The sampling team should reference the manufacturers' directions prior to sample collection (attached).

    a. Ensure that the EnCore™ Sampler is present at the sampling location before collecting the sample from the borehole or surface sample location. The necessary parts of the EnCore™ Sampler will consist of three disposable coring bodies, three disposable caps, and a reusable stainless steel T-handle.

    b. Retrieve the sampling tool from the borehole or sample location.

    c. Expose a surface of the soil sample. For Shelby tube samples, this would require the extrusion of the sample. For split spoon samples, this would require the spoon be disassembled and opened. If liners are being used in conjunction with a split spoon or solid barrel sampler, this would require the removal of the liners from the sampler, so that the soil at the liner's end is exposed.

    d. Following the manufacturer's directions for the use of the EnCore™ Sampler (attached), collect three aliquots of soil from the exposed soil surface, using the three coring bodies. After the collection of each aliquot, cap and label each aliquot. The manufacturer's direction for use of the EnCore™ Sampler are attached

2. If the use of the EnCore™ Sampler is not possible due to soil texture (e.g. gravels) the sample must be field preserved with acid and methanol in accordance with SW-846 Method 5035A.

3. If the soil material is too coarse for sampling with the EnCore™ Sampler and contains excessive calcium carbonate material that reacts with the acid preservative, the sample will be retained in the brass or stainless steel liner of the split-spoon sampler or similar device. The ends of these liners will be covered with Teflon™ rounds, capped and sealed with tape.

4. Record all information associated with sample collection in the Project Field Book.

5. The samples will be labeled, stored and shipped in accordance with the Roux Field Operating Procedure for Sample Labeling, Storage and Shipment Procedures.

ATTACHMENTS

EnCore™ Sampling Procedure (manufacturers instructions)

REFERENCES

Roux FOPs:
046 Sample Labeling, Storage and Shipment Procedures

ATTACHMENT

EnCore™ Sampling Procedure (manufacturers instructions)

Disposable
En Core® Sampler

Sampling Procedures

Using The
En Core® T-Handle

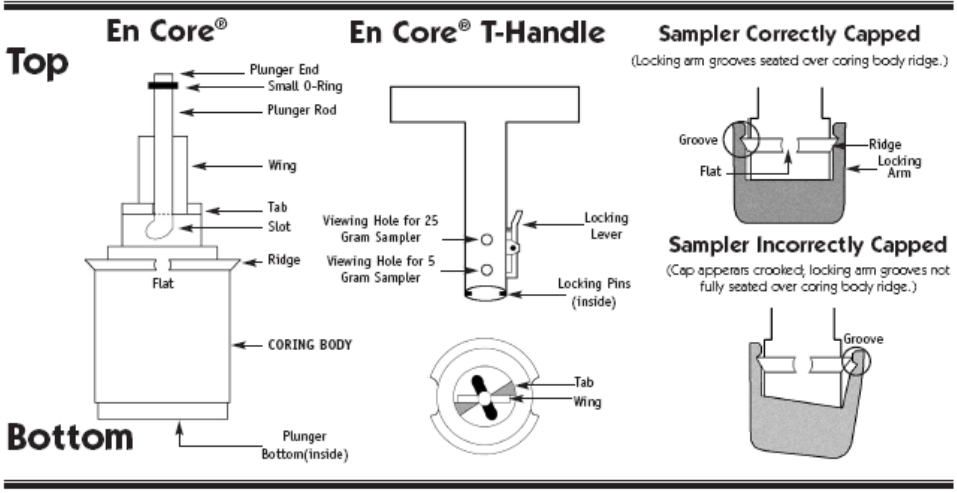
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Toll Free: 888-411-0757
www.ennovativetech.com

NOTE:

1. En Core® Sampler is a SINGLE USE device. It cannot be cleaned and/or reused.

2. En Core® Sampler is designed to store soil. Do not use En Core Sampler to store solvent or free product!

3. En Core® Sampler must be used with En Core® T-Handle and/or En Core® Extrusion Tool exclusively. (These items are sold separately.)



BEFORE TAKING SAMPLE:

1. Hold **coring body** and push **plunger rod** down until **small o-ring** rests against **tabs**. This will assure that plunger moves freely.

2. Depress **locking lever** on En Core T-Handle. Place coring body, **plunger end first**, into open end of T-Handle, *aligning the (2) slots on the coring body with the (2) locking pins in the T-Handle*. Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready for use.

TAKING SAMPLE:

3. Turn T-Handle with T-up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that plunger bottom is in position). Using T-Handle, push Sampler into soil until coring body is completely full. When full, small o-ring will be centered in T-Handle **viewing hole**. Remove Sampler from soil. Wipe excess soil from coring body exterior.

4. Cap coring body while it is still on T-handle. *Push* **cap** over **flat** area of **ridge** *and twist* to lock **cap** in place. **CAP MUST BE SEATED TO SEAL SAMPLER (see diagram).**

PREPARING SAMPLER FOR SHIPMENT:

5. Remove the capped Sampler by depressing locking lever on T-Handle while twisting and pulling Sampler from T-Handle.

6. Lock plunger by rotating extended plunger rod fully counter-clockwise until **wings** rest firmly against tabs (see plunger diagram).

7. Attach completed tear-off label (from En Core Sampler bag) to cap on coring body.

8. Return full En Core Sampler to zipper bag. Seal bag and put on ice.

Disposable En Core® Sampler

EXTRUSION PROCEDURES

USING THE En Core® EXTRUSION TOOL

CAUTION! Always use the Extrusion Tool to extrude soil from the En Core Sampler. If the Extrusion Tool is not used, the Sampler may fragment, causing injury.

1. Use a pliers to break locking arms on cap of En Core Sampler. Do not remove cap at this time. **(CAUTION: Broken edges will be sharp.)**

2. To attach En Core Sampler to En Core Extrusion Tool: Depress locking lever on Extrusion Tool and place Sampler, plunger end first, into open end of Extrusion Tool, aligning slots on coring body with pins in Extrusion Tool. Turn coring body clockwise until it locks into place. Release locking lever.

3. Rotate and gently push Extrusion Tool plunger knob clockwise until plunger slides over wings of coring body. (When properly positioned plunger will not rotate further.)

4. Hold Extrusion Tool with capped Sampler pointed upward so soil does not fall out when cap is removed. To release soil core, remove cap from Sampler and push down on plunger knob of En Core Extrusion Tool. Remove and properly dispose of En Core Sampler.

Warranty and Disclaimers

IMPORTANT: FAILURE TO USE THE EN CORE® SAMPLER IN COMPLIANCE WITH THE WRITTEN INSTRUCTIONS PROVIDED HEREIN VOIDS ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

PRINCIPLE OF USE. The En Core Sampler Cartridge System is a volumetric sampling system designed to collect, store and deliver a soil sample. The En Core Sampler comes in two sizes for sample volumes of approximately 25 or 5 grams. There are four components: the cartridge with a movable plunger; a cap with two locking arms; a T-handle (purchased separately); and an extrusion handle (purchased separately). NOTE: The En Core Sampler is designed to store soil. It is not designed to store solvent or free product.

The soil is stored in a sealed headspace-free state. The seals are achieved by three special Viton® * o-rings, two located on the plunger and one on the cap of the Sampler. At no time and under no condition should these o-rings be removed or disturbed.

QUALITY CONTROL. The cartridge is sealed in an airtight package to prevent contamination prior to use. Due to the stringent quality control requirements associated with the use of this system, the disposable cartridge is designed to be used only once.

WARRANTY. En Novative Technologies, Inc. ("En Novative Technologies") warrants that the En Core Sampler shall perform consistent with the research conducted under En Novative Technologies' approval, within thirty (30) days from the date of delivery, provided that the Customer gives En Novative Technologies prompt notice of any defect or failure to perform and satisfactory proof thereof. THIS WARRANTY DOES NOT APPLY TO THE FOLLOWING, AS SOLELY DETERMINED BY EN NOVATIVE TECHNOLOGIES: (a) Damage caused by accident, abuse, mishandling or dropping; (b)Samplers that have been opened, taken apart or mishandled; (c)Samplers not used in accordance with the directions; and (d)Damages exceeding the cost of the sampler. Seller warrants that all En Core Samplers shall be free from defects in title. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY INFORMATION PROVIDED BY SALES REPRESENTATIVES OR IN MARKETING LITERATURE. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. En Novative Technologies' warranty obligations and Customer's remedies, except as to title, are solely and exclusively as stated herein.

LIMITATION OF LIABILITY. IN NO EVENT SHALL EN NOVATIVE TECHNOLOGIES BE LIABLE FOR ANTICIPATED PROFITS, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF REVENUE, DOWN TIME, REMEDIATION ACTIVITIES, REMOBILIZATION OR RESAMPLING, COST OF CAPITAL, SERVICE INTERRUPTION OR FAILURE OF SUPPLY, LIABILITY OF CUSTOMER TO A THIRD PARTY, OR FOR LABOR, OVERHEAD, TRANSPORTATION, SUBSTITUTE SUPPLY SOURCES OR ANY OTHER EXPENSE, DAMAGE OR LOSS, INCLUDING PERSONAL INJURY OR PROPERTY DAMAGE. En Novative Technologies' liability on any claim of any kind shall be replacement of the En Core Sampler or refund of the purchase price. En Novative Technologies shall not be liable for penalties of any description whatsoever. In the event the En Core Sampler will be utilized by Customer on behalf of a third party, such third party shall not occupy the position of a third-party beneficiary of the obligation or warranty provided by En Novative Technologies, and no such third party shall have the right to enforce same. All claims must be brought within one (1) year of shipment, regardless of their nature.

En Novative Technologies, Inc.
1241 Bellevue Street
Green Bay, WI 54302
Phone: 920-465-3960 • Fax: 920-465-3963
Toll Free: 888-411-0757
www.ennovativetech.com

The En Core™ Sampler is covered by One or More of the Following U.S. Patents: 5,343,771; 5,505,098; 5,517,868; 5,522,271. Other U.S. and Foreign Patents Pending.

* Viton® is a registered trademark of DuPont Dow Elastomers.

FIELD OPERATING PROCEDURES

Split-Spoon Sampling Procedures

FOP 058.0

SPLIT-SPOON SAMPLING PROCEDURES

PURPOSE

This guideline presents the methods for using a split-spoon sampler for collecting soil samples from a boring and for estimating the relative in-situ compressive strength of subsurface materials (ASTM D 1586). Representative samples for lithologic description, geochemical analysis, and geotechnical testing will be collected from the subsurface materials using the split-spoon sampler.

PROCEDURE

1. Place plastic sheeting on a sturdy surface to prevent the split-spoon and its contents from coming in contact with the surface (several layers of sheeting may be placed on the surface so that they may be removed between each sample or as needed).

2. Lower the sampling string to the base of the borehole. Measure the portion of the sampling string that extends above surrounding grade (i.e. the stickup). The depth of sampling will equal the total length of the string (sampler plus rods) minus the stickup length.

3. Measure sampling depths to an accuracy of 0.1 feet. If field measurements indicate the presence of more than 0.3 feet of disturbed materials in the base of the borehole (i.e. slough), the sampler will be used to remove this material, after which a second sampling trip will be made.

4. Select additional sampler components as required (i.e., leaf spring core retainer for clays or a sand trap for non-cohesive sands). If a retainer or trap is not used, a spacer ring will be used to hold the liners in position inside the sampler.

5. For driving samples, attach the drive head sub and hammer to the drill rods without the weight resting on the rods. For pushing samples using the rig hydraulics, skip to Step 9.

6. Mark four 6-inch intervals on the drill rods relative to a reference point on the drill rig. With the sampler resting on the bottom of the hole, drive the sampler with the 140 lb. hammer falling freely over a 30-inch fall until 24 inches have been penetrated or 50 blows applied.

7. Record the number of blows per 6 inches. Determine the "N" value by adding the blows for the 6 to 12-inch and 12 to 18-inch intervals of each sample drive.

8. After penetration is complete, remove the sampling string. Avoid removing sampling string by hitting up on the string with the hammer as this can cause the sample to fall from the bottom of the split-spoon sampler. The sampling string should be removed via cable lifting or rig hydraulics. If sample retention has been poor, let the sampling string rest in place for at least 3 minutes, then rotate clockwise at least 3 times before removing from the borehole.

9. For pushed samples (i.e., using rig hydraulics), mark four 6-inch intervals on the drill rods relative to a reference point on the rig. Use the rig pull-down to press the sampler downward until 24 inches have been penetrated or no further progress can be made with the full weight of the rig on the sampler.

10. Remove the split-spoon sampler from the sampling string and place on the plastic-covered surface.

11. Open the split-spoon sampler only when the Roux field geologist is prepared to describe and manage the sample.

12. Describe the sample in accordance with the Unified Soil Classification System in accordance with the Roux FOP: Soil Description Procedures Using the Unified Soil Classification System (USCS).

13. Record all information in accordance with Roux's FOP: Documentation Requirements for Drilling and Well Installation.

14. Collect a portion of the sample for field screening as described in the Roux FOP: Screening of Soil Samples for Organic Vapors During Drilling Activities.

15. If applicable, collect soil samples for volatile organic constituents (VOCs). If applicable, collect sample for semi-volatile, metals, geotechnical, or other off-site analysis.

16. The samples will be labeled, stored and shipped in accordance with the Roux's FOP: Sample Labeling, Storage and Shipment Procedures.

ATTACHMENTS

none

REFERENCES

Roux FOPs:

015 Documentation Requirements for Drilling and Well Installation
046 Sample Labeling, Storage and Shipment Procedures
047 Screening of Soil Samples for Organic Vapors During Drilling Activities
054 Soil Description Procedures Using the Unified Soil Classification System (USCS)

FIELD OPERATING PROCEDURES

Surface and Subsurface Soil Sampling Procedures

FOP 063.4

SURFACE AND SUBSURFACE SOIL SAMPLING PROCEDURES

PURPOSE

This procedure describes the methods for sampling surface soil and subsurface soil samples for physical and chemical laboratory analysis during intrusive activities such as test pitting, hand augering, drilling, surface soil sampling etc. Typical health and safety related issues should be addressed in the Project Health and Safety Plan.

PRE-SAMPLING PROCEDURES

1. Review project objectives and the Project Health and Safety Plan (HASP).

2. Conduct tailgate health and safety meeting with project team and/or subcontractor(s) by completing the Tailgate Safety Meeting Form (sample attached).

3. Calibrate air-monitoring equipment in accordance with the appropriate Roux's Field Operating Procedures or manufacturers recommendations for calibration of field meters.

4. Commence intrusive activities in accordance with specific Roux FOPs (test pitting, hand augering, drilling etc.) or as directed by the Project Work Plan.

5. Conduct air monitoring as required by the HASP, Project Work Plan, or Roux's FOP Real-Time Air Monitoring During Intrusive Activities. Record all results on the Real Time Air Monitoring Log (sample attached).

6. Decontaminate all non-dedicated stainless steel (or Pyrex glass) equipment in accordance with Roux's Non-disposable and Non-dedicated Sampling Equipment Decontamination procedures.

7. Collect soil samples in accordance with the following sections.

SURFACE SOIL/FILL SAMPLING PROCEDURES

Collection of surface soil/fill samples facilitates the evaluation of potential health risks to current site receptors that may be exposed to soil/fill via direct contact, incidental ingestion, or inhalation of airborne particulates. The following procedure is in accordance with NYSDEC sampling protocol of surface soil/fill material.

1. Collect all soil/fill samples using dedicated (or decontaminated non-dedicated) sampling tools (i.e., spoons, trowels, bowls etc.), preferably constructed of stainless steel.

2. If the sample area is vegetated, then collect the surface soil/fill sample from 0 to 2 inches below ground surface (bgs) following removal of the sod.

3. If there is no soil present within the sample area (i.e., only slag, concrete, mixed with fines), excavate an area 12 inches by 12 inches by 6 inches deep, screen the material to less than 1/8 inch (No. 4 sieve), and submit the screened material for analysis. If there is not enough material to completely fill the sample jar, then expand the excavation 3 inches in all four directions screening the additional material. Expand the excavation in this manner until sufficient sample volume is obtained. Volatile organic analysis of surface soil/fill utilizing this method will yield negatively biased results and should not be performed.

SURFACE/NEAR-SURFACE/SUBSURFACE SOIL SAMPLING PROCEDURES

1. Collect all soil samples using dedicated (or decontaminated non-dedicated) sampling tools (i.e., spoons, trowels, bowls, EnCore™ Samplers, etc.), preferably constructed of stainless steel.

   Surface soil samples are typically collected from 0 to 6 inches below ground surface (bgs). Near-surface samples are typically sampled from 0 to 2 feet below ground surface (fbgs). Subsurface soils are typically sampled from

varying depths greater than 6-inches bgs based on field observations and as directed by the Project Work Plan.

2. Transfer samples for chemical (VOC, SVOC, Metals etc.) and physical (i.e., Atterberg Limits, Grain Size, Permeability etc.) analytical testing by direct grab (i.e., directly from the bucket of the excavation equipment, split-spoon sampler, hand auger etc.) using the dedicated (or decontaminated non-dedicated) sampling tools into appropriate laboratory-supplied containers and seal. The chemical or physical laboratory selected to perform the analysis should determine minimum sample volume for analysis.

3. Prepare collected samples in accordance with Roux's FOP: Sample Labeling, Storage, and Shipment Procedures. Do not allow the chemical soil samples to freeze during storage and shipping. It should be noted, ice is not required for physical soil samples and all physical soil samples should be kept at the collected soil moisture by securing with a tight sealing lid. Do not allow physical soil samples to gain or lose moisture from the collected soil moisture prior to analysis.

4. Record all sampling details (i.e., depth and location) in the Project Field Book; appropriate Roux log sheets depending on method of intrusion (i.e., drilling, test pitting, hand augering etc.); and on the Soil/Sediment Sample Collection Summary Log (sample attached).

PARAMETER-SPECIFIC PROCEDURES

1. Volatile Organic Compound (VOCs): After a fresh surface of the solid cohesive material is exposed to the atmosphere, sample collection should be completed in the least amount of time in order to minimize the loss of VOCs due to volatilization. Depending on soil cohesiveness and grain size(s), two different methods should be utilized as described below.

   a. **Cohesive soils** collected for VOC analysis should be sampled via USEPA Method 5035 using an EnCore™ Sampler (or equivalent) in a "closed-system-

purge-and-trap" process for the collection, preparation, and analysis of VOCs in soils, sediments, and solid waste.

The EnCore™ sampler is a sampling device that can be used as both a simultaneous coring tool for cohesive soils and a transport device to a support laboratory (field or off-site). The EnCore™ sampler is intended to be a combined sampler-storage device for soils until a receiving laboratory can initiate either immediate VOC analysis, or preserve extruded soil aliquots for later VOC analysis. It is meant to be disposed after use. The commercially available device is constructed of an inert composite polymer. It uses a coring/storage chamber to collect either a 5 g or 25 g sample of cohesive soils. It has a press-on cap with hermetically vapor tight seal and locking arm mechanism. It also has a vapor tight plunger for the nondisruptive extrusion of the sample into an appropriate container for VOC analysis of soil. An individual disposable EnCore™ sampler (or equivalent) is needed for each soil aliquot collected for vapor partitioning or methanol sample preparation. Upon soil sample collection, the EnCore™ sampler is stored at 4 ± 2EC until laboratory receipt within 48 hours. Upon laboratory receipt, soil aliquots are extruded to appropriate tared and prepared VOA vials.

Sample collection using EnCoreTM samplers will require:
2 EnCoreTM 5g samplers for low level analysis
1 EnCoreTM 5g sampler for medium level analysis
1 four ounce jar for percent total solids determination
T-handle for sampling

b. Transfer sufficient soil volume to fill the laboratory-supplied container (typically 4 ounces) by packing the soil sample with the sampling tool to the top of the container leaving no headspace. At no time should a gloved hand (i.e., latex, nitrile etc.) be used to pack the sample into the sample container as the sample may be compromised via cross-contamination.

2. All Other Parameters: All other parameters include, but are not limited to, Semi-VOCs (SVOCs), polychlorinated biphenyls (PCBs), herbicides, pesticides, total metals etc. Transfer sufficient soil volume to fill the laboratory-supplied container by packing the soil sample with the sampling tool to the top of the container. Unless otherwise indicated by the laboratory or the Project Work Plan, the sample jar for all other parameters does not have to be packed completely leaving no headspace as with the VOC containers.

ATTACHMENTS

Tailgate Safety Meeting Form (sample)
Soil/Sediment Sample Collection Summary Log (sample)
Real Time Air Monitoring Log (sample)

REFERENCES

Roux FOPs:

006 *Calibration and Maintenance of Combustible Gas/Oxygen Meter*
010 *Calibration and Maintenance of Portable Flame Ionization Detector*
011 *Calibration and Maintenance of Portable Photoionization Detector*
040 *Non-disposable and Non-dedicated Sampling Equipment Decontamination*
046 *Sample Labeling, Storage and Shipment Procedures*
073 *Real-Time Air Monitoring During Intrusive Activities*

SURFACE AND SUBSURFACE SOIL SAMPLING PROCEDURES

ROUX **DAILY TAILGATE HEALTH & SAFETY CHECKLIST**

Job Name: _____ Date(s): _____

Location: _____ Project Number: _____

Weather: M- T- W- TH- F-

- Tailgate meeting conducted at least once per day
- Involves everyone working at the Site
- Should familiarize everyone with work area & vicinity
- Work permit procedures
  Emergency access/exits & "muster" point
- Emergency contacts/phone #s, hospital/urgent care route
- Every worker on-site has Stop Work Authority
- Provide details of work planned for the day
- Review the Job Safety Analysis (JSA) and work hazards
- Required PPE for the planned work
- HASP is reviewed
- Ensure safety equipment is on Site
- Test required safety equipment (such as emergency stop controls)
- Can also include inspection of tools and equipment to be used

Instructions: Please only use form for Monday through Friday of one calendar week.

#	CHECKLIST ITEM	DATE M-	T-	W-	TH-	F-
1	The HASP (including emergency phone #s) has been reviewed & signed by Roux staff & subcontractors.					
2	Personnel are OSHA-40 hour HAZWOPER trained (if applicable).					
3	Emergency muster points known, urgent care and ER identified.					
4	Applicable JSAs have reviewed by subcontractors					
5	Roux personnel & subcontractors have discussed hazards associated with Site-specific work.					
6	Any potential slips, trips or fall hazards have been identified.					
7	All workers have appropriate PPE., and have signed in for the day (2nd Page).					
8	Fit for duty: No worker is under the influence of any drugs, alcohol or any other substance that can alter your ability to work safely.					
9	Critical equipment on-Site is noted and is in safe working order.					
10	Site control has been established and exclusion zone is identified (using safety cones or barricades to mark out work area).					
11	Appropriate permits have been obtained (if applicable).					
13	Lock Out / Tag Out procedures have been followed where applicable, for electric and water.					
14	Electrical power operated tools shall be properly grounded and used with a GFCI.					
15	Traffic Safety Control measures have been put in place where applicable.					
16	All vessels containing flammable/corrosive material are labeled and SDSs are available for all chemicals.					
17	Subsurface work : Drilling, trenching, etc. conducted according to required Protocol, including pre-field preparations, utility mark-out and "hand" clearing.					
18	Excavated soils are properly stored; excavations are properly shored/sloped and barricaded.					
19	Good housekeeping procedures are meet; food and beverages are consumed outside of the work area.					
20	A first aid kit, eye wash bottle/station, and fire extinguishers are available for use.					
21	No smoking signs are visibly posted in areas of potential flammable vapors.					
	Initial on right to verify that these actions have taken place. If the action does not apply, use N/A.					

Comments and Exceptions _____

NOTE: THIS IS A TWO-SIDED FORM; PLEASE COMPLETE BOTH SIDES

ROUX **DAILY TAILGATE HEALTH & SAFETY MEETING LOG**

Job Name _____ Date(s) _____

Location: _____ Project Number: _____

SUBCONTRACTORS: _____

Activities Planned _____

Name	Company	Mon.	Tue.	Wed.	Thur.	Fri.

SAMPLE

ROUX

SOIL/SEDIMENT
SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Depth (feet)		Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, depth changes, important matrix observations or description, gravel thickness, etc.)
			from	to						

Equipment Rinsate Blanks *- Pour clean deionized water over or through decontaminated sampling equipment into sample containers. Collect at a frequency of 1 per 20 samples of each matrix when non-dedicated equipment is utilized in accordance with DER-10.*

MS/MSD *- Collect at a frequency of 1 per 20 samples of each matrix in accordance with DER-10.*

Field Blank *- Pour clean deionized water (used as final decon rinse water) into sample containers while at the sampling site. Collect field blanks at a frequency of 1 per 20 samples of each matrix.*

Investigation Derived Waste (IDW) Characterization samples *- Collect composite samples from all drums of decon fluids and soil at the frequency required by the disposal facility. Please note number of drums and labels on collection log.*

Notes:
1. See QAPP for sampling frequency and actual number of QC samples.
2. MS/MSD - Matrix Spike, Matrix Spike Duplicate, Matrix Spike Blank.
3. BD - Blind Duplicate - indicate location of duplicate.

SAMPLE

Sample Summary Collection Logs - soil and sediment-REV.xlsx Page ____ of ____ Prepared By: _____

ROUX

REAL TIME AIR MONITORING LOG

Date:
Project Name:
Project Number:
Project Location:
Client:
Purpose of Air Monitoring:

WEATHER CONDITIONS:

Time of Day:	A.M.	P.M.
Ambient Air Temp.:		
Wind Direction:		
Wind Speed:		
Precipitation:		

Date	Personnel	Time	Air Monitoring Meter Measurement (Units)							Location/Activity/Comments
			PID (ppm)	LEL (%)	H2S (ppm)	O2 (%)	CO (ppm)	Particulates (mg/m^3)	Other	

SAMPLE

NOTE: SEE EQUIPMENT CALIBRATION LOG FOR DESCRIPTION OF EQUIPMENT TYPE.

Prepared By: Date:

Copy of AIR - Real Time Air Monitoring Log.xls

Page _____ of _____

FIELD OPERATING PROCEDURES

Test Pit Excavation and Logging Procedures

FOP 065.1

TEST PIT EXCAVATION & LOGGING PROCEDURES

PURPOSE

This procedure describes the methods for completing test pits, trenches, and other excavations that may be performed to expose subsurface soils or materials. In most cases, these pits will be mechanically excavated, using a backhoe, trackhoe, or other equipment. Because pits and other excavations can represent a substantial physical hazard, it requires a particular focus on safety procedures. The Project Health and Safety Plan identifies practices related to excavation permits, entry, and control that must be incorporated into excavation activities.

EXCAVATION PROCEDURE

1. Review project objectives and the Project Health and Safety Plan (HASP).

2. Perform excavation equipment safety checks with the operator. Specific concerns should include, but not limited to, no leaking hydraulic lines, fire extinguisher on board of the excavation equipment, operator experience etc.

3. Conduct tailgate health and safety meeting with project team and excavation operator(s) by completing the Tailgate Safety Meeting Form (sample attached).

4. Calibrate air-monitoring equipment in accordance with the appropriate Roux's Field Operating Procedures or manufacturers recommendations for calibration of field meters.

5. Conduct air monitoring as required by the HASP and/or Project Work Plan. Record all results on the Real Time Air Monitoring Log (sample attached).

6. Mobilize the excavation equipment to the site and position over the required location.

7. Select excavation locations, which provide necessary information for achieving objectives. Check locations with owner/operator to ensure excavation

operations will not interfere with site operations, and select appropriate access routes.

8. Stake locations in the field and measure distance from locations to nearest landmarks. Survey location, if required.

9. Obtain clearances from appropriate utilities and, if buried waste/metallic objects are suspected, screen location with appropriate geophysical methods, as necessary.

10. Decontaminate excavation equipment in accordance with Roux's Drilling and Excavation Equipment Decontamination procedures.

11. Excavate pits. In uncontrolled areas, excavate only as many test pits as can be backfilled during the same day. Generally, allow equal time for excavation and backfilling. To the extent practicable, no pits should be left open overnight in an uncontrolled area. If sudden weather changes or other unforeseen events necessitate this, pits will be covered and/or barricaded and flagged with caution/hazard tape. These pits should be backfilled as soon as possible.

12. The Roux field geologist or experienced professional should determine the depth of excavation. The depth is generally limited by the safe reach of the selected equipment, but may also be limited by the stability of the excavated materials (i.e. wall stability).

13. Excavate the test pits in compliance with applicable safety regulations. In no case should a pit deeper than 4 feet be entered without first stabilizing the sidewalls by using forms, or by terracing or sloping (2:1 slope maximum) the sidewalls.

14. Excavated spoils must be placed no closer than 2 feet from the open excavation.

15. Collect soil samples from pit sidewalls in accordance with Roux's Surface and Subsurface Soil Sampling Procedures. If the test pit is greater than 4 feet in depth, it will not be entered for sampling. In this event, collect samples using

the backhoe bucket, then fill sample containers from the center of the bucket using the stainless steel sampling equipment (i.e., spoon, spade, trowel etc.) or drive a Shelby tube or EnCore™ sampler for VOCs.

16. Record excavation observations in the Project Field Book or Test Pit Excavation Log form (sample attached). Information recorded should include:

- Physical dimension of the pit;
- A scaled sketch of one side of the pit showing any lithologic contacts, zones of groundwater seepage, other special features (jointing, boulders, cobbles, zones of contamination, color abnormalities, etc.)
- General information such as project number, pit designation number, depth, date, name of responsible professional (i.e., geologist), type of excavating equipment utilized, time of excavation and backfilling, method of collecting samples and amount of sample collected (if applicable);
- Rate of groundwater inflow, depth to groundwater and time of measurement; and
- Unified Soil Classification System (USCS) designation of each distinctive unit.

17. Photograph each excavation, highlighting unique or important features. Use a ruler or other suitable item for scale. Include a label with the pit designation so the developed picture will be labeled.

18. Backfill pit to match the existing grade compacting in 2 to 3 foot lifts. Since the excavated material should be cover soil, the excess soil will be placed back into the hole. The Roux Field Team Leader will provide direction on whether excavated soils may be used as fill, or these materials are to be containerized as investigation derived waste.

ATTACHMENTS

Tailgate Safety Meeting Form (sample)
Real Time Air Monitoring Log (sample)
Test Pit Excavation Log (sample)

REFERENCES

Roux FOPs:

006 *Calibration and Maintenance of Combustible Gas/Oxygen Meter*
010 *Calibration and Maintenance of Portable Flame Ionization Detector*
011 *Calibration and Maintenance of Portable Photoionization Detector*
018 *Drilling and Excavation Equipment Decontamination*
063 *Surface and Subsurface Soil Sampling Procedures*

ROUX

TAILGATE SAFETY MEETING FORM

Project Name: Date: Time:
Project Number: Client:
Work Activities:

HOSPITAL INFORMATION:

Name:
Address: *City:* *State:* *Zip:*
Phone No.: *Ambulance Phone No.*

SAFETY TOPICS PRESENTED:

Chemical Hazards:

Physical Hazards: Slips, Trips, Falls

PERSONAL PROTECTIVE EQUIPMENT:

Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D

New Equipment:

Other Safety Topic (s): Environmental Hazards (aggressive fauna)
Eating, drinking, use of tobacco products is prohibited in the Exclusion Zone (EZ)

ATTENDEES

Name Printed	Signatures

Meeting conducted by:

SAMPLE

ROUX

REAL TIME AIR MONITORING LOG

Date:
Project Name:
Project Number:
Project Location:
Client:
Purpose of Air Monitoring:

WEATHER CONDITIONS:

Time of Day:	A.M.	P.M.
Ambient Air Temp.:		
Wind Direction:		
Wind Speed:		
Precipitation:		

Date	Personnel	Time	Air Monitoring Meter Measurement (Units)							Location/Activity/Comments
			PID (ppm)	LEL (%)	H_2S (ppm)	O_2 (%)	CO (ppm)	Particulates (mg/m³)	Other	

SAMPLE

NOTE: SEE EQUIPMENT CALIBRATION LOG FOR DESCRIPTION OF EQUIPMENT TYPE.

Prepared By: Date:

ROUX

TEST PIT EXCAVATION LOG

Project:	TEST PIT I.D.:
Project No.	Excavation Date:
Client:	Excavation Method:
Location:	Logged / Checked By:

Test Pit Location: *NOT TO SCALE*

Test Pit Cross Section:



TIME		
Start:	Length:	(approx.)
End:	Width:	(approx.)
	Depth:	(approx.)

Depth (fbgs)	USCS Symbol & Soil Description	PID Scan (ppm)	Photos Y / N	Samples Collected (fbgs)

SAMPLE

COMMENTS:			
GROUNDWATER ENCOUNTERED:	yes	no	If yes, depth to GW:
VISUAL IMPACTS:	yes	no	Describe:
OLFACTORY OBSERVATIONS:	yes	no	Describe:
NON-NATIVE FILL ENCOUNTERED:	yes	no	
OTHER OBSERVATIONS:	yes	no	Describe:
SAMPLES COLLECTED:	yes	no	Sample I.D.:
			Sample I.D.:
			Sample I.D.:

FIELD OPERATING PROCEDURES

Well/Piezometer Construction Materials and Design

FOP 070.0

WELL/PIEZOMETER CONSTRUCTION MATERIALS AND DESIGN

PURPOSE

This guideline presents construction materials and design requirements for monitoring well/piezometer installations in accordance with NYSDEC recommended specifications (6NYCRR Part 360).

CONSTRUCTION MATERIALS

1. Well Screen and Riser – Only new flush threaded screen and riser materials will be used. Screen and riser materials, well dimensions, screen slot opening size and length to be determined based on formation characteristics and suspect water quality or as specified by the project geologist/hydrogeologist. A vented cap or J-plug should be placed over the riser. A V-slot cut in the riser or permanent marking, both placed on the north side of the riser, will act as a monitoring reference point.

2. Bentonite Well Seal – The bentonite should be from a commercial source free of chemical additives (granular or powdered for grout and pelletized for seal).

3. Concrete – Low heat of hydration concrete should be used for grout and cementing protective casing if well construction materials are composed of PVC (ASTM Type II or Type IV Portland Cement).

4. Water – Water should be from a potable source of known chemistry and free of chemical constituents which may compromise integrity of installation.

5. Grout – Mixture of bentonite, cement and water in accordance with the following specifications. Premix bentonite and water prior to adding cement.

   Grout Slurry Composition (% Weight)

1.5 to 3.0%	-	Bentonite (Quick Gel)
40 to 60 %	-	Cement (Portland Type I)
40 to 60 %	-	Potable Water

6. Filter Pack – The filter pack should consist of clean, inert, siliceous, rounded to subrounded particles. Filter pack particle size is dependent on the formation and the slot size of the screen.

   A secondary filter about 6-inches thick may be placed between filter pack and the bentonite seal and potentially between the bentonite seal and the grout backfill, to minimize grout penetration of the seal. A uniformly graded fine sand (100% passing No. 30 sieve) should be used as a secondary filter.

7. Protective Casing, Locking Cap and Lock – Protective casing with a lockable cap should be cemented in place around the riser. The inside diameter of the protective casing should be a minimum of 2-inches larger than the outside diameter of the well riser. The annular space between the casing and the riser should be filled with pea gravel or coarse sand. A weep hole should be drilled near the base of the casing to facilitate drainage of standing water. If more than one well is installed, all locks should be keyed alike.

8. A sample of all cement, bentonite and sand used in well construction should be saved in a labeled, Teflon-sealed, precleaned glass jar.

REFERENCES

New York State Department of Environmental Conservation, July 1988, *Drilling and Monitoring Well Installation Guidance Manual.*

Driscoll, F.G., 1987, *Groundwater and Wells*, Johnson Division, St. Paul, Minnesota, p. 1089.

Sara, M. N., *Proposed Recommended Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers: ASTM Subcommittee D18.21.*

FIELD OPERATING PROCEDURES

Real-Time Air Monitoring During Intrusive Activities

FOP 073.2

REAL-TIME AIR MONITORING DURING INTRUSIVE ACTIVITIES PROCEDURE

PURPOSE

This guideline presents requirements for real-time community air monitoring and required responses during all project required intrusive activities, such as drilling, test pitting, earthwork construction etc. This procedure is consistent with the requirements for community air monitoring for all intrusive projects, including projects conducted at remediation sites, as established by the New York State Department of Health (NYSDOH) and the New York State Department of Environmental Conservation (NYSDEC). Accordingly, it follows procedures and practices outlined under NYSDEC's DER-10 (May 2010) Appendix 1A (NYSDOH's Generic Community Air Monitoring Plan) and Appendix 1B (Fugitive Dust and Particulate Monitoring).

This FOP requires real-time monitoring for constituents of concern (COC) (i.e., volatile organic compounds (VOCs), lower explosive limit (% LEL), particulates (i.e., dust) etc.) at the upwind and downwind perimeter as well as the exclusion zone of a project site during all intrusive activities. This FOP is not intended for use in establishing action levels for worker respiratory protection (see Project Health and Safety Plan (HASP) for worker protection action levels). Rather, its intent is to provide a measure of protection for the surrounding community from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The community, as referenced in this document, includes any off-site residences, public buildings/grounds and commercial or industrial establishments adjacent to the project site. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, this FOP helps to confirm that work activities did not spread contamination off-site through via air transport mechanisms. Community air monitoring shall be integrated with the construction

worker personal exposure-monitoring program contained in the project and site-specific HASP.

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

MONITORING & MITIGATION PROCEDURE

Real-time air monitoring perimeter locations for monitoring stations will be established based on the location of the exclusion zone (i.e., immediate work area) and wind direction. Where wind direction is shifting or winds are calm, the downwind monitoring location will default to the perimeter location nearest the most sensitive receptor (i.e., residential property). All downwind receptors being equal, the downwind monitoring location will default to the perimeter location downwind of the prevailing winds at the site. Although additional site specific COCs may be monitored during real-time air monitoring activities, the most common COCs are discussed in this FOP, including organic vapors (i.e., VOCs), airborne particulates (i.e., fugitive dust) and combustible gases (i.e., methane) and oxygen.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence

ORGANIC VAPORS

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion 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 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring 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 of 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.

- All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

- **Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures**

    - When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and

particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure (s). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m3 or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen SUlfide, carbon monoxide) may also need to be monitored Response levels and actions should be pre-determined, as necessary, for each site.

Additionally, if following the cessation of work and efforts to abate the emission source are unsuccessful, and if sustained organic vapor levels exceed 25 ppm above background within the 20-foot zone for more than 30 minutes, then the **Major Vapor Emission Response Plan** (see below) will automatically be placed into effect.

Major Vapor Emission Response Plan

Upon activation of Major Vapor Emission Response Plan, the following activities will be undertaken:

1. All Emergency Response Contacts as listed below and in the Site-Specific Health and Safety Plan will be contacted.

2. The local police authorities will immediately be contacted by the Site Safety and Health Officer and advised of the situation.

3. The Site Safety and Health Officer will determine if site workers can safely undertake source abatement measures. Abatement measures may include covering the source area with clean fill or plastic sheeting, or consolidating contaminated materials to minimize surface area. The Site Safety and Health Officer will adjust worker personal protective equipment as necessary to protect workers from over-exposure to organic vapors.

The following personnel are to be notified by the Site Safety and Health Officer in the listed sequence if the Major Vapor Emission Response Plan is activated:

Contact	Phone
Police/Fire Department	911
New York State DOH	(518) 402-7860
New York State DEC Region 8	(585) 226-2466, switchboard

New York State DEC Region 9	(716) 851-7220
State Emergency Response Hotline	(800) 457-7362

In addition, the Site Safety and Health Officer will provide these authorities with a description of the apparent source of the contamination and abatement measures being taken by the contractor, if any.

AIRBORNE PARTICULATES

Fugitive dust suppression and airborne particulate monitoring shall be performed during any intrusive activities involving disturbance or handling of site soil/fill materials. Fugitive dust suppression techniques will include the following minimum measures:

- Spraying potable water on all excessively dry work areas and roads.
- All fill materials leaving the site will be hauled in properly covered containers or haul trailers.
- Additional dust suppression efforts may be required as discussed below.

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. 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 all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (µg/m^3) 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/m^3 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/m^3 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/m^3 of the upwind level and in preventing visible dust migration.

- All readings must be recorded and be available for State (DEC and DOH) personnel to review.

Visual Assessment

In conjunction with the real-time monitoring program, TurnKey personnel and any subcontractors thereof will be responsible for visually assessing fugitive dust migration from the site. If airborne dust is observed leaving the site, the work will be stopped until supplemental dust suppression techniques are employed in those areas.

Supplemental Dust Suppression

Supplemental dust suppression techniques may include but are not necessarily limited to the

following measures:

- Reducing the excavation size, number of excavations or volume of material handled.
- Restricting vehicle speeds.
- Applying water on buckets during excavation and dumping.
- Wetting equipment and excavation faces.
- Wetting haul roads.
- Restricting work during extreme wind conditions.
- Use of a street sweeper on paved haul roads, where feasible.

Work can resume using supplemental dust suppression techniques provided that the measures are successful in reducing the sustained downwind particulate concentration to below 150 ug/m^3 of the upwind level, and in preventing visible dust migration off-site.

COMBUSTIBLE GASES & OXYGEN

Ambient combustible gas and oxygen concentrations should be measured prior to commencing intrusive activities each workday and a minimum of every 30-minutes thereafter. Air monitoring activities should be performed using equipment appropriate to measure combustible gases in percent lower explosive limit (LEL) and percent oxygen and calibrated daily. All combustible gas and oxygen readings must be recorded in the Project Field Book and/or Real-Time Air Monitoring Logs (sample attached) and, if applicable, be made available for State (DEC and DOH) personnel to review.

Mitigation upon the detection of various action levels of organic vapors are presented below:

Combustible Gas:

- If the sustained ambient air concentration of combustible gas at the downwind perimeter of the site exceeds a reading of 10 to 25% LEL, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 10% LEL, work activities can resume with continued monitoring.

- If sustained combustible gas levels at the downwind perimeter of the site persist at levels in excess of 25% LEL, work activities must be halted, the source of explosion hazards identified, corrective actions taken to abate emissions and monitoring continued. Following combustible gas mitigation, work activities can resume provided that the sustained total organic vapor level 200 feet downwind of the exclusions 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 a sustained value of 10% LEL.

Oxygen:

- If the sustained ambient oxygen concentration at the downwind perimeter of the site measures a reading between 19.5% - 21% oxygen, work activities can continue with extreme caution, however attempts to determine the potential source of oxygen displacement must be conducted.

- If the sustained oxygen level readily decreases below 19.5% LEL, work activities should be discontinued and all personnel must leave the area immediately.

- If the sustained oxygen level at the downwind perimeter of the site persists at levels between 21-25%, work activities can resume with caution.

- If the sustained oxygen level at the downwind perimeter of the site persists at levels exceeding 25% (fire hazard potential), work activities should be discontinued and all personnel must leave the area immediately.

ATTACHMENTS

Real-Time Air Monitoring Log (sample)

REFERENCES

TurnKey FOPs:

006 *Calibration and Maintenance of Combustible Gas/Oxygen Meter*
010 *Calibration and Maintenance of Flame Ionization Detector*
011 *Calibration and Maintenance of Portable Photoionization Detector*
084 *Calibration and Maintenance of Portable Particulate Meter*

ROUX

REAL TIME AIR MONITORING LOG

Date:
Project Name:
Project Number:
Project Location:
Client:
Purpose of Air Monitoring:

WEATHER CONDITIONS:

Time of Day:	A.M.	P.M.
Ambient Air Temp.:		
Wind Direction:		
Wind Speed:		
Precipitation:		

Date	Personnel	Time	Air Monitoring Meter Measurement (Units)							Location/Activity/Comments
			PID (ppm)	LEL (%)	H_2S (ppm)	O_2 (%)	CO (ppm)	Particulates (mg/m^3)	Other	

SAMPLE

NOTE: SEE EQUIPMENT CALIBRATION LOG FOR DESCRIPTION OF EQUIPMENT TYPE.

Prepared By: Date:

FIELD OPERATING PROCEDURES

"Before Going Into The Field" Procedure

FOP 076.0

"BEFORE & AFTER" PROJECT PROCEDURES FOR FIELD PERSONNEL

PURPOSE

This procedure describes the required field and office activities to be preformed "before and after" project assignments by field personnel. Field activities may include, but are not limited to, drilling oversight, excavation contractor oversight, matrix sample collection (e.g., soil, sediment, groundwater, surface water, wipe, and/or air), third party oversight, and site reconnaissance to name a few. Office activities may include, but are not limited to, photocopying field book entries, completing all field forms, tabulating collected field and laboratory data, and preparation of report text.

The primary goal of this procedure is to eliminate delays and unnecessary budgetary "strain" due to a lack of preparedness and knowledge of the site by the field team members. This procedure also seeks to streamline the preparation and transfer of field information/data from field personnel to the Project Manager upon field work completion.

PROJECT ASSIGNMENT

During the initial meeting with the Project Manager, several questions should be raised by the field team member and answered by the Project Manager. A pad of paper and pen should be in hand to record all pertinent job information. At a minimum, the following questions should be answered:

1. *What is the job number?*
2. *Who is the client and the on-site representative (if applicable)?*
3. *What is the name of the project?*
4. *What are the job responsibilities and how should they be accomplished?*
5. *How much time do I have to complete the assigned tasks?*
6. *Are there any project required documents? What are they?*

Any deviation from the above questions should be approved by the Project Manager prior to contravention, not at the end of the day or following the project completion.

"BEFORE" CHECKLISTS

Checklists should be developed and used so that all of the required steps prior to going into the field are undertaken. A good checklist will include:

- Adequate review of the documents listed in this FOP
- Any documents, equipment, and supplies presented in this FOP
- Providing adequate notification to the laboratory (so that holding times are not exceeded) and to the owner of the site and the primary regulatory agency (usually in writing) that a round of sampling is to commence in order to facilitate sampling and allow for a sampling audit or split sampling.
- Specifying and documenting the equipment maintenance and calibration undertaken prior to going into the field relative to the sampling event.
- Checking and calibrating the equipment.
- Listing the documents, equipment, and supplies required to collect samples at the site as presented in this FOP.

Prior to going into the field, sampling personnel should reacquaint themselves with the sampling plan. The review is undertaken so that the required specific protocol such as sampling from the least to the most contaminated wells, knowing where quality control samples are to be taken, knowing the disposition of purge water, etc., is understood and followed.

The amount of equipment maintenance and calibration required prior to going into the field should be clearly specified in the presampling equipment maintenance and calibration checklists, which are based on the manufacturer's recommendations, sampling objectives, and prior experience. Maintenance and calibration performed before sampling must be

documented to provide evidence that the equipment was adequately maintained and calibrated and to keep a permanent record of equipment servicing and performance.

A list of all the documents, equipment, and supplies required for the sampling event should be prepared and used. It can be frustrating and time consuming to forget equipment and supplies, so some up-front preparation is warranted. The following sections provide a list of the documentation, equipment, and supplies, which should assist in preparing a site-specific equipment and supply checklist. Once prepared, the checklist and project requirements should be reviewed with the Project Manager.

"BEFORE" DOCUMENTATION SUMMARY

Prior to going into the field, the field team should review and understand all of the project documents including, but not limited to:

- The Health and Safety Plan (HASP)
- The Site Analytical Plan (SAP), Sampling Plan, or similar document
- The Quality Assurance Project Plan (QAPP)
- The Work Plan
- Project specific Field Operating Procedures and field forms
- Site Maps
- Equipment operation manuals
- Chain-of-Custody forms
- Shipping labels and custody seals
- Any reference materials (i.e., conversion tables, volume calculation, etc.). The Pocket Ref, Third Edition by Thomas Glover is a great source for the field.

If at any time, the field team does not understand the project required protocol, procedures, sample locations, etc.; the Project Manager should be consulted for clarification.

"BEFORE" EQUIPMENT SUMMARY

Prior to going into the field, the field team should review the following equipment checklist, noting that project specific equipment may not be included in this list:

- Water level indicator
- Pumps, sample tubing, flow controllers, power cord(s), batteries, compressors, generators, etc.
- Bailers (disposable, PVC, stainless steel, glass), rope
- Flow-through cell
- Field meters with adequate calibration solutions (pH/Eh meter, conductivity meter, dissolved oxygen meter, turbidity meter, batteries, etc.)
- Garden hose
- Explosive gas meter and/or photoionization detector (PID) with calibration supplies
- Complete set of hand tools including a sharp knife, screw drivers, pliers, hacksaw, flashlight, large pipe wrench, hammer, bolt cutters, and replacement locks
- Fish hook with weight and string
- Field filtering equipment and supplies
- Decontamination supplies, such as scrub brushes, Alconox®, distilled water, potable water, 5-gallon bucket, paper towels, aluminum foil
- 5-gallon bucket(s)
- Measuring cup
- Sample bottles/containers (with extras) and preservatives
- Stainless steel spoons, trowels, shovels
- Shipping containers (i.e., coolers)
- Clipboard
- Calculator
- Water resistant clock or watch with second hand
- First aid kit

"BEFORE" SUPPLIES SUMMARY

Prior to going into the field, the field team should review the following supplies checklist, noting that project specific supplies may not be included in this list:

- Laboratory grade non-phosphate detergent (Alconox®)
- Appropriate personal protective equipment appropriate to the contaminants of concern, such as nitrile gloves, Tyvek, boots, hardhat, safety glasses, hearing protection, etc.
- Bags of ice
- Plastic garbage bags
- Plastic sheeting
- Sufficient quantities of potable and laboratory grade deionized water for cleaning and equipment blanks
- Methanol
- Isopropyl alcohol
- Clean rags and paper towels
- Electrical tape, duct tape, and wide transparent tape
- Hand soap
- Regular, ballpoint, and indelible pens
- Hollow braid polyethylene rope

After providing adequate notification (lab, state and/or federal agencies), performing the presampling maintenance and calibration, obtaining the site and well keys, and packing the supplies and equipment, the field activities are ready to be performed.

"AFTER" – PROJECT FILE REVIEW & CREATION

It is the responsibility of each field crew member to review his/her own field notes and time sheet for accuracy and completeness. All errors to the field notes should be corrected, dated, and initialed for Project Manager review. Once reviewed by the field team member, the Project Field Book, all field forms, photographs, chain-of-custodies etc. must be

photocopied, scanned (if required), downloaded, etc. and then given to the Project Manager in an organized file folder in a timely manner. Avoiding delay during this step is critical, especially when there are severe time constraints for the project.

REFERENCES

1. Wilson, Neal. *Soil Water and Ground Water Sampling*, 1995

FIELD OPERATING PROCEDURES

Calibration & Maintenance of Portable Particulate Meter

FOP 084.0

CALIBRATION AND MAINTENANCE OF PORTABLE PARTICULATE METER

PURPOSE

This guideline describes a method for calibration of a portable particulate meter, specifically the Thermo Electron Corporation MIE DataRAM 4 (Model DR-4000). The DataRAM 4 measures the concentration of airborne particulate matter (liquid or solid), as well as mean particle size, air temperature, and humidity, providing direct and continuous readout as well as electronic recording of the information. This parameter is of interest both as a general indicator of air quality, and because of its pertinence to community air monitoring typically required at most construction/remediation/investigation sites. The DataRAM covers a wide measurement range from 0.0001 mg/m^3 to 400 mg/m^3. With its large capacity internal data logging capabilities with data retrieval on screen or downloaded, the DataRAM can store up to 50,000 data points, including individual point averages, particle size, temperature, and humidity with time stamp as well as overall average and maximum concentration.

Because the DataRAM meter must be factory calibrated once a year, this guideline presents a method for start-up, operation, and maintenance, which is performed to verify instrument function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each year. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter. The user should reference the manufacturer's instruction manual prior to operating this unit.

ACCURACY & PRECISION

The calibrated accuracy of the DataRAM 4 particulate meter is within ± 2% of reading ± precision over the temperature range of -4° to 158° F (-10° to 50° C) and 10 to 95% relative humidity (non-condensing). The precision is ± 1% of reading or ± 0.001 mg/m^3, whichever

is greater (1-second averaging) and ± 0.3% of reading or ± 0.0003 mg/m^3, whichever is greater (10-second averaging).

INSTRUMENT PANEL VIEW

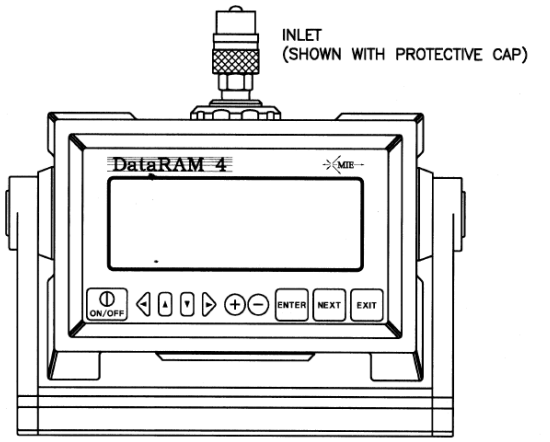


FIGURE 1. FRONT–PANEL VIEW OF DataRAM

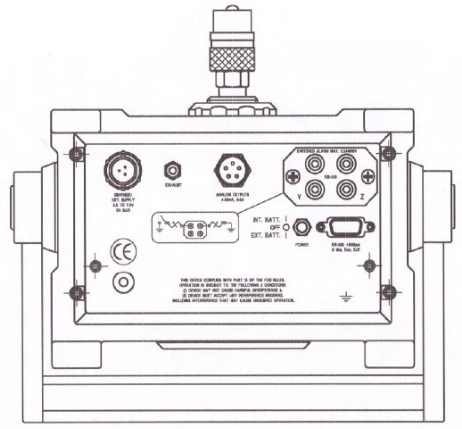


FIGURE 2. BACK–PANEL VIEW OF DataRAM

MAINTENANCE

General Guidelines

The DataRAM 4 is designed to be repaired at the factory. No user serviceable components are inside the metal enclosure of the DataRAM 4 with exception of the filter cartridge or the analytic filter holder. Access to the internal components of the unit by others than authorized MIE personnel voids warranty.

Unless a MALFUNCTION message is displayed, or other operational problems occur, the DataRAM 4 should be returned to the factory once every two years for routine check out, test, cleaning and calibration check.

Battery Charging and Cycling

If the DataRAM 4 is to be operated without its charger/power supply, i.e., deriving power from its internal battery, this battery should be fully charged before initiating a run. The

DataRAM 4 charger/power supply can be connected continuously to the instrument whether the DataRAM 4 is on or off. If the charger/power supply is not connected, the internal battery will discharge very slowly depending on storage temperature. Low storage temperature reduces battery capacity. High storage temperatures, however, reduce battery life which is of the order of 8 years at 20°C (68°F), and only 2 years at 40°C (104°F).

In general, the user should maintain the battery charge as high as possible in order to extend its charge/discharge cycling capacity (this characteristic differs from that of nickel-cadmium batteries).

Instrument Storage

If the DataRAM 4 is to be stored for an extended period of time (i.e., 3 months or more), place the 3-position switch on the back panel in its OFF position (mid-position), in order to minimize gradual battery discharge. This will have no effect on data retention or internal clock function. It is recommended, however, that the battery be recharged every 3 months in order to prolong battery life.

During storage always snap on quick-connect cap over the instrument inlet to protect the sensing optics from gradual dust contamination. Store DataRAM 4 in a dry environment.

Filter Replacement

To replace either of two types of filters used with DataRAM 4, place the instrument on its back rubber feet (front panel facing upward). On the bottom surface of the DataRAM, locate the large threaded plastic filter cover and holding the cross bar, rotate this cover counterclockwise. Remove cover and the filter holder within the open cavity.

HEPA Filter Cartridge Replacement

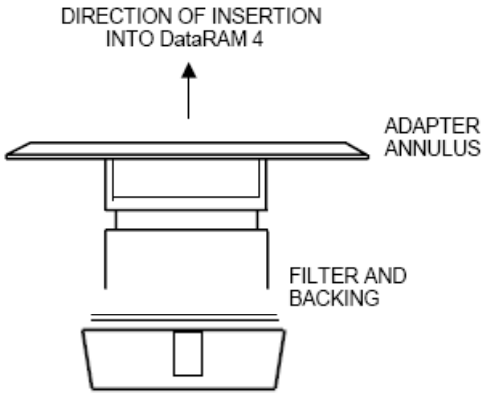
The DataRAM 4 is shipped from the factory with the HEPA filter cartridge installed. This cartridge can be identified by its metallic cover. Remove this cartridge. Clean the internal black rubber gasket against which the cartridge is normally compressed. Install new HEPA-type cartridge (MIE part no. MSA-95302) by inserting its wider ridged end first. Reposition threaded plastic cover engaging threads carefully; rotate cover clockwise, hand tightening firmly. Properly dispose of used cartridge to prevent inadvertent re-use.

Analytic Filter Installation/Replacement

In order to install or replace the analytical filter holder, proceed as follows. Remove the HEPA cartridge normally in place. Remove (separate) the inlet cover (with the blue plug) of the Millipore plastic filter holder from the rest of that holder assembly containing the white membrane filter. Insert firmly the gray plastic adapter annulus into the open face of the filter holder assembly. Remove the red plastic plug from the exhaust nipple of the filter holder assembly. Ensure that all three components of the holder assembly are fully compressed to preclude any leafage. Insert the assembly into the filter cavity of the DataRAM 4 with the gray plastic adapter annulus bearing against the internal black gasket (adapter annulus inserted first). Reposition threaded plastic cover and hand-tighten carefully and firmly. Set aside HEPA cartridge for future use.

In order to remove and/or to replace the membrane filter within its holder, remove the gray plastic adapter annulus and separate (pry apart) the two transparent plastic rings that compress the membrane filter. Make sure to remove and replace only the membrane filter (using tweezers), leaving the white backing disc in the holder. A new membrane filter should then be placed over that backing and the sealing ring should then be inserted to trap and compress the filter and backing discs. For storage, the inlet cap with the blue plug should be inserted as well as the red plug on the back of the filter holder.

Analytical filter holder with adapter annulus inserted



Cleaning of Optical Sensing Chamber

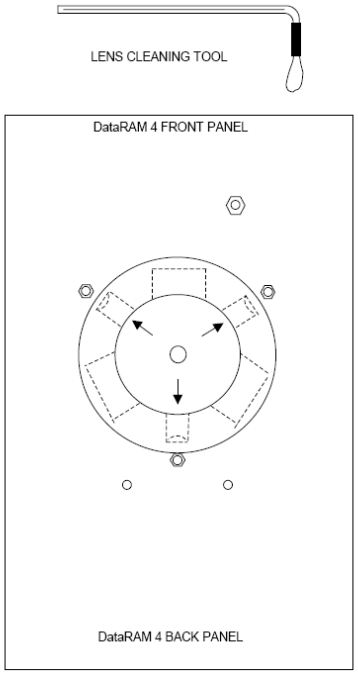
Although the DataRAM 4 incorporates filtered air shielding of the critical optical sensing surfaces, continued sampling of airborne particles at high concentrations may result in gradual build-up of contamination on those interior surfaces of the sensing chamber components. This may cause an excessively high optical background level. If this background level does becomes excessive, the DataRAM 4 will alert the user at the completion of the zeroing sequence by the display of a BACKGROUND HIGH message. If this message is presented, the DataRAM 4 can continue to be operated providing accurate measurements. However, it is then advisable to clean the front surfaces of the optical lenses within the sensing chamber at the first convenient opportunity, as described below. The tools required for this cleaning are: an intense concentrated light source (e.g., flash light) to view the inside of the sensing chamber, denatured alcohol, a soft lint-free cloth, and the special cleaning tool provided with the DataRAM 4 consisting of a cut-off cotton swab inserted in a plastic sleeve and held by a right-angle Allen wrench.

Proceed as follows to clean the lens surfaces within the sensing chamber:

- **Make sure to shut off power completely before proceeding with cleaning**
- Install the stainless steel cover on the inlet of the DataRAM 4 to protect this fitting.
- Place the DataRAM 4 upside down on a table, resting the instrument on the inlet cover and the rear protective bumper.
- Unscrew the gray plastic cover of the filter cavity on the bottom surface of the DataRAM 4.
- Remove the filter cartridge from its cavity.
- Carefully clean the black soft filter-sealing gasket within the filter cavity by wiping it with the lint-free soft cloth. Use alcohol if necessary.
- Shine the concentrated light source into the sensing chamber located about 3 cm (1¼ in.) beyond the soft-sealing gasket in the filter cavity.
- Locate the three smaller side cavities inside the sensing chamber, identified by the arrows on that figure (see page 6). These three cavities contain the lenses of the two sources and the common detector of the DataRAM 4. The frontal surfaces of these lenses are likely to require cleaning if the instrument indicates BACKGROUND HIGH.
- Wet the cotton swab of the lens-cleaning tool with alcohol (e.g., methanol, ethanol, or rubbing alcohol).

- Holding the cleaning tool by its long handle, insert this tool into the sensing chamber without touching the walls of this chamber.
- Direct the cotton swab tip towards the opening of one of the three smaller cavities as indicated by the arrows of the figure below, and insert the cotton tip into this cavity as far as it will go. Gently wipe that internal surface touched by the swab tip by a rotating motion. Carefully withdraw the swab tip from the cavity.
- Repeat previous cleaning step for the other two small cavities.
- Carefully remove the cleaning tool from the sensing chamber. Allow the alcohol to dry leaving the filter cavity open for about 15 minutes.
- Re-insert the filter cartridge into its cavity and close it with its gray plastic cover, hand-tightening it firmly. Remove the inlet cap and store on its pod on the back panel.
- Place the DataRAM 4 right side up and key ON. Proceed to check its optical background by running the ZERO/INITIALIZE check as. The message READY! should appear at the end of this check indicating that the lens contamination has been eliminated. Should the message BACKGROUND HIGH persist after completion of the above-described lens cleaning procedure, please contact the factory.

Lens cleaning tool and bottom view of open filter cavity showing location of sensor chamber lens cavities (arrows).



FACTORY CALIBRATION

For mass concentration measurements, each DataRAM 4 is factory calibrated against a set of reference monitors that, in turn, are periodically calibrated against a gravimetric standard traceable to the National Institute of Standards and Testing (NIST).

The primary factory reference method consists of generating a dust aerosol by means of a fluidized bed generator, and injecting continuously the dust into a mixing chamber from which samples are extracted concurrently by two reference filter collectors and by two master real-time monitors that are used for the routine calibration of every DataRAM 4.

The primary dust concentration reference value is obtained from the weight increase of the two filters due to the dust collected over a measured period of time, at a constant and known flow rate. The two master real-time monitors are then adjusted to agree with the reference mass concentration value (obtained from averaging the measurements of the two gravimetric filters) to within ±1%.

Three primary, NIST traceable, measurements are involved in the determination of the reference mass concentration: the weight increment from the dust collected on the filter, the sampling flow rate, and the sampling time. Additional conditions that must be met are: a) suspended dust concentration uniformity at all sampling inlets of the mixing chamber; b) identical sample transport configurations leading to reference and instrument under calibration; and c) essentially 100% collection efficiency of filters used for gravimetric reference for the particle size range of the test dust.

The test dust used for the MIE factory calibration of the DataRAM 4 is SAE Fine (ISO Fine) supplied by Powder Technology, Inc. It has the following physical characteristics (as dispersed into the mixing chamber):

- Mass median aerodynamic particle diameter: 2 to 3 μm
- Geometric standard deviation of lognormal size distribution: 2.5
- Bulk density: 2.60 to 2.65 g/cm3
- Refractive index: 1.54

In addition to the mass calibration described above, the DataRAM 4 is factory calibrated using a gas with known scattering coefficient in order to adjust the relative scattering irradiance at the two source wavelengths.

ATTACHMENTS

None

FIELD OPERATING PROCEDURES

Field Quality Control Procedures

FOP 085.0

FIELD QUALITY CONTROL PROCEDURES

PURPOSE

In addition to traditional environmental samples (e.g., soil, groundwater, wipe, vapor etc.) described in each project work plan, site-specific field quality assurance/quality control (QA/QC) samples are typically collected and analyzed to support the required third-party data usability assessment effort of a project. Site-specific QA/QC samples generally include matrix spikes, matrix spike duplicates, blind duplicates (where appropriate), and trip blanks which accompany aqueous volatile organic compound (VOC) samples only.

The number of QA/QC field samples (blind duplicate, matrix spike/matrix spike duplicate, trip blank, field blank, or equipment blank) will be designated prior to field mobilization, but final QC sample locations will be contingent upon field conditions. This procedure outlines and discusses each QA/QC sample that may be required during a project.

PROCEDURE

A brief summary of each QA/QC sample identified above is presented below. Where appropriate, the procedure to be used to collect these samples is also presented.

- **Trip Blanks** – A sufficient number of trip blanks for VOC analysis must be prepared by the laboratory and delivered to the sampling team prior to a sampling event, typically two or three 40-ml VOA vials with organic free reagent water. One sealed blank will be carried into the field per day along with the sample containers for each day that water matrix volatile organic samples are collected. Trip blanks will be transported and handled in the same manner as the actual samples. The results of the trip blank analysis will be reviewed to evaluate if the potential for sample contamination during transportation and handling exists. The trip blanks will be analyzed for the same VOCs (and method) as the project groundwater samples.

- **Blind Duplicate** – One blind duplicate must be collected and analyzed per 20 samples collected per matrix (i.e., soil, groundwater, soil vapor, etc.). The location

of the sample collection point will not be disclosed to the analytical laboratory, therefore the field sample containers will be returned to the laboratory identified only as the "blind duplicate." The well or sample location will be recorded in the Project Field Book or handheld RuggedReader® Pocket PC and on the field data sheets, and the results will be compared to review analytical precision. Sample analysis will be identical to the original sample per the project work plan. The Blind Duplicate sample must be collected simultaneously from the same source under identical conditions as the original sample.

- **Matrix Spike/Matrix Spike Duplicate (MS/MSD)** – A sufficient volume of sample will be collected at one sampling location per sampling event for MS/MSD analysis per matrix (i.e., soil and groundwater only). The laboratory will report the results of the MS/MSD analysis, which will be reviewed for sampling and analysis precision and accuracy. Sample analysis will be identical to the original sample per the project work plan. The MS/MSD sample must be collected simultaneously from the same source under identical conditions as the original sample.

- **Equipment (Rinsate) Blank** – In general, dedicated sampling equipment is used to minimize field decontamination time and avoid the need for equipment blanks; however there may be instances where the use of non-dedicated equipment cannot be avoided. An equipment blank will be collected for each day of sampling activity when non-dedicated sampling equipment is used. These equipment blank samples will be used as a QC check of the decontamination procedures for sampling equipment. Sample analysis for the equipment blank will consist of the most comprehensive parameter list used for risk assessment in which the non-dedicated equipment was used for environmental sample collection. During most projects, every effort to use dedicated sampling equipment should be made in order to minimize field decontamination time and avoid the need for equipment blanks. Equipment Blank sampling procedure is as follows:
    - Non-dedicated equipment are to be decontaminated in accordance with Roux's Non-disposable and Non-dedicated Sampling Equipment Decontamination procedures prior to use in the field. If organic-free

deionized water (generally provided by the laboratory) is not available for decontamination, equipment will be allowed to thoroughly air dry.
    - Once properly rinsed or allowed to air dry, analyte-free water (provided by the laboratory) is poured appropriately over or through the decontaminated sample collection device, collected in a sample container, and returned to the laboratory as a sample.

- **Field Blank** – A field blank is a sample of the unused final decontamination rinse water that is collected at the sampling site and returned to the laboratory as a sample. Sample analysis for the field blank will consist of the most comprehensive parameter list used during the investigation.

- **Split Sample** – A split sample is a sample that has been portioned into two or more containers from a single sample container or sample mixing container. Samples for VOC analysis should never be mixed prior to splitting.

- **Blank Wipe Samples** – There are two types of blank wipe samples, an equipment blank and a field blank that may be required per the project work plan, both are described below:
    - Equipment Blank – Required only if reusable templates are used for wipe sample collection. The decontaminated template is wiped with a hexane saturated swab. The swab is placed in the appropriate sample container and returned to the laboratory as a sample.
    - Field Blank – Clean disposable gloves are wiped with a hexane saturated swab. The swab is placed in the appropriate sample container and returned to the laboratory as a sample.

REFERENCES

Roux FOPs:

040 Non-disposable and Non-dedicated Sampling Equipment Decontamination

FIELD OPERATING PROCEDURES

Underground Piping Decommissioning Procedures

FOP 088.0

UNDERGROUND PIPING DECOMMISSIONING PROCEDURES

PURPOSE

This procedure describes the method for the excavation and removal of underground piping requiring decommissioning that may contain hazardous or flammable material. Prior to each day or as necessary, the project Health and Safety Plan (HASP) will be reviewed with field personnel (e.g., tailgate safety meeting). It is the responsibility of field personnel to ensure all field equipment is in proper working order and calibrated according to manufacturer's recommendations.

PROCEDURE

1. Review project objectives and the Project HASP with the Contractor.

2. Perform excavation equipment safety checks with the operator. Specific concerns should include, but not limited to, no leaking hydraulic lines, fire extinguisher on board of the excavation equipment, operator experience etc.

3. Conduct tailgate health and safety meeting with project team and excavation operator(s) by completing the Tailgate Safety Meeting Form (sample attached). Discuss with excavation contractor personnel the scope of work and what will be expected of them.

4. Calibrate air-monitoring equipment in accordance with the appropriate TurnKey's Field Operating Procedures or manufacturers recommendations for calibration of field meters.

5. Conduct community air monitoring as required by the HASP and/or Project Work Plan. Record all results on the Real Time Air Monitoring Log (sample attached), as necessary.

6. Mobilize the excavation equipment to the site and position over the required location.

7. Pre-stake locations in the field and measure distance from locations to nearest landmarks or survey the location using a handheld GPS unit, as required.

8. Wear appropriate protective gear (i.e., latex gloves, safety glasses), as required in the project HASP.

9. Excavate and expose underground piping requiring decommissioning in accordance with TurnKey's Test Pit Excavation & Logging Procedures FOP. Great care should be taken to avoid damaging the pipe and allowing the contents, if any, to be released to the environment.

10. Once exposed, over excavate the area around the section of pipe to be cut and place a container below the pipe. Tap two test holes in the top of the pipe using an intrinsically safe drill with non-sparking drill bit approximately 15 feet from the open end of the pipe (above the container).

11. Continue monitoring the ambient air space within the excavation for worker safety until work is complete. Refer to the project HASP for action levels.

12. Remove any solids and/or liquids within the first 15 to 20 feet of exposed pipe to the extent practicable.

13. Insert an appropriately sized double pipe seal apparatus into the open end of the pipe.

14. Using a single pipe seal apparatus attached to a steel rod, push the double pipe seal into the pipe beyond the tap holes (approximately 16 feet or so). Be sure to capture any residuals flowing out of the two tap holes with the previously mentioned container.

15. Retract the single pipe seal and push rod leaving an approximate 1 to 2 foot void space between the single and double pipe seal.

16. Through one of the tap holes, test the ambient air quality of the newly created void space between seals with an oxygen meter and explosimeter. If the air quality within the pipe indicates 0% oxygen on the oxygen meter and less than

10% Lower Explosive Limit (LEL) on the explosimeter, proceed with cutting the pipe into workable sections.

17. If the void space air quality exceeds either of those levels, inject nitrogen (or approved other inert gas) through the tap holes into the void air-space until safe levels are achieved. Nitrogen is 3% less dense than ambient air.

18. Cut the pipe into manageable sections (typically 15 feet) while periodically monitoring the ambient air within the pipe and injecting additional nitrogen (or approved other inert gas), as necessary.

19. Once section of pipe is removed, proceed with final cleaning activities in accordance with the project Work Plan and any local, state, and/or federal regulations.

20. Record all observations in the Project Field Book, including but not limited to length of recovered pipe, air monitoring observations, depths, diameters, etc.

ATTACHMENTS

Tailgate Safety Meeting Form (sample)
Real Time Air Monitoring Log (sample)

REFERENCES

TurnKey FOPs:
006 Calibration and Maintenance of Combustible Gas/Oxygen Meter
065 Test Pit Excavation & Logging Procedures

ROUX

TAILGATE SAFETY MEETING FORM

Project Name: Date: Time:
Project Number: Client:
Work Activities:

HOSPITAL INFORMATION:

Name:
Address: *City:* *State:* *Zip:*
Phone No.: *Ambulance Phone No.*

SAFETY TOPICS PRESENTED:

Chemical Hazards:

Physical Hazards: Slips, Trips, Falls

PERSONAL PROTECTIVE EQUIPMENT:

Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D

New Equipment:

Other Safety Topic (s): Environmental Hazards (aggressive fauna)
Eating, drinking, use of tobacco products is prohibited in the Exclusion Zone (EZ)

ATTENDEES

Name Printed	Signatures

Meeting conducted by:

SAMPLE

ROUX

REAL TIME AIR MONITORING LOG

Date:
Project Name:
Project Number:
Project Location:
Client:
Purpose of Air Monitoring:

WEATHER CONDITIONS:

Time of Day:	A.M.	P.M.
Ambient Air Temp.:		
Wind Direction:		
Wind Speed:		
Precipitation:		

Date	Personnel	Time	Air Monitoring Meter Measurement (Units)							Location/Activity/Comments
			PID (ppm)	LEL (%)	H_2S (ppm)	O_2 (%)	CO (ppm)	Particulates (mg/m³)	Other	

SAMPLE

NOTE: SEE EQUIPMENT CALIBRATION LOG FOR DESCRIPTION OF EQUIPMENT TYPE.

Prepared By: Date:

FIELD OPERATING PROCEDURES

Outdoor Ambient Air VOC Sample Collection Procedure

FOP 090.0

OUTDOOR AMBIENT AIR VOC SAMPLE COLLECTION PROCEDURE

PURPOSE

This procedure describes the methods for collecting outdoor ambient air samples for volatile organic compound (VOC) analysis via USEPA Method TO-15 using Summa® canisters (or approved other). Typically, outdoor air samples are collected to characterize and document site-specific VOCs that may be present in outdoor ambient air. For sample collection associated with intrusive activities that may potentially release VOCs to the ambient air, sample location(s) typically are collected downwind of the intrusive activity at the perimeter of the work area and/or exclusion zone for the Site. Upwind sample location(s) may be utilized if regional facilities (e.g. gasoline service station, factories) are located proximate to the Site to assess off-site ambient VOC contributions (background).

SAMPLE COLLECTION PROCEDURES

The following actions should be taken to document conditions during outdoor air sampling and ultimately to aid in the interpretation of the analytical results:

- A site map should be prepared to indicate the outdoor ambient air sample locations including all site improvements (e.g., buildings, access roads, etc.), public roads/streets (if applicable), the location of potential VOC contributors (e.g., gasoline stations, factories, lawn movers, etc.), compass orientation (north), and scale.

- Weather conditions (e.g., precipitation, wind speed, outdoor temperature, and barometric pressure) should be reported on the Air Canister Field Record (sample attached); and

- Any pertinent observations, such as odors, readings from field instrumentation, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) should be recorded.

The following describes the outdoor air sampling procedure:

1. Typically, a 6-liter, passivated (inert), stainless steel, evacuated sampling sphere (e.g., Summa canister) (or approved other) will be supplied by the laboratory that will be conducting the analysis. The canister should be received from the laboratory, certified clean, evacuated, and prepared for sampling.

2. Sampling will take place in accordance with the project work plan. Selected sample locations will be sufficiently spaced to allow location(s) to be field modified, if necessary.

3. The number of Summa canisters required as well as the flow rate of the constant differential low volume flow controllers will be supplied by the laboratory in accordance with the project work plan.

4. Prior to placement, complete an Air Canister Field Record (sample attached) of each canister, which includes: project information, field staff, weather conditions, canister serial number, flow controller number, sample date(s)/time(s), shipping date(s), canister lab vacuum, field vacuum check, initial field vacuum, final field vacuum, and duration of sample collection.

5. The pressure in the canisters must be monitored with the laboratory provided pressure gauge at the beginning and the end of the sampling period as well as before and after shipment of the canisters at the laboratory. The **target final field vacuum must be approximately 5 inches of mercury. Samples with a final field vacuum of greater than 10 inches of mercury, or equal to zero, will be flagged** and usability of the data will depend on the sample volume and reporting limits that can be achieved.

6. Canisters may be placed on the ground provided there is a clear plastic sheet beneath it to prevent cross contamination. The intake tubing, however, must be positioned at a height of approximately 3 to 5-feet above grade to collect air at an elevation representative of ambient air within the breathing zone. Typically, the canister is chained and locked to a secure step ladder with the intake tubing tethered to the ladder.

7. Ship the canisters to the laboratory under chain-of-custody command within three days of sample collection so that no sample will exceed the 30-day holding time (since receipt from the lab) per USEPA TO-15.

8. Air samples will be analyzed by Gas Chromatography/Mass Spectroscopy (GC/MS) in accordance with EPA Method TO-15, or as specified. Analytical results will be reported as concentrations of each VOC at each location during each sampling event, typically in parts per billion by volume (ppbv).

9. Sample collection should take place on warm, dry days. If rain or high humidity conditions develop during sampling, the sampling event should be suspended. Temperature, barometric pressure, and wind speed should be monitored during the sampling event, for use in analysis of the results. The combination of sampling location, height, and meteorological conditions will assure that sampling will measure VOCs at their highest concentrations.

QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

Extreme care should be taken during all aspects of sample collection to ensure that sampling error is minimized and high quality data are obtained. The sampling team members should avoid actions (e.g., fueling vehicles, using permanent marking pens, and wearing freshly dry-cleaned clothing or personal fragrances), which can cause sample interference in the field. Appropriate QA/QC protocols must be followed for sample collection and laboratory analysis, such as use of certified clean sample devices, meeting sample holding times and temperatures, sample accession, chain of custody, etc. Samples should be delivered to the analytical laboratory as soon as possible after collection. In addition, laboratory accession procedures must be followed including field documentation (sample collection information and locations), chain of custody, field blanks, field sample duplicates, and laboratory duplicates, as appropriate.

Some methods require collecting samples in duplicate to assess errors. Duplicate and/or split samples should be collected in accordance with the requirements of the sampling and analytical methods being implemented.

For certain regulatory programs, a Data Usability Summary Report (DUSR) may be required to determine whether or not the data, as presented, meets the site or project specific criteria for data quality and data use. This requirement may dictate the level of QC and the category of data deliverable to request from the laboratory. Guidance on preparing a DUSR is available by contacting the NYSDEC's Division of Environmental Remediation.

New York State Public Health Law requires laboratories analyzing environmental samples collected from within New York State to have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. If ELAP certification is not currently required for an analyte (e.g., trichloroethene); then the analysis should be performed by a laboratory that has ELAP certification for similar compounds in air and uses analytical methods with detection limits similar to background (e.g., tetrachloroethene via EPA Method TO-15).

ATTACHMENTS

Air Canister Field Record (sample)

REFERENCES

United States Environmental Protection Agency. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*. Second Addition (EPA/625/R-96/010b). January 1999.

ROUX

AIR CANISTER FIELD RECORD

PROJECT INFORMATION:

Project:
Job No:
Location:
Field Staff:
Client:

SAMPLE I.D.:

Size of Canister:
Canister Serial No.:
Flow Controller No.:
Sample Date(s):
Shipping Date:
Sample Type: ☐ ☐
☐ ☐
Soil Gas Probe Depth:

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.:
Ambient Air Temp. - P.M.:
Wind Direction:
Wind Speed:
Precipitation:

FIELD SAMPLING INFORMATION:

READING	TIME	VACUUM (inches Hg) or PRESSURE (psig)	DATE	INITIALS
Lab Vacuum (on tag)				
Field Vacuum Check [1]				
Initial Field Vacuum [2]				
Final Field Vacuum [3]				
Duration of Sample Collection				

LABORATORY CANISTER PRESSURIZATION:

Initial Vacuum (inches Hg and psia)		
Final Pressure (psia)		
Pressurization Gas		

SUBSLAB SHROUD:

Shroud Helium Concentration:
Calculated tubing volume: x 3 =
Purged Tubing Volume Concentration:
Is the purged volume concentration less than or equal to 10% in shroud?
☐
☐

COMPOSITE TIME (hours)	FLOW RATE RANGE (ml/min)
15 Min.	316 - 333
0.5 Hours	158 - 166.7
1	79.2 - 83.3
2	39.6 - 41.7
4	19.8 - 20.8
6	13.2 - 13.9
8	9.9 - 10.4
10	7.92 - 8.3
12	6.6 - 6.9
24	3.5 - 4.0

NOTES:

1 Vacuum measured using portable vacuum gauge (provided by Lab)
2 Vacuum measured by canister gauge upon opening valve
3 Vacuum measured by canister gauge prior to closing valve

Signed:

APPENDIX E

Project Documentation Forms

TAILGATE SAFETY MEETING FORM

Project Name: Date: Time:

Project Number: Client:

Work Activities:

HOSPITAL INFORMATION:

Name:

Address: *City:* *State:* *Zip:*

Phone No.: *Ambulance Phone No.*

SAFETY TOPICS PRESENTED:

Chemical Hazards:

Physical Hazards: Slips, Trips, Falls

PERSONAL PROTECTIVE EQUIPMENT:

Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D

New Equipment:

Other Safety Topic (s): Environmental Hazards (aggressive fauna)

Eating, drinking, use of tobacco products is prohibited in the Exclusion Zone (EZ)

ATTENDEES

Name Printed	Signatures

Meeting conducted by:

ROUX

EQUIPMENT CALIBRATION LOG

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	POST CAL. READING	SETTINGS
☐ pH meter	units		Myron L Company Ultra Meter 6P	6243084 ☐ 6212375 ☐ 6223973 ☐		4.00 7.00 10.01		
☐ Turbidity meter	NTU		Hach 2100P or 2100Q Turbidimeter	06120C020523 (P) ☐ 17110C062619 (Q) ☐		10 NTU verification <0.4 20 100 800		
☐ Turbidity Meter	NTU			LaMotte ☐		0 1 10		
☐ Sp. Cond. meter	uS mS		Myron L Company Ultra Meter 6P	6243084 ☐ 6212375 ☐ 6223973 ☐		_____ mS @ 25 °C		
☐ PID	ppm		MinRAE 2000			open air zero _____ ppm Iso. Gas		MIBK response factor = 1.0
☐ Dissolved Oxygen	ppm		HACH Model HQ30d	231041130043 ☐ 232721130003 ☐		100% Satuartion		
☐ Particulate meter	mg/m^3					zero air		
☐ Radiation Meter	uR/H					background area		

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

ROUX

DAILY LOG	DATE			
	NO.			
	SHEET		OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME:	PROJECT NO.
PROJECT LOCATION:	CLIENT:
FIELD ACTIVITY:	

DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:

TIME	DESCRIPTION

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:

WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
A.M.:	
P.M.:	

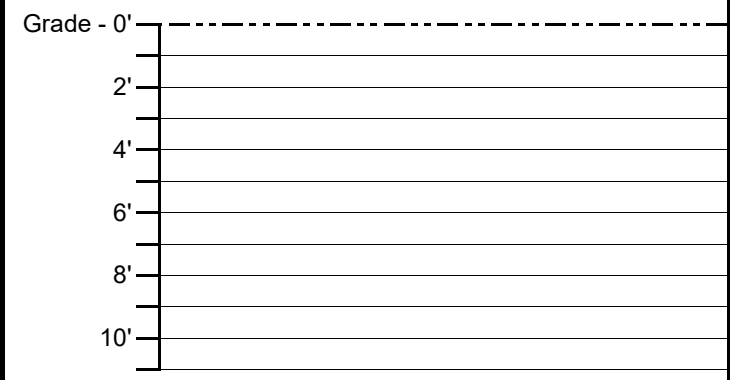
PERSONNEL ON SITE:

SIGNATURE DATE:

TEST PIT EXCAVATION LOG

Project:	TEST PIT I.D.:
Project No.:	Excavation Date:
Client:	Excavation Method:
Location:	Logged / Checked By:

Test Pit Location: *NOT TO SCALE*



TIME		
Start:	Length:	(approx.)
End:	Width:	(approx.)
	Depth:	(approx.)

Depth (fbgs)	USCS Symbol & Soil Description	PID Scan (ppm)	Photos Y / N	Samples Collected (fbgs)

COMMENTS:

GROUNDWATER ENCOUNTERED:	☐ YES	☐ NO	If yes, depth to GW:
VISUAL IMPACTS:	☐ YES	☐ NO	Describe:
OLFACTORY OBSERVATIONS:	☐ YES	☐ NO	Describe:
NON-NATIVE FILL ENCOUNTERED:	☐ YES	☐ NO	
OTHER OBSERVATIONS:	☐ YES	☐ NO	Describe:
SAMPLES COLLECTED:			Sample I.D.:
			Sample I.D.:
			Sample I.D.:

ROUX

FIELD BOREHOLE LOG

PROJECT:		**Log of Boring No.:**	
BORING LOCATION:		ELEVATION AND DATUM:	
DRILLING CONTRACTOR:		DATE STARTED:	DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST: / COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION (ASTM D 2488)	REMARKS
							USCS Classification: Color, Moisture Condition, Primary Soil Type, Secondary Soil Type (<5% Trace, 5-10% Few, 15-25% Little, 30-45% Some), Structure (varved, stratified, thinly bedded, bedded, thickly bedded, laminated, fissured, blocky, lensed, massive), Consistency/Density (Standard Penetration Test, SPT), Weathering/Fracturing, Odor, Fill Materials (if present), Other	
							SURFACE ELEVATION (FMSL):	

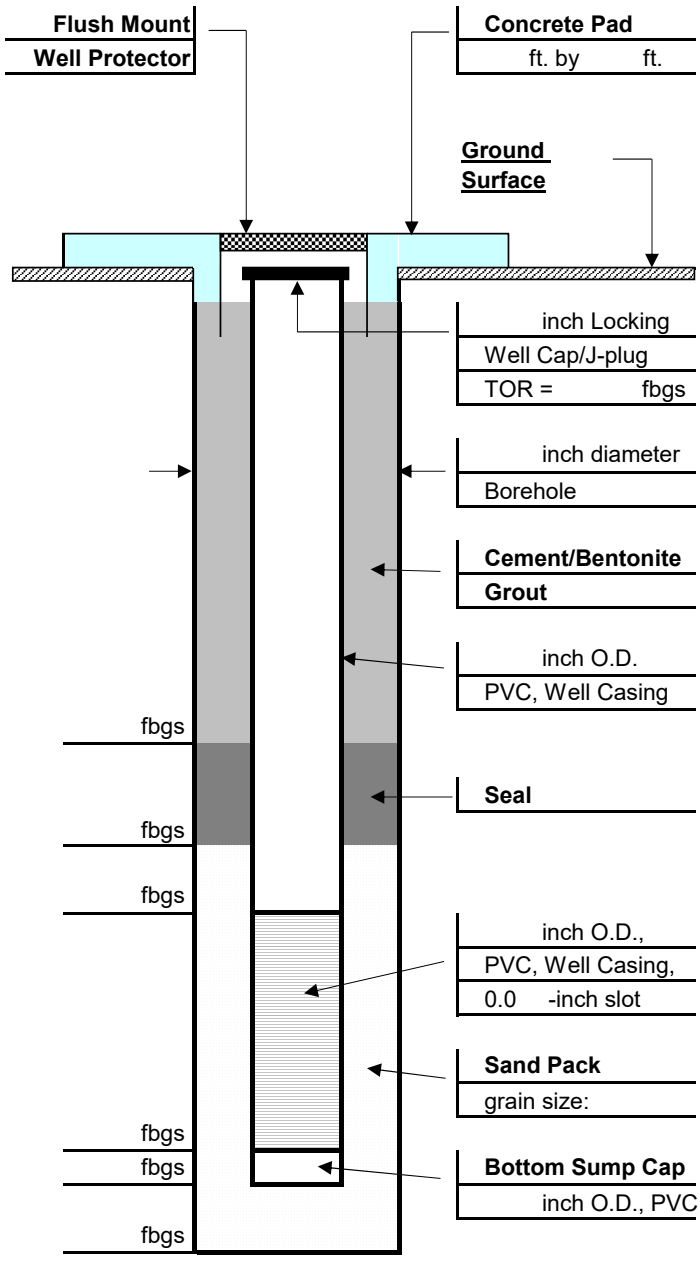
ABANDONMENT:

Volume of cement/bentonite grout required:	$V = \pi r^2 \times 7.48 =$	gallons	borehole depth =	ft.
Volume of cement/bentonite grout installed:		gallons	borehole diameter =	ft.
Has bridging of grout occurred? ☐ yes ☐ no			borehole radius =	ft.
If yes, explain resolution:				
Method of installation:				

Project No:		Figure

FLUSHMOUNT WELL COMPLETION DETAIL

Project Name:	WELL NUMBER:
Client:	Date Installed:
Boring Location:	Project Number:



Driller Information

Company:	
Driller:	
Helper:	
Permit Number:	
Drill Rig Type:	

Well Information

Land Surface Elevation:	fmsl (approximate)
Drilling Method:	
Soil Sample Collection Method:	
Drilling Fluid:	
Fluid Loss During Drilling:	gallons (approximate)

Material of Well Construction

Casing:	
Screen:	
Sump:	
Sand Pack:	
Annular Seal:	

Well Development

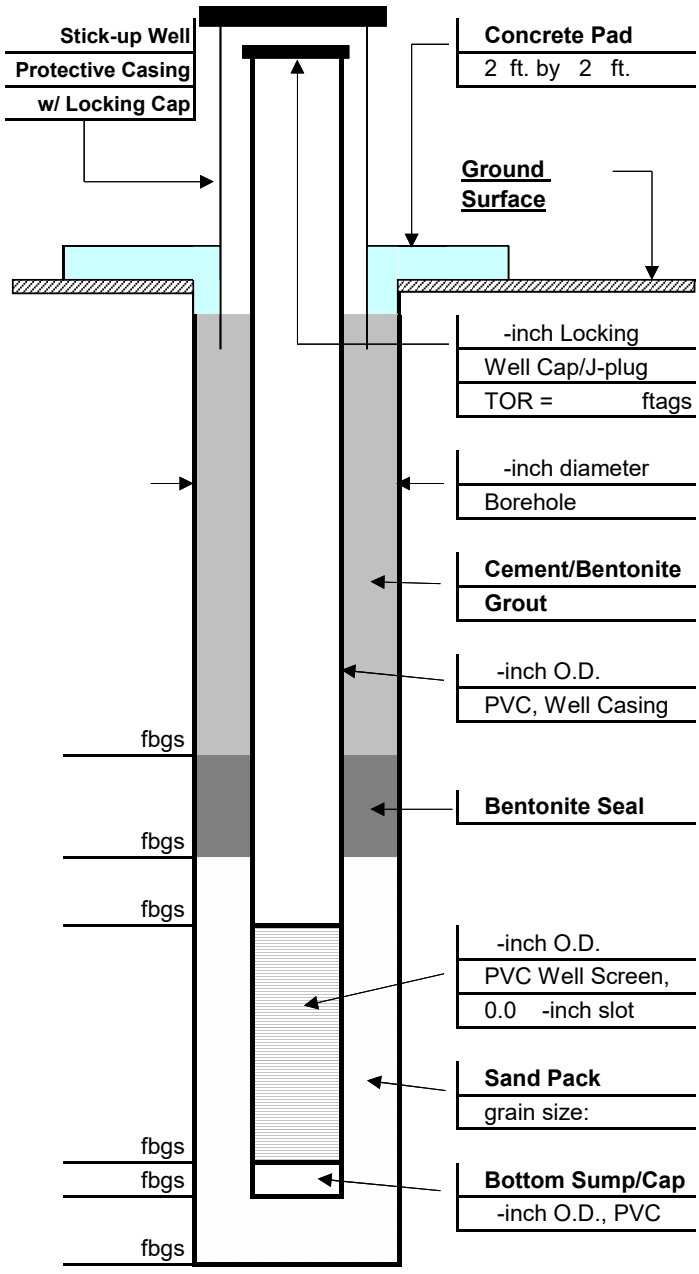
Well Purpose:	
Technique(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level (SWL):	fbTOR
Pump Depth:	
Purge Duration:	minutes
Yield:	gpm
Specific Capacity:	gpm/ft

Comments:

PREAPRED BY: DATE:

STICK-UP MONITORING WELL COMPLETION DETAIL

Project Name:	WELL NUMBER:
Client:	Date Installed:
Boring Location:	Project Number:



Driller Information

Company:	
Driller:	
Helper:	
Permit Number:	
Drill Rig Type:	

Well Information

Land Surface Elevation:	fmsl (approximate)
Drilling Method:	
Soil Sample Collection Method:	
Drilling Fluid:	
Fluid Loss During Drilling:	gallons (approximate)

Material of Well Construction

Casing:	
Screen:	
Sump:	
Sand Pack:	
Annular Seal:	

Well Development

Well Purpose:	
Technique(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level (SWL):	fbTOR
Pump Depth: bottom of well	
Purge Duration:	minutes
Yield:	gpm
Specific Capacity:	gpm/ft

Comments: saturated thickness: SWL - stickup = fbgs

Total Depth = fbTOR Total Depth - SWL = feet

stick-up = feet

Total Depth = fbgs

PREPARED BY: DATE:

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Date / Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			One Well Volume (gal):			Purpose: ☐ Development ☐ Sample ☐ Purge & Sample			
Total Depth (fbTOR):			Total Volume Purged (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:									
	S1								
	S2								

Well No.			Diameter (inches):			Sample Date / Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			One Well Volume (gal):			Purpose: ☐ Development ☐ Sample ☐ Purge & Sample			
Total Depth (fbTOR):			Total Volume Purged (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:									
	S1								
	S2								

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:

AIR CANISTER FIELD RECORD

PROJECT INFORMATION:

Project:
Job No:
Location:
Field Staff:
Client:

SAMPLE I.D.:

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.:
Ambient Air Temp. - P.M.:
Wind Direction:
Wind Speed:
Precipitation:

Size of Canister:
Canister Serial No.:
Flow Controller No.:
Sample Date(s):
Shipping Date:
Sample Type: ☐ Indoor Air ☐ Outdoor Air
☐ Subslab, complete section below ☐ Soil Gas
Soil Gas Probe Depth:

FIELD SAMPLING INFORMATION:

READING	TIME	VACUUM (inches Hg) or PRESSURE (psig)	DATE	INITIALS
Lab Vacuum (on tag)				
Field Vacuum Check [1]				
Initial Field Vacuum [2]				
Final Field Vacuum [3]				
Duration of Sample Collection				

LABORATORY CANISTER PRESSURIZATION:

Initial Vacuum (inches Hg and psia)		
Final Pressure (psia)		
Pressurization Gas		

SUBSLAB SHROUD:

Shroud Helium Concentration:
Calculated tubing volume: x 3 =
Purged Tubing Volume Concentration:
Is the purged volume concentration less than or equal to 10% in shroud?
☐ YES, continue sampling
☐ NO, improve surface seal and retest

COMPOSITE TIME (hours)	FLOW RATE RANGE (ml/min)
15 Min.	316 - 333
0.5 Hours	158 - 166.7
1	79.2 - 83.3
2	39.6 - 41.7
4	19.8 - 20.8
6	13.2 - 13.9
8	9.9 - 10.4
10	7.92 - 8.3
12	6.6 - 6.9
24	3.5 - 4.0

NOTES:

1 Vacuum measured using portable vacuum gauge (provided by Lab)
2 Vacuum measured by canister gauge upon opening valve
3 Vacuum measured by canister gauge prior to closing valve

Signed:

INDOOR AIR QUALITY QUESTIONNAIRE & BUILDING INVENTORY

Project Name:	Project No.
Project Location:	Client:
Preparer's Name:	Date/Time:
Preparer's Affiliation:	Phone No:
Purpose of Investigation:	

1. OCCUPANT:

Interviewed: yes no

Last Name:	First Name:
Address:	
County:	
Home Phone:	Office Phone:
Number of Occupants/persons at this location:	Age of Occupants:

2. OWNER OR LANDLORD: (check if same as occupant_____)

Interviewed: yes no

Last Name:	First Name:
Address:	
County:	
Home Phone:	Office Phone:

3. BUILDING CHARACTERISTICS

Type of Building: check appropriate response)

☐ Residential	☐ School	☐ Commercial/Multi-use
☐ Industrial	☐ Church	☐ Other:

If the property is residential, type? (check appropriate response)

☐ Ranch	☐ 2-Family	☐ 3-Family
☐ Raised Ranch	☐ Split Level	☐ Colonial
☐ Cape Cod	☐ Contemporary	☐ Mobile Home
☐ Duplex	☐ Apartment House	☐ Townhouse/Condo
☐ Modular	☐ Log Home	☐ Other:

If multiple units, how many?

If the property is commercial, type?

Business Type(s):

Does it include residences (i.e., multi-use)? yes no If yes, how many?

Other Characteristics:

Number of floors	Building age
Is the building insulated? yes no	How air tight? tight average not tight

4. AIR FLOW

Use air current tubes or tracer smoke to evaluate air flow patterns and qualitatively describe:

Airflow between floors

Airflow near source

Outdoor air infiltration

Infiltration into air ducts

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (check all that apply)

a. Above grade construction:	☐ wood frame	☐ concrete	☐ stone
b. Basement type:	☐ full	☐ crawlspace	☐ slab
c. Basement floor:	☐ concrete	☐ dirt	☐ stone
d. Basement floor:	☐ uncovered	☐ covered	☐ covered with _____
e. Concreter floor:	☐ unsealed	☐ sealed	☐ sealed with _____
f. Foundation walls:	☐ poured	☐ block	☐ stone
g. Foundation walls:	☐ unsealed	☐ sealed	☐ sealed with _____
h. The basement is:	☐ wet	☐ damp	☐ dry
i. The basement is:	☐ finished	☐ unfinished	☐ partially finished
j. Sump present?	☐ yes	☐ no	
k. Water in Sump?	☐ yes	☐ no	☐ not applicable

Basement/Lowest level depth below grade:

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

6. HEATING, VENTING, and AIR CONDITIONING (check all that apply)

Type of heating system(s) used in this building: (check all that apply - note primary)

- ☐ Hot air circulation
- ☐ Heat pump
- ☐ Hot water baseboard
- ☐ Space Heaters
- ☐ Steam radiation
- ☐ Radiant floor
- ☐ Electric baseboard
- ☐ Wood stove
- ☐ Outdoor wood boiler
- ☐ Other _____

The primary type of fuel used is:

- ☐ Natural Gas
- ☐ Fuel oil
- ☐ Kerosene
- ☐ Electric
- ☐ Propane
- ☐ Solar
- ☐ Wood
- ☐ Coal
- ☐ Other _____

Domestic hot water tank fueled by: _____

Boiler/furnace located in:

☐ Basement ☐ Outdoors ☐ Main Floor ☐ Other _____

Air Conditioning:

☐ Central Air ☐ Window units ☐ Open Windows ☐ None _____

Are there air distribution ducts present? ☐ yes ☐ no

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

7. OCCUPANCY

Is basement/lowest level occupied? ☐ Full-time ☐ Occaisionally ☐ Seldom ☐ Almost Never

Level	General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage)
Basement	
First Floor	
Second Floor	
Third Floor	
Fourth Floor	

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? ☐ yes ☐ no

b. Does the garage have a separate heating unit? ☐ yes ☐ no ☐ NA

c. Are petroleum-powered machines or vehicles stored in the garage? ☐ yes ☐ no ☐ NA
(e.g., lawnmower, atv, car) If yes, please specify: _____

d. Has the building ever had a fire? ☐ yes ☐ no
If yes, when? _____

e. Is a kerosene or unvented gas space heater present? ☐ yes ☐ no
If yes, where? _____

f. Is there a workshop or hobby/craft area? ☐ yes ☐ no
If yes, where and type? _____

g. Is there smoking in the building? ☐ yes ☐ no
If yes, how frequently? _____

h. Have cleaning products been used recently? ☐ yes ☐ no
If yes, when & type? _____

i. Have cosmetic products been used recently? ☐ yes ☐ no
If yes, when & type? _____

j. Has painting/staining been done in the last 6 months? ☐ yes ☐ no
If yes, where & when? _____

k. Is there new carpet, drapes, or other textiles? ☐ yes ☐ no
If yes, where & when? _____

l. Have air fresheners been used recently? ☐ yes ☐ no
If yes, when & type? _____

m. Is there a kitchen exhaust fan? ☐ yes ☐ no
If yes, where vented? _____

n. Is there a bathroom exhaust fan? ☐ yes ☐ no
If yes, where vented? _____

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY (continued)

o. Is there a clothes dryer? ☐ yes ☐ no

If yes, is it vented outside? yes no

p. Has there been a pesticide application? ☐ yes ☐ no

If yes, when & type? _____

q. Are there odors in the building? ☐ yes ☐ no

If yes, please describe? _____

_____

r. Do any of the building occupants use solvents at work? ☐ yes ☐ no

(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist)

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? ☐ yes ☐ no

s. Do any of the building occupants regularly use or work at a dry-cleaning service?

(check appropriate response)

☐ yes, use dry-cleaning regularly (weekly) ☐ no

☐ yes, use dry-cleaning infrequently (monthly or less) ☐ unknown

☐ yes, work at a dry-cleaning service

t. Is there a radon mitigation system for the building/structure? ☐ yes ☐ no

If yes, date of installation? _____

Is the system active or passive? _____

9. WATER AND SEWAGE

Water Supply: ☐ Public Water ☐ Drilled Well ☐ Driven Well ☐ Dug Well

☐ Other: _____

Sewage Disposal: ☐ Public Sewer ☐ Septic Tank ☐ Leach Field ☐ Dry Well

☐ Other: _____

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: _____

b. Residents choose to: ☐ remain in home ☐ relocate to friends/family ☐ relocate to hotel/motel

c. Responsibility for costs associated with reimbursement explained? ☐ yes ☐ no

d. Relocation package provided and explained to residents? ☐ yes ☐ no

11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

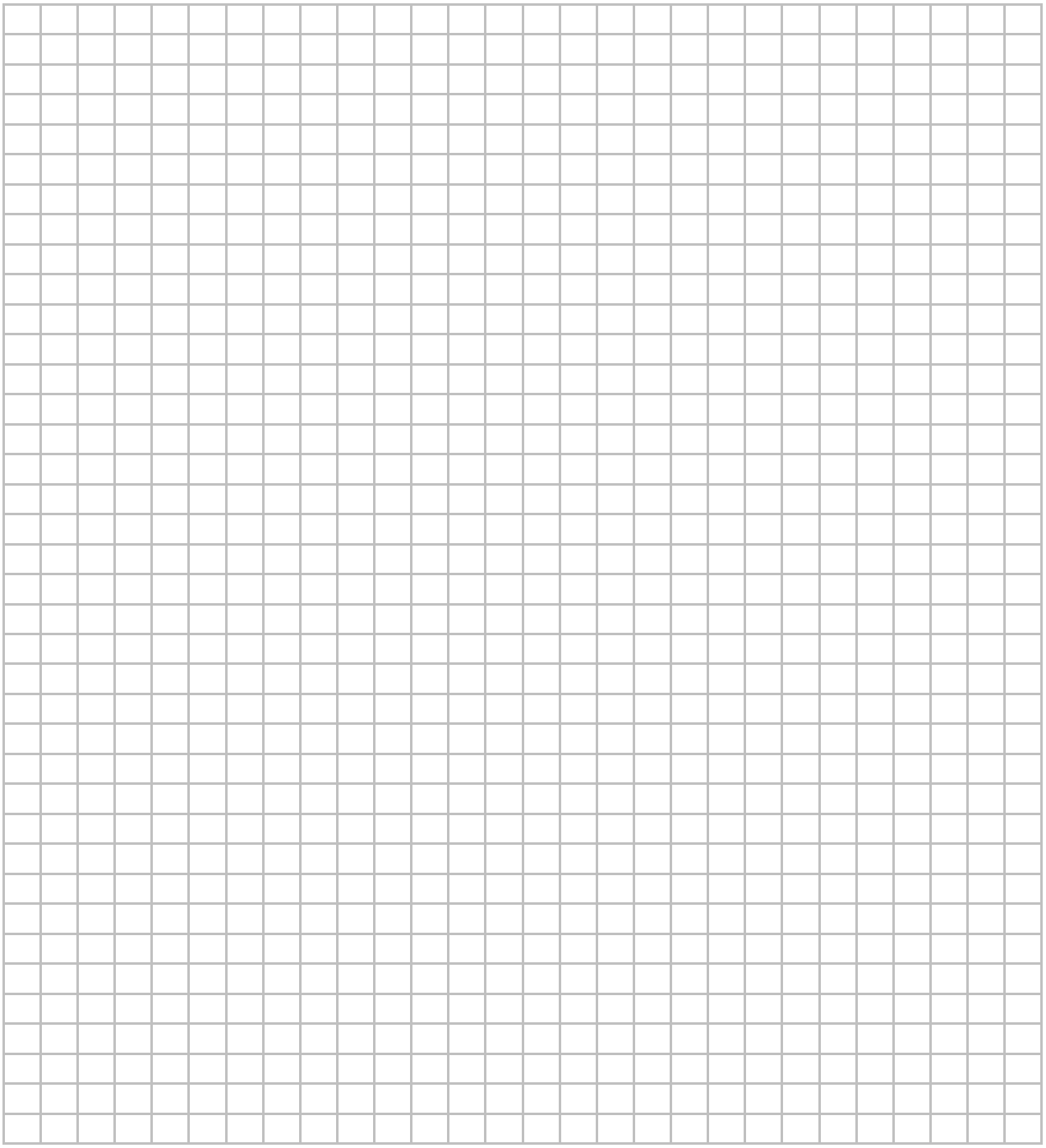
Basement:

First Floor:

12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s), and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and spetic system, if applicable, and a qualifying statement to help locate the site on a topographic map.



13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: _____

List specific products found in the structure that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition [1]	Chemical Ingredients	Field Instrument Reading (units)	Photo (Y/N)

Notes:

1. Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D).**
2. Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

ROUX

DAILY LOG	DATE			
	REPORT NO.			
	PAGE		OF	

PROBLEM IDENTIFICATION REPORT

Date:
Project:
Job No:
Location:
CQA Monitor(s):
Client:
Contractor:
Contractor's Supervisor:

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.:
Ambient Air Temp. - P.M.:
Wind Direction:
Wind Speed:
Precipitation:

Problem Description:

Problem Location (reference test location, sketch on back of form as appropriate):

Problem Causes:

Suggested Corrective Measures or Variances:

Linked to Corrective Measures Report No. *or Variance Log No.*

Approvals (initial):

CQA Engineer:

Project Manager:

Signed:

CQA Representative

ROUX

DAILY LOG	DATE			
	REPORT NO.			
	PAGE		OF	

CORRECTIVE MEASURES REPORT

Date:

Project:

Job No:

Location:

CQA Monitor(s):

Client:

Contractor:

Contractor's Supervisor:

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.:

Ambient Air Temp. - P.M.:

Wind Direction:

Wind Speed:

Precipitation:

Corrective Measures Undertaken (reference Problem Identification Report No.)

Retesing Location:

Suggested Method of Minimizing Re-Occurrence:

Approvals (initial):

CQA Engineer:

Project Manager:

Signed:

CQA Representative

COMMUNITY AIR MONITORING DAILY LOG

Date:

Project:

Job No.:

Client:

LOCATION of ACTIVITIES/MONITORING STATIONS (Provide Sketch on Attached Map):

WEATHER CONDITIONS:

Time of Day:	A.M.	P.M.
Ambient Air Temp.:		
Wind Direction:		
Wind Speed:		
Precipitation:		

DESCRIPTION OF SITE ACTIVITIES:

PARTICULATE MONITORING	Location	Time	Value	Duration	Corrective Measures Taken (Eng Controls/Work Stoppage, etc.)
Exceedence of 100 ug/m3 [1]					
Exceedence of 150 ug/m3 [1]					
Visual Observation of Fugitive Dust			NA		
			NA		
			NA		

VOC MONITORING	Location	Time	Value	Duration	Corrective Measures Taken (Eng Controls/Work Stoppage, etc.)
Exceedence of 5 ppm [1]					Temporarily halt Work and continue monitoring
Reading of 5 to 25 ppm [1]					Temporarily halt Work, abate emissions with corrective actions and continue monitoring [3]
Exceedence of 25 ppm [2]					Shut Down Work Immediately and notify Site Safety & Health Officer

1. Above background for 15 minute moving average.
2. Above background at Site perimeter (indicate location on attached sketch)
3. Work may resume when total VOC conc. 200 ft downwind or half the distance to nearest receptor (whicever is less) is below 5 ppm for 15 min.

NOTE: All exceedences are to be reported to Benchmark within 15 minutes.

Prepared By: Date:

Checked By: Date:

APPENDIX F

Health and Safety Plan

Health and Safety Plan

3701 River Road Site
Tonawanda, New York

April 2026

Prepared for:

3701 River Road, LLC
2101 St. Rita's Lane
Buffalo, NY 14221

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.
2558 Hamburg Turnpike, Suite 300
Buffalo, New York 14218

4727.0001B000

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B. Safety Data Sheets (SDSs) for Chemicals Used
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D. Personal Protective Equipment (PPE) Management Program
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F. Heavy Equipment Exclusion Zone Management Program

Site-Specific Emergency Information

Emergency Phone Numbers

Most emergency services can be obtained by calling 911. Where 911 service is not available, use the telephone numbers provided in the below table. The following is a master emergency phone list for use by the project management personnel. A more condensed version of the emergency numbers listed below will be posted throughout project work areas. Emergencies encountered on the site will be responded to by a combination of off-site emergency services and on-site personnel.

Emergency Contact Information			
Site Personnel			
Title	**Contact**		**Telephone**
Operations Manager (OM)	Thomas Forbes		716-856-0599
Project Principal (PP)	Michael Lesakowski		716-856-0599
Project Manager (PM)	Bryan Mayback		716-856-0599
Site Supervisor (SS)	TBD		TBD
Site Health and Site Safety Officer (SHSO)	TBD		TBD
Office Health and Safety Manager (OHSM)	Paul Werthman		716-997-9584
Corporate Health and Safety Director (CHSD)	Brian Hobbs, CIH, CSP		631-807-0193
WorkCare, Inc.	Occupational Health Care Management Provider		888-449-7787
Client Emergency Contact	Tim Boyle		716-362-5072
NYSDEC Project Manager	Jason Kryszak		716-851-7012
NYSDOH Project Manager	Ivana Zivkovic		518-485-7174
Outside Assistance			
Agency	**Contact**	**Telephone**	**Address/Location**
Ambulance/emergency medical services (EMS)	Kenmore Mercy Hospital	911/ 716-447-6100	2950 Elmwood Avenue Buffalo, NY 14217
Police	Town of Tonawanda Police Department	911/ 716-876-5300	1835 Sheridan Drive Buffalo, NY 14223
Fire	River Road Volunteer Fire Station	911/ 716-574-9140	39 Kaufman Avenue Tonawanda, NY 14150
Site Address	3701 River Road, Tonawanda, NY 14150		

Route to Kenmore Mercy Hospital Emergency Room:

- Turn left onto River Road (southeast)
- Turn left onto Sheridan Drive (northeast)
- Turn right onto Elmwood Avenue (south)
- Turn right into Emergency Room parking/drop-off area

1. Introduction

This Site-specific Health and Safety Plan (HASP) has been prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux) for use during the Remedial Investigation (RI) activities being performed by Roux at the 3701 River Road Site, located at 3701 River Road in the Town of Tonawanda, New York (Site; **Figure 1**). This HASP was prepared in general accordance with the requirements of the Occupational Safety and Health Administration (OSHA) standards promulgated at 29 CFR 1910.120 and 29 CFR 1926.65, both commonly referred to as the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard. In accordance with the HAZWOPER Standard, this Site-specific HASP was prepared to address the safety and health hazards associated with the RI activities being performed at the Site by Roux and to provide requirements and procedures for the protection of Roux employees, subcontractor personnel, government oversight personnel, Site personnel, and the general public. It also addresses client- and Site-specific requirements for health and safety. Additionally, subcontractors may be required to submit their own HASP as it relates to their specific work activities and will be kept onsite during such work.

Implementation of this HASP is the joint responsibility of the Project Manager (PM), the Site Health and Safety Officer (SHSO), and all field staff, with assistance from the Project Principal (PP), Office Health and Safety Manager (OHSM), and Corporate Health and Safety Director (CHSD). The PM for this project is Bryan Mayback. The Site Supervisor (SS) is TBD and Site Health and Safety Officer (SHSO) is TBD.

This HASP will be introduced to, reviewed, and signed off on by all Roux personnel through a formal training session prior to commencing work. A copy of the HASP will be kept at the Site at all times. The Roux SHSO or PM will be responsible for posting any changes, amendments, memos, etc. to the HASP. Any revisions to this HASP will be signed by appropriate personnel, which can include Roux's PP, CHSD, and SS. Any changes will be announced to all workers at the next safety meeting.

1.1 Roles and Responsibilities

Overall Roles and Responsibilities (R&Rs) of Roux personnel are provided in Roux's Policies and Procedures Manual. Only those R&Rs specific to HASP requirements are listed below.

Project Manager (PM)

The PM has responsibility and authority to direct all work operations. The PM coordinates safety and health functions with the Site Health and Safety Officer (SHSO), has the authority to oversee and monitor the performance of the SHSO, and bears ultimate responsibility for the proper implementation of this HASP. The specific duties of the PM are:

- Preparing and coordinating the Site work plan;
- Providing Site supervisor(s) with work assignments and overseeing their performance; Coordinating safety and health efforts with the SSHO;
- Ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC); and
- Serving as primary Site liaison with public agencies and officials and Site contractors.

Site Health and Safety Officer (SHSO)

The SHSO has the full responsibility and authority to develop and implement this HASP and to verify compliance. The SHSO reports to the Project Manager. The SHSO is on Site or readily accessible to the Site during all work operations and has the authority to halt Site work if unsafe conditions are detected. The specific responsibilities of the SHSO include:

- Managing the safety and health functions on this Site;
- Serving as the Site's point of contact for safety and health matters;
- Ensuring Site monitoring, worker training, and effective selection and use of PPE;
- Assessing Site conditions for unsafe acts and conditions and providing corrective action;
- Assisting the preparation and review of this HASP;
- Maintaining effective safety and health records as described in this HASP; and
- Coordinating with the SS and others as necessary for safety and health efforts.

Site Supervisor (SS)

The Site Supervisor (SS) is responsible for field operations and reports to the Project Manager (PM). The SS ensures the implementation of the HASP requirements and procedures in the field. The specific responsibilities of the Site Supervisor include:

- Executing the work plan and schedule as detailed by the PM;
- Coordination with the SHSO on safety and health; and
- Ensuring Site work compliance with the requirements of this HASP.

Employees

All Roux employees are responsible for reading and following all provisions of the Corporate Health and Safety Manual, including this HASP. Employees report to the SS at the project Site. Each employee is also responsible for the following:

- Wearing all appropriate PPE as outlined within this HASP;
- Attending all safety meetings;
- Inspecting tools and equipment prior to use, and taking any defective tools or equipment out of service;
- Appropriately documenting field events as they occur within a logbook or equivalent;
- Properly operating machinery and/or equipment only if trained to do so;
- Stopping work operations if unsafe conditions exist;
- Identifying and mitigating hazards when observed;
- Reporting all incidents and near misses to the Roux SHSO and SS immediately; and
- Knowing where emergency equipment is located (e.g., first aid kit, fire extinguisher).

Subcontractors and Visitors

Subcontractors and visitors are responsible for complying with the same health and safety requirements. It is the responsibility of all to make sure subcontractors and visitors comply and uphold the HASP. Subcontractors and visitors have the following additional responsibilities:

- Designating a qualified safety representative for the project that can make the necessary changes in work practices, as necessary;
- Attending all safety meetings while participating in Roux Site work activities;
- Reporting all incidents and near misses to Roux SHSO and SS immediately;
- Conducting initial and periodic equipment inspections in accordance with manufacturer and regulatory guidelines; and
- Providing copies of all Safety Data Sheets (SDS) to Roux SHSO for materials brought to the Site.

2. Background

Relevant background information is provided below, including a general description of the Site; a brief review of the Site's history with respect to hazardous material use, handling, and/or storage; and a review of known and potential releases of hazardous substances at the Site.

2.1 Site Description

The Site is located in a developed commercial and industrial area in the Town of Tonawanda, Erie County, New York. The 3.19-acre Site consists of one (1) parcel as summarized below:

Parcel Address	SBL No.	Acreage
3701 River Road	64.12-1-15.113	3.19

The Site is currently developed with one main commercial building that is used for storage. The eastern portion of the Site is currently used as a landscape supply company with a scale house and entrances to the Site from River Road (west) and a private driveway to the north.

2.2 Site History

Prior to purchase by the Applicant, the Site was previously used as a portion of a greater oil refinery with on-site operations including a fuel storage terminal with a fueling rack, petroleum tanks, and associated product piping. Historic aerial photographs indicate the presence of one bulk oil storage tank, east of the existing building that was historically used as a fueling rack from at least 1951 through at least 1985. Historic aerial photographs also depict railroad tracks running east-west across the southern portion of the Site.

The previous Phase II investigation at the Site identified petroleum-impacted soil and groundwater with grossly contaminated media (GCM) observed at sixteen (16) investigation locations across the Site.

2.3 Known and Potential Releases of Hazardous Substances at the Site

Based on petroleum-impacts including GCM, an orphan underground storage tank (UST), and product piping observed in the field, the NYSDEC was notified during the work and Spill No. 2404522 was opened on August 14, 2024 and remains active to-date and will be administratively closed upon entry of the Site into the BCP.

3. Scope of Work

This RI will be completed to further investigate the extents of the contamination at the Site. The scope of work to be conducted at the Site by Roux employees and Roux-applicable subcontractors includes the following:

- Clearing and grubbing.
- Excavation test pits.
- Soil boring advancement using a direct push or hollow stem auger (HSA).
- Collection of soil samples for characterization and analytical analysis.
- Installation of monitoring wells.
- Development and sampling of newly installed groundwater monitoring wells.
- Collection of subslab soil vapor sample, exterior soil vapor samples, indoor ambient air samples, and outdoor ambient air samples.
- Waste characterization sampling.
- Management (including characterization and disposal, if needed) of investigation-derived waste
- Ground penetrating radar (GPR) investigation.

If there are any changes with the scope a revision of the HASP will be required to address any new hazards.

4. Site Control

This Site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of the Site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the Site, and to deter vandalism and theft.

4.1 Site Map

A map of this Site, showing Site boundaries, designated work zones, and points of entry and exit is provided in **Figure 2**.

4.2 Site Access

Access to the work areas at the Site is restricted to reduce the potential for exposure to its safety and health hazards. During hours of Site operation, Site entry and exit is authorized only at the points identified in **Figure 2**. Entry and exit at these points will be controlled by the following: cones and caution tape. When the Site is not operating, access to the Site will be controlled by the following: cones, caution tape, and the Site owner.

4.3 Buddy System

This section is not applicable for all components of the SOW described in Section 3. Some Site inspections, and RI activities are completed by a single Roux employee. However, when completing these tasks, the single Roux employee is accompanied either by Roux subcontractors or the Site caretaker/other representatives from3701 River Road, LLC. Any time Roux is on-site, 3701 River Road, LLC is made aware and communications with 3701 River Road, LLC and the Roux PM is maintained via cellular phone.

While working in the Exclusion Zone, Site workers use the buddy system. The buddy system means that personnel work in pairs and stay in close visual contact to be able to observe one another and summon rapid assistance in case of an emergency. The responsibilities of workers using the buddy system include:

- Remaining in close visual contact with partner;
- Providing partner with assistance as needed or requested;
- Observing partner for signs of heat stress, chemical overexposure or other difficulties;
- Periodically checking the integrity of partner's PPE; and
- Notifying the SS or other Site personnel if emergency assistance is needed.

4.4 Site Communications

The following communication equipment is used to support on-site communication: cell phones and visual hand signals.

As applicable, hand signals will be used according to the following:

Hand Signals

SIGNAL	MEANING
Hand gripping throat	Out of air; I cannot breathe
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I am all right; okay
Thumbs down	No; negative

A current list of emergency contact numbers is included in the Site-Specific Emergency Information at the beginning of this HASP.

4.5 Site Work Zones

The SOW does not require the implementation of work zones; however, should the need arise, this section provides details for the proper execution of work zones at this Site.

Work areas at the Site will be divided into three (3) major zones, described below. These zones are characterized by the likely presence or absence of biological, chemical, or physical hazards and the activities performed within them. Zone boundaries are clearly marked at all times and the flow of personnel among the zones is controlled. The Site is monitored for changing conditions that may warrant adjustment of zone boundaries. Zone boundaries are adjusted as necessary to protect personnel and clean areas. Whenever boundaries are adjusted, zone markings are also changed and workers are immediately notified of the change.

Exclusion Zone

The area where contamination exists is the Exclusion Zone (EZ). All areas where excavation and handling of contaminated materials take place are considered part of the EZ. This zone will be clearly delineated by chain link fencing, caution tape, cones, or other effective barriers, as necessary. Safety tape may be used as a secondary delineation within the EZ. The zone delineation markings may be opened in areas for varying lengths of time to accommodate equipment operation or specific construction activities. The SHSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy (co-worker);
- Required minimum level PPE;
- Medical authorization;
- Training certification; and
- Requirement to be in the zone.

Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) is established between the exclusion zone and the support zone. The CRZ contains the Contamination Reduction Corridor (CRC) and provides an area for decontamination

of personnel and equipment. The CRZ will be used for general Site entry and egress in addition to access for heavy equipment and emergency support services. Personnel are not allowed in the CRZ without:

- A buddy (co-worker);
- Appropriate PPE;
- Medical authorization;
- Training certification; and
- Requirement to be in the zone.

Support Zone

The Support Zone (SZ) is an uncontaminated area that will be the field support area for the Site operations. The SZ will contain the vehicles and provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

5. Job Hazard Evaluation

Roux's work at the Site is expected to entail a variety of physical, chemical, and biological hazards, all of which must be sufficiently managed to allow the work to be performed safely. Some of the hazards are Site-specific (i.e., they are associated with the nature, physical characteristics, and/or routine operation of the Site itself), while others are activity-specific (i.e., they are associated with [or arise from] the particular activity being performed). The various hazards can be grouped into the following categories:

- **Caught/Crushed** – the potential to become caught in, under, between, or by an object or parts of an object, such as equipment with parts that open and close or move up and down ("pinch points") or equipment that rotates, and the accompanying potential to have body parts cut, mangled, or crushed thereby.
- **Contact** – the potential to be struck by or against moving or stationary objects that can cause physical injury, such as heavy machinery, overhead piping, moving vehicles, falling objects, and equipment (including tools and hand-held equipment) or infrastructure with the ability to cut or impale.
- **Energy Sources** – the potential for bodily harm associated with energy sources, most notably electricity, but also including latent energy sources such as compressed air and equipment under tension (which when released could cause injurious contact or a fall).
- **Ergonomics** – the potential for musculoskeletal injury associated with lifting/carrying, pushing/pulling, bending, reaching, and other physical activity attributable to poor body position/mechanics, repetitive motion, and/or vibration.
- **Exposure** – the potential for injury/illness due to physical, chemical, or biological exposures in the work environment, including, but not limited to, temperature extremes, solar radiation, and noise (physical), chemical splashes and hazardous atmospheres (chemical), and animal/insect bites and poisonous plants (biological).
- **Falls** – the potential to slip or trip and thus fall or drop a load, resulting in bodily injury to oneself or others.

The foregoing is intended to provide Roux employees with a general awareness of the hazards involved with Site work. A more detailed review of the potential hazards associated with each specific activity planned for the Site (or on-going activity, as the case may be) is provided in the activity-specific Job Safety Analysis (JSA) forms in **Attachment A**. As can be seen in the JSA forms, the hazards are identified by category per the above, and specific measures designed to mitigate/manage those hazards are also identified. In preparing the JSA forms, all categories of hazards were considered, and all anticipated potential hazards were identified to the extent possible based on the experience of the personnel preparing and reviewing the JSA forms. However, there is always the possibility for an unanticipated hazard to arise, potentially as condition change over the course of the workday. Roux personnel must maintain a continual awareness of potential hazards in the work zone, regardless of whether the hazard is identified in the JSA form. Particular attention should be paid to hazards associated with exposure to hazardous substances (see **Table 1** for a listing of the hazardous substances most likely to be encountered in environmental media at the Site) and to Site personnel being located "in the line of fire" with respect to moving equipment, pinch points, and latent energy (e.g., being located or having body parts located within the swing radius of an excavator, between two sections of pipe being connected, below a piece of suspended equipment, or adjacent to a compressed air line).

5.1 Hazard Communication and Overall Site Information Program

The information in the JSAs and SDSs is made available to all employees and subcontractors who could be affected by it prior to the time they begin their work activities.

Modifications to JSAs are communicated during routine pre-work briefings, and periodically updated as needed in the HASP. SDSs will be maintained by the SHSO/SS for new chemicals brought on-site as needed. Copies of SDSs can be found in **Attachment B**.

5.2 Noise

Noise is associated with the operation of heavy equipment, power tools, pumps, and generators. Noise is also a potential hazard when working near operating equipment such as excavators, drill rigs or pole drivers. High noise (i.e., < 85 dBA) operations may be evaluated by the SHSO utilizing a type 2 handheld sound level meter (SLM) operating on the "A"-weighted scale with slow response because this scale most closely resembles human response to noise and complies with OSHA 29 CFR 1910.95. Hearing protection is required in areas with noise exposure greater than 85 dBA. Double hearing protection (ear plugs and earmuffs) should be donned in areas where the noise exposure is more than 95 dBA. Noise exposure will be controlled by hearing protection as described above or by maintaining set-backs from high-noise equipment, as warranted. Personnel handling heavy equipment and using power tools that produce noise levels exceeding those described levels above are required by OSHA 29 CFR 1910.95 to wear the appropriate Noise Reduction Rating (NRR) level of hearing protection. Appropriate hearing protection will be evaluated by the SHSO as necessary in consultation with the OHSM and CHSD.

5.3 Slip, Trip, and Fall Hazards

Slip, trip, and fall hazards may include, but are not limited to, general slip and trip hazards associated with uneven ground, possible debris, wet grass, and equipment. Prior to work, walking paths will be assessed for solid footings, any ground penetrations that may cause a tripping hazard will be appropriately marked, and other areas will be noted and discussed with the field team.

Personnel shall be aware of their surroundings and footings at all time, and all accommodations should be made for proper housekeeping and organized equipment placement at the Site, where possible, to help prevent any slip, trip, and fall-related incidents. All tools and materials should be appropriately stored when not in use and placed in appropriate storage containers.

5.4 Biological Hazards

Biological hazards that may potentially be present at a Site, include poisonous plants, insects (ticks, spiders, bees), animals (snakes, dogs), etc. Information on biological hazards can be found within Roux's Biological Hazard Awareness Management Program located within Roux's Corporate Health and Safety Manual. There is also potential for transmission and/or exposure to SARS-CoV-2, the virus that causes COVID-19. Prior to beginning work, on-Site protocols shall be established by the project team, including subcontractors, in accordance with federal, state, county, city, and/or other guidance, as applicable.

6. Emergency Response Plan

This emergency response plan details actions to be taken in the event of Site emergencies. The PM and SHSO is responsible for the implementation of emergency response procedures onsite. The SHSO/PM provides specific direction for emergency action based upon information available regarding the incident and response capabilities and initiates emergency procedures and notification of appropriate authorities. In the event of an emergency, Site personnel are evacuated and do not participate in emergency response activities, response is facilitated through external emergency services.

6.1 Emergency Response

The SHSO, after investigating the incident and relevant information, shall determine the level of response required for containment, rescue and medical care. Limited on-site emergency response activities could occur therefore the SHSO is responsible for notifying external emergency response agencies. The SHSO provides relevant information to the responding organizations, including, but not limited to, the hazards associated with the emergency incident, potential containment problems, and missing Site personnel.

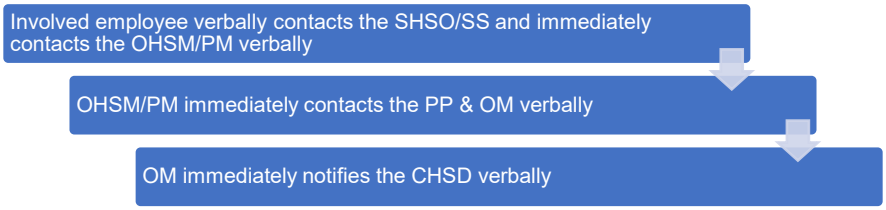
6.2 Emergency Alerting and Evacuation

If evacuation notice is given, Site workers leave the worksite, if possible, by way of the nearest exit. Appropriate primary and alternate evacuation routes and assembly areas have been identified and are shown on the Site Plan with Emergency Muster Area (**Figure 2**). The routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by SHSO/PM.

Personnel exiting the Site gather at a designated assembly point. To determine that everyone has successfully exited the Site, personnel will be accounted for at the assembly point. If any worker cannot be accounted for, notification is given to the SHSO, PM, and any arriving response authorities so that appropriate action can be initiated. Subcontractors on this Site have coordinated their emergency response plans to ensure that these plans are compatible and potential emergencies are recognized, alarm systems are clearly understood, and evacuation routes are accessible to all personnel relying upon them.

6.3 Emergency Medical Treatment and First Aid

In the event of a work-related injury or illness, employees are required to follow the procedures outlined below. All work-place injury and illness situations require Roux's Project and Corporate Management Team to be notified when an injury/illness incident occurs, and communication with the contracted Occupational Health Care Management Provider, WorkCare, Inc., is initiated, as necessary. The Injury/Illness Notification Flowchart is provided below and within Roux's Incident Investigation and Reporting program included within Roux's Corporate Health and Safety Manual.



If on-Site personnel require any medical treatment, the following steps will be taken:

a. Notify Roux's Project and Corporate Management Team for any work-related injury and/or illness occurrence, and communicate with the contracted Occupational Health Care Management Provider, WorkCare, immediately following the notifications provided above.

b. Based on discussions with the Project Team, Corporate Management and the WorkCare evaluation, if medical attention beyond onsite first aid is warranted, transport the injured / ill person (IP) to the Urgent Care Center, or notify the Fire Department or Ambulance Emergency service and request an ambulance or transport the victim to the hospital, and continue communications with Corporate Management Team. An Urgent Care/Hospital Route map with location to Kenmore Mercy Hospital is included as **Figure 3**.

c. Decontaminate to the extent possible prior to administration of first aid or movement to medical or emergency facilities.

d. First aid medical support will be provided by onsite personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).

e. The SHSO and PM will perform a Loss Investigation (LI) and the Project Team will complete the final Loss Report. If a Roux employee is involved in a vehicular incident, the employee must also complete the Acord Automobile Loss Notice.

7. Environmental Conditions and Response

7.1 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO or project principal will determine if work can continue without jeopardizing the health and safety of field workers. Some of the items related to adverse weather conditions to be considered prior to determining if work should continue include:

- Potential for heat stress and heat-related injuries;
- Potential for cold stress and cold-related injuries;
- Treacherous weather-related conditions. If wind speed is greater than 15 mph averaged over a 15-minute period or wind gusts over 25 mph, earthmoving operations will be ceased
- Limited visibility; and
- Electrical storm potential.

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions may include heavy rain, fog, high winds, and lightning. The SHSO and/or PM shall observe daily weather reports and evacuate, if necessary, in case of inclement weather conditions.

7.2 Electrical Storm Guidelines

In the event that lightning and/or thunder are observed while working onsite, all onsite activities shall stop and personnel shall seek proper shelter (e.g., substantial building, enclosed vehicle, etc.). Work shall not resume until the threat of lighting has subsided and no lightning or thunder has been observed for 30 minutes. If the possibility of lightning is forecast for the day, advise the onsite personnel on the risks and proper procedure at the pre-work safety briefing. Continuously monitor for changing weather conditions and allow enough time to properly stop work if lightning is forecast.

7.3 Environmental Stressors, Heat Stress, Heat Exhaustion, and Heat Stroke

It is the employer's responsibility to monitor weather forecasts and ambient air temperatures, both prior to the work shift and during the shift. The National Oceanic and Atmospheric Administration records average minimum/maximum temperatures of 18 to 81 degrees Fahrenheit during the year in the Town of Tonawanda, New York.

To prevent potential heat illness, the following strategies will be implemented:

- Adjusting personnel work/rest intervals;
- Monitoring for symptoms of heat illness;
- Providing shaded rest areas;
- Providing cool potable water so that each employee has access to at least one quart per hour for the entire shift, free of charge;
- Allowing for employees to acclimatize to the weather conditions and work demands;
- Observe workers during a heat wave (i.e., when the temperature is at least 80oF, and 10 degrees hotter than the average temperature of the five preceding days); and

- Implementing high heat procedures when the temperature reaches 95oF.

Roux's Heat Illness Prevention Plan is implemented when the when ambient temperatures exceed 80oF. Roux's Heat Illness Prevention Program can be found within **Attachment C**. Additional information regarding heat illnesses is provided below. This can include, but is not limited to, access to shade that is sufficient in size to fit all workers who are on break; a car with air conditioning is acceptable, too. Preventative cool-down breaks shall be allowed at any time, and anyone taking such a break will be monitored for heat illness symptoms and not required to return to work until all symptoms (if present) of heat illness have disappeared. If necessary, first aid will be offered, but if symptoms are severe, emergency response procedures will be implemented per Section 6.3. Anyone who has shown symptoms of severe heat illness will not be sent home without being offered first aid or medical treatment.

High heat procedures must be implemented when temperatures reach 95oF. These procedures include:

- Ensuring that effective communication by voice, observation, or electronic means is maintained so that employees at the work site can contact a supervisor when necessary. An electronic device, such as a cell phone or text messaging device, may be used for this purpose only if the reception in the area is reliable.
- Observing employees for alertness and signs or symptoms of heat illness. The employer shall ensure effective employee observation/monitoring by implementing one or more of the following:
    - Supervisor or designee observation of 20 or fewer employees;
    - Mandatory buddy system; and
    - Regular communication with sole employee such as by radio or cellular phone, or other effective means of observation.
- Designating one or more employees on each worksite as authorized to call for emergency medical services and allowing other employees to call for emergency services when no designated employee is available.
- Encouraging employees throughout the work shift to drink plenty of water.
- A review of the high heat procedures during the daily tailgate meeting and remind employees of their right to take a cool-down rest when necessary.

7.3.1 Heat Stress

Heat stress is the body's response to excessive heat and can be a significant potential hazard. The risk of heat stress can be increased with heavy physical activity and/or the use of personal protective equipment in hot, humid weather environments. There are also personal risk factors that can contribute to the risk of suffering from heat stress, such as obesity, water intake, alcohol and caffeine consumption, pregnancy, age, medication, etc. Heat illness includes heat cramps, heat exhaustion, heat syncope, and heat stroke.

7.3.2 Heat Cramps

Heat cramps may be brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps, typically in the legs.

First aid treatment includes, but is not limited to, shade, rest, and fluid replacement. Typically, the individual should recover within one-half hour while being monitored constantly. If the individual has not improved substantially within 30 minutes and the body temperature has not decreased, the individual should be transported to a hospital for medical attention.

Per Roux's Heat Illness Prevention Plan, employees shall have access to potable drinking water that is fresh, pure, suitably cool, free of charge and in sufficient quantities. Access to shade shall be present when temperatures exceed 80 degrees Fahrenheit and shall be available when temperatures do not exceed 80 degrees Fahrenheit.

7.3.3 Heat Exhaustion

Heat exhaustion may occur in an individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin to rid the body of excess heat through transference. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;
- Cold and clammy skin with heavy perspiration;
- Skin appears pale;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment includes, but is not limited to, cooling the victim, elevating the feet, and replacing fluids.

If the individual is not substantially improved within 30 minutes and the body temperature has not decreased, the individual should be transported to the hospital for medical attention.

7.3.4 Heat Stroke

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a MEDICAL EMERGENCY requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- Dry, hot, red skin;
- Body temperature approaching or above 105oF;
- Confusion, altered mental state, slurred speech;
- Seizures;
- Large (dilated) pupils; and
- Loss of consciousness – the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility. Heat stress is a significant hazard if any type of protective equipment (semi-permeable or impermeable) that prevents evaporative cooling when worn in hot weather environments.

7.4 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 60°F. A work/rest regimen will be initiated when ambient temperatures and protective

clothing cause a stressful situation. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. The signs and symptoms of cold stress include the following:

- Severe shivering;
- Abnormal behavior;
- Slowing;
- Weakness;
- Stumbling or repeated falling;
- Inability to walk;
- Collapse; and/or
- Unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks and encourage activity such as walking, wrapped in a blanket.

8. Safety Procedures

This section of the HASP presents the specific safety procedures to be implemented during Roux's activities at the Site in order to protect the health and safety of various on-site personnel. Minimum OSHA-mandated procedures are presented first, followed by client- and Site-specific procedures. Lastly, activity-specific procedures are discussed. These Site and activity-specific procedures supplement the general safety procedures included in Roux's Corporate Health and Safety Manual, which also must be followed in their entirely.

8.1 Training

At a minimum, Site personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety-trained prior to performing work onsite per OSHA 29 CFR 1910.120(e) and 29 CFR 1926.65(e). More specifically, all Roux, subcontractor, and other personnel engaged in sampling and remedial activities at the Site and who are exposed or potentially exposed to hazardous substances, health hazards, or safety hazards must have received at a minimum the 40 hour initial HAZWOPER training consistent with the requirements of 29CFR 1910.120(e)(3)(i) training and a minimum of 3 days' actual field experience under the direct supervision of a trained experienced supervisor, plus 8 hours of refresher training on an annual basis. Depending on tasks performed, less training may be permitted. Evidence of such training must be maintained at the Site at all times. Furthermore, all on-Site management and supervisory personnel directly responsible for or who supervise the employees engaged in Site remedial operations, must have received an additional 8 hours of specialized training at the time of job assignment on topics including, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques, plus 8 hours of refresher training on an annual basis. Additionally, all workers who will be required to don a respirator will be properly trained on their employer's Respiratory Protection Program, which also includes being medically cleared to wear a respirator and passed a fit test, at least initially prior to use, and then annually thereafter in accordance with 29 CFR 1910.134, Respiratory Protection.

Roux personnel training records are maintained in a corporate database with records available upon request from either the OHSM/SHSO/CHSD or Human Resources Department.

8.2 Site-Specific Safety Briefings for Visitors

A site-specific briefing is provided to all site visitors who enter this site beyond the site entry point. For visitors, the site-specific briefing provides information about site hazards, the site lay-out including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

8.3 HASP Information and Site-Specific Briefings for Workers

Site personnel review this HASP and are provided a Site-specific tailgate briefing prior to the commencement of work to ensure employees are familiar with this HASP and the information and requirements it contains, as well as the relevant JSAs included in **Attachment A**. Additional briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during on-going Site characterization and analysis of changing conditions. Conditions for which we

schedule additional briefings include, but are not limited to: changes in site conditions, changes in the work schedule/plan, newly discovered hazards, and incidents occurring during Site work.

8.4 Medical Surveillance

The medical surveillance section of the Health and Safety Plan describes how worker health status is monitored at this site. Medical surveillance is used when there is the potential for worker exposure to hazardous substance at levels above OSHA Permissible Exposure Limits (PEL) or other published limits. The purpose of a medical surveillance program is to medically monitor worker health to ensure that personnel are not adversely affected by site hazards. The provisions for medical surveillance at this site are based on the site characterization and job hazard analysis found in Section 4 of this HASP and are consistent with OSHA requirements in 29 CFR 1910.120(f) as applicable.

8.4.1 Site Medical Surveillance Program

Medical surveillance requirements are based on a worker's potential for exposure as determined by the site characterization and job hazard analysis documented in Section 4 and JSAs within **Attachment A** of this HASP and in compliance with the requirements of 29 CFR 1910.120(f)(2). Based on site information and use of direct reading instruments, limited use of respirators (less than 30 days per year), and the absence of an employee-staffed HAZMAT team, a limited medical surveillance program is required and implemented at this site. The medical surveillance program provides that:

1. Workers assigned to tasks requiring the use of respirators receive medical examinations in accordance with 29 CFR 1910.134(e) to ensure they are physically capable to perform the work and use the equipment, and
2. If a worker is injured, becomes ill, or develops signs or symptoms of possible over-exposure to hazardous substance or health hazards, medical examinations are provided to that worker as soon as possible after the occurrence and as required by the attending physician.
3. These medical examinations and procedures are performed by or under the supervision of a licensed physician and are provided to workers free of cost, without loss of pay, and at a reasonable time and place. In addition, the need to implement a more comprehensive medical surveillance program will be re-evaluated after any apparent over-exposure.

8.4.2 Medical Recordkeeping Procedures

Medical recordkeeping procedures are consistent with the requirements of 29 CFR 1910.1020 and are described in the company's overall safety and health program. A copy of that program is available at our Islandia, New York office.

The following items are maintained in worker medical records:

- Respirator fit test and selection;
- Physician's medical opinion of fitness for duty (pre-placement, periodic, termination);
- Physician's medical opinion of fitness for respirator protection (pre-placement, periodic); and
- Exposure monitoring results.

8.4.3 Program Review

The medical program is reviewed to ensure its effectiveness. The Corporate Health and Safety Manager, in coordination with the Human Resources Director, is responsible for this review. At minimum, this review consists of:

- Review of accident and injury records and medical records to determine whether the causes of accidents and illness were promptly investigated and whether corrective measures were taken wherever possible;
- Evaluation of the appropriateness of required medical tests based on site exposures; and
- Review of emergency treatment procedures and emergency contacts list to ensure they were site specific, effective, and current.

8.5 Personnel Protection

Site safety and health hazards are eliminated or reduced to the greatest extent possible through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices and PPE are used to protect employees. Appropriate personal protective equipment (PPE) shall be worn by Site personnel when there is a potential exposure to chemical, biological or physical hazards (e.g., falling objects, flying particles, sharp edges, electricity, and noise), as determined by the SHSO. The level of personal protection, type and kind of equipment selected will depend on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors will be made before work can be safely executed.

Roux maintains a comprehensive written PPE program that addresses proper PPE selection, use, maintenance, storage, fit and inspection. Roux's PPE program can be found within **Attachment D**. PPE to be used at the Site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General/Construction Industry) standards for minimum PPE requirements.

The minimum level of PPE for entry onto the Site is Level D. The following equipment shall be worn:

- Work uniform (long pants, sleeved shirt);
- Hard hat;
- Steel or composite toe work boots (must comply with American Society for Testing and Materials [ASTM]) F 2412-05, Standard Test Methods for Foot Protection and ASTM F 2413-05, Standard Specification for Performance Requirements for Foot Protection);
- Safety Glasses (must comply with one of the following ANSI/ISEA Z87.1-2010, ANSI Z87.1-2003, ANSI Z87.1-2003);
- Boot Covers (as needed);
- Hearing protection (as needed);
- High visibility clothing (shirt/vest); and
- Hand protection (e.g., minimum cut resistance meeting ANSI 105-2000 Level 2).

Note that jewelry shall be removed or appropriately secured to prevent it from becoming caught in rotating equipment or unexpectedly snagged on a fixed object (e.g., wrist watches, bracelets, rings, chains and necklaces, open earrings). Do not wear loose clothing and all shoulder-length hair should be tied back.

Site specific PPE ensembles and materials are identified within task specific JSAs located within **Attachment A**, and any upgrades or downgrades of the level of protection (i.e., not specified in the JSA) must be approved by the PP and immediately communicated to all Roux personnel and subcontractors as applicable. PPE is used in accordance with manufacturer's recommendations.

8.5.2 Hearing Conservation

Hearing protection is made available when noise exposures equal or exceed an 8-hour time-weighted average sound level of 85 dBA. Hearing protection is required when the 8-hour time weighted average sound level > 85 dBA, or when noise levels exceed 140 dBA at any point or exceeds 115 dBA for at least 15 minutes. Where noise exposure meets or exceeds this level, noise is listed as a physical hazard in the JSA for the tasks/operation, and hearing protection is included as one of the control measures (PPE).

8.6 Monitoring

An air monitoring program is important to the safety of on- and off-Site personnel, and the surrounding area. A preliminary survey, to establish background conditions in the immediate sampling area, may be made prior to the initiation of Site work including, but not limited to, monitoring wind direction (e.g., wind socks) and approximate temperature during all invasive Site activities. This survey will be conducted with the appropriate pre-calibrated air monitoring instrument(s), as warranted by the field activity. Once this survey has been complete, any changes in the type of PPE will be determined and relayed to those working on Site.

Work zone air monitoring will be performed to verify that the proper level of PPE is used, and to determine if increased protection or work stoppage is required. The following equipment shall be used to monitor conditions:

- A Photoionization Detector (PID) with a lamp energy of 10.6 eV will be used to provide direct readings of organic vapor concentrations during intrusive activities to determine that personnel protection is adequate. Concentrations shall be recorded during intrusive activities with the potential to encounter contaminant vapors.

Personal exposure monitoring utilizing activated charcoal tubes may be considered based on whether or not the area sample results are at or above half of the PEL. The decision to perform the monitoring will be made by, and under the control of, the CHSD.

Below are monitoring action levels for Site-specific chemicals of concern. In the event PID readings above the thresholds identified below are sustained for 5 minutes in the breathing zone, worker protection will require upgrading following notification to the OHSM and applicable parties.

8.6.1 Action Levels for Air Monitoring

PPE can remain at Level D if breathing zone VOC concentrations are less than 5 ppm and benzene is non detect. Personnel are required to evacuate the Site when breathing zone VOC readings exceed 25 ppm.

The following tables include summaries of the air monitoring, work practices, and action levels for the expected contaminants. The action levels to initiate testing with colorimetric tubes for airborne volatiles is 1 ppm (PID reading) and is based on the Permissible Exposure Limit (PEL) for benzene (1 ppm). The colorimetric tubes are used to confirm the presence or absence of specific constituents, and they do not provide a measured concentration.

PPE can remain at Level D if breathing zone VOC concentrations are less than 5 ppm. Personnel are required to evacuate the Site when breathing zone VOC readings exceed 25 ppm.

The following tables include summaries of the air monitoring, work practices, and action levels for the expected contaminants.

Air Monitoring Summary and Action Levels Organic Vapors	
PID Reading in Breathing Zone (ppm)	**Action**
<5 ppm	Continue Monitoring, ventilate space
≥ 5 ppm - ≤ 25 ppm	Ventilate space until PID reads < 5 ppm. If < 5 ppm cannot be achieved, upgrade to Level C[1].
≥ 25 ppm	Ventilate space and evacuate area. Consult with CHSD.

Background concentrations should be established at the beginning of each work day. It may be necessary to re-establish background concentrations and ambient conditions vary through the day.

1 Measured air concentrations of known organic vapors will be reduced by the respirator to one half of the PEL or lower, and the individual and combined compound concentrations shall be within the service limit of the respirator cartridge.

Air Monitoring Summary and Action Levels Oxygen	
O_2 Reading in Breathing Zone (%)[1]	**Action**
20.9% O_2	Oxygen level normal
< 19.5% O_2	Oxygen deficient Interrupt task/Evacuate area
>23.5% O_2	Oxygen enriched Interrupt task/Evacuate area

1. Action levels based on USEPA Standard Operating Safety Guides; Table 5-1

Air Monitoring Summary and Action Levels Carbon Monoxide	
CO Reading in Breathing Zone (ppm)[1]	**Action**
<12.5 ppm	Inspect exhaust system for leaks or other sources of CO. Monitor initially and every 15 minutes during use of CO-generating equipment.
12.5-25 ppm	Ventilate area. Monitor continuously and record measurements. Contact PM.
>25 ppm	Cease Field Operations. Ventilate area.

1. Based upon the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) of 25 ppm as an 8-hour time weighted average (TWA) and OSHA's Permissible Exposure Limit (PEL) of 50 ppm as an 8-hour TWA concentration.

Air Monitoring Summary and Action Levels Combustible Gases

Lower Explosive Limit (LEL) Reading	Action
< 4% LEL	Site activities will continue with normal monitoring
4% – 20% LEL	Stop work until levels dissipate to <4% LEL
> 20% LEL	Potential explosion hazard. Halt all site activities, research source of release, aerate work area, suppress source.
Air Monitoring Summary and Action Levels Hydrogen Sulfide	
Hydrogen Sulfide (H_2S) Reading	**Action**
<10 ppm	Site activities will continue with normal monitoring
≥10 ppm	Stop work until levels dissipate to <10 ppm; use mechanical ventilation if possible. Consult with CHSD if unable to reduce concentrations below 10 ppm.

8.6.2 Air Monitoring Equipment and Calibration

A PID calibrated to an appropriate calibration mixture will be used to detect organic vapors in and around the work areas. Monitoring will be conducted in and around all work areas and at the workers breathing zone before activities commence to establish a background level, then at 15-minute intervals throughout the day. All equipment will be calibrated according to the manufacturer's recommendation. A calibration log will be maintained and will include the name of the person who performed the calibration, the date and time calibrated, and the instrument reading at the time of calibration. A manual bellows pump or equivalent with colorimetric tubes for specific compounds will be utilized to determine the course of action related to upgrading or downgrading the level of respiratory protection, as applicable.

If air monitoring data indicate safe levels of potentially harmful constituents at consistent intervals (5-minute intervals), then monitoring can be conducted less frequently (every 30 minutes). This determination will be made by the onsite SHSO. Monitoring data, including background readings and calibration records, will be documented. Work to be performed on-Site will conform to Roux's Standard Operating Procedures (SOPs). Conformance with these guidelines as well as the guidelines described in this HASP will aid in mitigating the physical and chemical hazards mentioned throughout this HASP.

8.7 Tailgate Safety Meetings

A designated Site worker will provide daily safety briefings (e.g., tailgate meetings) including, but not limited to, the following scenarios:

- When new operations are to be conducted;
- Whenever changes in work practices must be implemented; and
- When new conditions are identified and/or information becomes available.

Daily safety briefings shall be recorded on the Roux Daily Tailgate Health and Safety Meeting Log/Daily Site Safety Checklist, and all completed forms will become a part of the project file.

8.8 Spill Containment

Spill containment equipment and procedures should, at a minimum, meet the requirements of the facility's Spill Prevention, Control and Countermeasure Plan, if applicable. Otherwise, spill containment equipment and procedures must be considered depending on the task, including, but not limited to, chemical/product transfer points and handling.

8.8.1 Initial Spill Notification and Response

Any worker who discovers a hazardous substance spill will immediately notify the SHSO. The worker will, to his/her best ability, report the hazardous substance involved, the location of the spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, and any associated injuries without compromising their own safety.

8.8.2 Spill Evaluation and Response

The SHSO is responsible for evaluating spills and determining the appropriate response. When this evaluation is being made, the spill area will be isolated and demarcated to the extent possible. If necessary to protect nearby community members, notification of the appropriate authorities is made by the PM as appropriate. On-Site response is limited to small spills (e.g., <10 gallons); large spills require external emergency responders who will be contacted by the SHSO.

8.9 Decontamination

The decontamination section of the HASP describes how personnel and equipment are decontaminated when they leave the Exclusion Zone. This section also describes how residual waste from decontamination processes is disposed. The site decontamination procedures are designed to achieve an orderly, controlled removal or neutralization of contaminants that may accumulate on personnel or equipment. These procedures minimize worker contact with contaminants and protect against the transfer of contaminants to clean areas of the site and off-site. They also extend the useful life of PPE by reducing the amount of time that contaminants contact and can permeate PPE surfaces. Decontamination is facilitated within the CRZ at this site, if applicable.

8.9.1 Decontamination Procedures for Personnel and PPE

The following are general decontamination procedures established and implemented at this site.

1. Decontamination is required for all workers exiting a contaminated area. Personnel may re-enter the SZ only after undergoing the decontamination procedures described below in the next section.
2. Protective clothing is decontaminated, cleaned, laundered, maintained and/or replaced as needed to ensure its effectiveness.
3. PPE used at this site that requires maintenance or parts replacement is decontaminated prior to repairs, or
4. PPE used at this site is decontaminated or prepared for disposal on the premises. Personnel who handle contaminated equipment have been trained in the proper means to do so to avoid hazardous exposure.
5. This site uses an off-site laundry for decontamination of PPE. The site has informed that facility of the hazards associated with contaminated PPE from this site.
6. The site requires and trains workers that if their permeable clothing is splashed or becomes wetted with a hazardous substance, they will immediately exit the work zone, perform applicable decontamination procedures, shower, and change into uncontaminated clothing.

7. Procedures for disposal of decontamination waste meet applicable local, State, and Federal regulations.

8.9.2 Decontamination Procedures for Equipment

All tools, equipment, and machinery from the EZ or CRZ are decontaminated in the CRZ prior to removal to the SZ. Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure and to avoid cross-contamination and chemical incompatibilities.

General Equipment Decontamination Procedures:

1. Decontamination is required for all equipment exiting a contaminated area. Equipment may re-enter the SZ only after undergoing the equipment decontamination procedures.
2. Vehicles that travel regularly between the contaminated and clean areas of the site are carefully decontaminated each time they exit the EZ and the effectiveness of that decontamination is monitored to reduce the likelihood that contamination will be spread to other parts of the site.
3. Particular attention is given to decontaminating tires, scoops, and other parts of heavy equipment that are directly exposed to contaminants and contaminated soil.
4. Procedures for disposal of decontamination waste shall meet applicable local, State, and Federal regulations.

The following items may be used to decontaminate equipment:

- Fresh water rinse;
- Non-phosphorus detergent wash;
- Acetone rinse;
- Distilled water rinse; and
- A steam cleaner or pressure washer (heavy equipment only).

8.9.3 Monitoring the Effectiveness of Decontamination Procedures

Visual examination and sampling are used to evaluate the effectiveness of decontamination procedures. Visual examination is used to ensure that procedures are implemented as described and that they appear to control the spread of contaminants under changing site conditions. Visual examination is also used to inspect for signs of residual contamination or for contaminant permeation of PPE.

Personnel who work in contaminated areas of the site, either the Contamination Reduction Zone (CRZ) or the Exclusion Zone, are trained in the principles and practices of decontamination described in this section of the HASP and in related SOPs. If site procedures are changed as a result of inspection and monitoring, all affected employees are notified of these changes.

8.10 Confined Space Entry

Confined space entry will not be performed at the Site. However, should the need arise based on unanticipated work activities the CHSD shall me consulted and the following procedures will be implemented.

The following is a list of the safety requirements for confined space entry at the Site:

- **ROUX PERSONNEL ARE NOT AUTHORIZED TO ENTER AN OSHA PERMIT REQUIRED CONFINED SPACE;**
- Currently the scope of work **DOES NOT** require personnel to enter permitted confined space for this project; and
- Any changes to the field activities that may necessitate confined space entry will be reported to the Project Principal and OHSM.

Confined space is defined as any space, depression, or enclosure that:

- Has limited opening for entry and egress;
- Is large enough for and employee to enter and perform assigned work; and
- Is not intended for continuous occupancy.

A permit required confined space is one that meets the definition of a confined space and has one or more of the following characteristics:

- May contain or produce life-threatening atmospheres due to oxygen deficiency the presence of toxic, flammable, or corrosive contaminants;
- Contains a material that has the potential for engulfment;
- Has an internal configuration that may cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; and
- Contains any other serious safety or health hazards.

Although Roux personnel will not perform confined space entry, it is expected that subcontractors performing cleaning and mitigation and/or remedial measures activities may be required to enter structures that are considered to be a permit required confined space. Permitting of the confined space as well as hazard mitigation for entry will be completed by the subcontractor in accordance with 29 CFR 1910.146 or 1926.1201-1213 and/or applicable local/client requirements.

8.11 Client and Site-Specific

In addition to the OSHA-specific procedures discussed above, there may be client and site-specific safety procedures that must be adhered to during the performance of remedial activities at the Site.

8.12 Unusual or Significant Risks

Field activities that appear to have unusual or significant risks that cannot be adequately managed with existing risk tools such as LPS, HASPs, traffic safety plans, work permits, design and O&M practices, equipment HAZOPS or other safety tools must be referred to the CHSD to help with the assessment and management of the associated potential safety risks. Examples include the use of explosives for demolition, use of firearms to control wildlife, rappelling, demolition over water, diving, etc.

8.13 Activity-Specific Hazards

In addition to the general hazards discussed above, there are activity-specific hazards associated with each work activity planned for the Site. An activity-specific JSA has been completed for each of the activities planned for the Site. JSAs are provided in **Attachment A**. In the event that new work activities or tasks are planned, JSAs will be developed and implemented prior to performing the new activities. In the absence

of a JSA, the personnel performing work must prepare a field JSA and receive clearance from a designated competent safety official prior to performing any task with significant risk. In emergency situations where time is critical SPSAs will be utilized to identify the task, associated hazards and mitigative actions to take. For lower risk activities (as deemed by the discretion of a Competent Person) where a JSA is determined to not be needed, the individual(s) conducting the activities must perform SPSAs prior to and during the work.

8.13.1 Electrical and Other Utility Assessment and Accommodations

Roux shall perform a site walk to identify any potential overhead electrical or utility lines. All applicable guidelines will be followed in the vicinity of overhead power and utility lines (see Section 8.13.3 below).

Roux will review all available Site maps showing buried utility lines to identify potential hazards. In addition, a GPR investigation will be completed and any underground utilities identified by the investigation will be recorded and marked on Site.

8.13.2 Subsurface Work

Subsurface work activities will require adherence to Roux's Corporate Subsurface Utility Clearance Management program found within **Attachment E**.

8.13.2.1 Excavations and Trenching

Trenching and excavation work activities carried out by Roux and their subcontractors shall comply with applicable OSHA standards (i.e., 29 CFR 1926.650-652). Regional Notification Centers (i.e., Underground Services Alert) shall be notified at least two working days prior to the start of any digging or excavation work per state requirements (i.e., 811-One Call). Personnel responsible for excavation activities will be trained in their job responsibilities. Additionally, for trenches 4 feet or deeper, where employees will enter, the trench needs to have a stairway, ladder or other safe means of egress, and located so that employees do not have to travel farther than 25 feet horizontally. Where employees will enter trenches greater than 5 feet deep, the trench must have some type of protective system or sloped sidewalls appropriately to prevent cave-ins.

The SHSO or other responsible Roux personnel will be present on-Site during all Roux contracted excavation and backfill operations and will supplement health and safety monitoring conducted by Subcontractor air quality screening to ensure that appropriate levels of protection and safety procedures are utilized. The proximity of chemical, water, sewer, and electrical lines will be identified by Roux and/or their subcontractor before any subsurface activity or sampling is attempted. Prior to any excavation activities, trees, shrubbery, and other objects that can potentially pose as a hazard during excavation should be supported or removed from the excavation area. The following safe work practices will be implemented during this task.

- The proximity of chemical, water, sewer, and electrical lines will be identified by a facility representative prior to beginning any subsurface activity;
- At the start of every day, a competent person will inspect excavations to evaluate if the area is stable and safe to enter. Inspections will be conducted as needed throughout the excavation operations. If deemed necessary, a competent person may also conduct inspections after rainfall or any other event that can potentially affect the integrity of the excavation. Employees will not enter excavations where water has accumulated until protective measures have been implemented.

- Prior to entering excavations greater than 4 feet in depth, air monitoring for oxygen and hazardous atmospheres must be conducted to assure atmospheric conditions are within normal levels described in Section 8.6. Continuous air monitoring with a standard multi-gas detector (O2, LEL%, CO, H2S) shall be used during the course of work within an excavation; if action limits are reached workers shall safely exit the excavation. Upgrades to worker protection should be evaluated with the SHSO and PP in consultation with the CHSD. Emergency rescue equipment, such as breathing apparatuses and safety harnesses connected to an extraction device, will be readily available in the event of hazardous atmospheric conditions;
- While earthmoving, stay out of the excavator's delineated heavy equipment exclusion zone and away from the excavation sides where there is potential for cave in (within excavations that are 6 feet or more in depth, a delineated perimeter 6 feet away from the excavated edge is required);
- During loading and unloading operations, stand away from haul trucks and other vehicles to avoid contact with any falling loads; and
- Traffic cones, caution tape, or other barriers will be set up around the perimeter of the excavation when employees are working along the excavation edge and for any excavation that will be left open overnight or unattended for more than two days.

Maximum Allowable Slopes

Soil or Rock Type	Maximum Allowable Slopes (H:V)[1] for Excavations Less Than 20 Feet Deep[3]
Stable Rock	Vertical (90°)
Type A[2]	3/4 : 1 (53°)
Type B	1 : 1 (45°)
Type C	1 1/2 : 1 (34°)

29 CFR 1926 Subpart P Appendix B Sloping and Benching Table B-1

Notes:

[1] Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

[2] A short-term maximum allowable slope of 1/2H : 1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 meters) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 meters) in depth shall be 3/4H : 1V (53°).

[3] Sloping or benching for excavations greater than 20 feet deep shall be designed and stamped by a registered professional engineer.

Proper stockpiling (i.e., 2 feet minimum distance from the excavation edge), containment, transport, storage, and disposal practices will be utilized and is dependent upon the potential type and amount of waste generated during operations. The location of safety equipment and evacuation procedures will be established prior to initiation of operations according to this HASP.

8.13.3 Heavy Equipment

Use of heavy equipment at the Site will require adherence to Roux's Corporate Heavy Equipment Exclusion Zone Management Program found within **Attachment F**. Additionally, operation of the drill rig/other heavy equipment will maintain clearances from overhead power lines in accordance with 29 CFR 1926.1408 Table A Minimum Clearance Distances provided below.

Minimum Required Clearances for Energized Overhead Power Lines

Nominal System Voltage of Power Line (K V)	Minimum Required Clearance (feet)
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1000	45

1 kilovolt (KV) = 1,000 volts

8.14 Traffic Control

If Site operations encroach upon public streets or highways and a hazard exists to Site personnel because of traffic conditions, a traffic control plan will be implemented in accordance with the United States Department of Transportation's (DOT's) "Manual on Uniform Traffic Control Devices."

8.15 Sanitation

Sanitation facilities will be provided in accordance with the sanitation standards (29 CFR 1910.141, 29 CFR 1926.51 and 29 CFR 1928.110). Sanitation facilities will be maintained and kept in good conditions at all times.

9. Field Team Review

Each person performing work at or visiting this site shall sign this section after site-specific training is completed and before being permitted to access the CRZ or Exclusion Zone.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Site/Project: 3701 River Road Site

Name & Company	Signature	Date

10. Approvals

By their signature, the undersigned certify that this HASP is approved and will be utilized at the 3701 River Road Site.

TBD – Site Health and Safety Officer	Date
Paul Werthman Jr. – Office Health and Safety Manager	Date
Bryan Mayback – Project Manager	Date
Michael Lesakoski – Project Principal	Date

TABLE

1. Toxicological Properties of Hazardous Substances Present at the Site

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
ORGANOCHLORINE PESTICIDES (OCP)									
DDT	50-29-3	TWA 1 mg/m3	TWA 0.5 mg/m3	TWA 1 mg/m3	500 mg/m3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eyes, skin, central nervous system, kidneys, liver, peripheral nervous system	White, odorless and tasteless, very stable, water-insoluble, synthetic BP: 260°F Fl.Pt. = 162-171°F LEL: NA UEL: NA
Aldrin	309-00-2	TWA 0.1 mg/m3	TWA 0.25 mg/m3	TWA 0.25 mg/m3	25 mg/m3	Inhalation, ingestion, skin and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort); myoclonic jerks of limbs; clonic, tonic convulsions; coma; hematuria (blood in the urine), azotemia; [potential occupational carcinogen]	Developmemntal, Endocrine, Liver, Immune System, Nervous System,	Colorless to dark-brown crystalline solid with a mild chemical odor. BP: 293°F Fl.Pt. = 150°F LEL: NA UEL: NA
Lindane (gamma-BHC)	58-89-9	TWA 0.5 mg/m3	TWA 0.5 mg/m3	TWA 0.5 mg/m3	50 mg/m3	Inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; headache; nausea; clonic convulsions; resp difficulty; cyanosis; aplastic anemia; muscle spasm; In Animals: liver, kidney damage	Eyes, skin, respiratory system, central nervous system, blood, liver, kidneys	White to yellow, crystalline powder with a slight, musty odor. BP: 614°F Fl.Pt. = 150°F LEL: NA UEL: NA
Dieldrin	860-57-1□	TWA 0.1 mg/m3	TWA 0.25 mg/m3	TWA 0.25 mg/m3	25 mg/m3	Inhalation, ingestion, skin and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma; ; In Animals: liver, kidney damage [potential occupational carcinogen]	Developmemntal, Endocrine, Liver, Immune System, Nervous System,	Colorless to light-tan crystals with a mild, chemical odor. BP: NA (Decomposes) Fl.Pt. = NA LEL: NA UEL: NA
VOLATILE ORGANIC COMPOUNDS (VOCs)									
1,1,1-Trichloroethane	71-55-6	TWA 350 ppm STEL 450 ppm	C 350 ppm (1900 mg/m^3) [15-minute]	TWA 350 ppm (1900 mg/m^3)	700 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eyes, skin, central nervous system, cardiovascular system, liver	Colorless liquid with a mild, chloroform-like odor. BP: 165°F Fl.Pt. = NA LEL: 7.5% UEL: 12.5% Combustible Liquid, but burns with difficulty
1,1,2,2-Tetrachloroethane	79-34-5	TWA 1 ppm [skin]	Ca TWA 1 ppm (7 mg/m^3) [skin]	TWA 5 ppm (35 mg/m^3) [skin]	Ca [100 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Nausea, vomiting, abdominal pain; tremor fingers; jaundice, hepatitis, liver tenderness; dermatitis; leukocytosis (increased blood leukocytes); kidney damage; [potential occupational carcinogen]	Skin, liver, kidneys, central nervous system, gastrointestinal tract	Colorless to pale-yellow liquid with a pungent, chloroform-like odor BP: 296°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	TWA 1000 ppm STEL 1250 ppm	TWA 1000 ppm (7600 mg/m3) ST 1250 ppm (9500 mg/m3)	TWA 1000 ppm (7600 mg/m3)	2000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation skin, throat, drowsiness, dermatitis; central nervous system depression; In Animals: cardiac arrhythmias, narcosis	Skin, heart, central nervous system, cardiovascular system	Colorless to water-white liquid with an odor like carbon tetrachloride at high concentrations. [Note: A gas above 118°F.] BP: 118°F Fl.Pt. = NA LEL: NA UEL: NA
1,1,2-Trichloroethane	79-00-5	TWA 10 ppm [skin]	Ca TWA 10 ppm (45 mg/m3) [skin]	TWA 10 ppm (45 mg/m3) [skin]	Ca [100 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; central nervous system depression; liver, kidney damage; dermatitis; [potential occupational carcinogen]	Eyes, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a sweet, chloroform-like odor BP: 237°F Fl.Pt. = NA LEL: 6% UEL: 15.5% Combustible Liquid, forms dense soot
1,1-Dichloroethane	75-34-3	TWA 100 ppm	TWA 100 ppm (400 mg/m^3)	TWA 100 ppm (400 mg/m^3)	3,000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation skin; central nervous system depression; liver, kidney, lung damage	Skin, liver, kidneys, lungs, central nervous system	Colorless, oily liquid with a chloroform-like odor. BP: 135°F Fl.Pt. = 2°F LEL: 5.4% UEL: 11.4% Class IB Flammable Liquid Fl.P. below 73°F and BP at or above 100°F.
1,1-Dichloroethene	75-35-4	TWA 5 ppm	Ca	None	Ca	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor BP: 89°F Fl.Pt. = -2°F LEL: 6.5% UEL: 15.5% Class IA Flammable Liquid: Fl.P. below 73°F and BP below 100°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,2,3-Trichlorobenzene	87-61-6	Cameo Chemicals Source https://cameochemicals.noaa.gov/chemical/10051	NA	NA	NA	Inhalation, skin absorption, ingestion, skin and/or eye contact	Inhalation may cause irritation of respiratory tract. Irritating to the eyes. May redden skin on contact. Ingestion may cause liver damage.	Skin, eyes, respiratory tract, liver	A white solid with a sharp chlorobenzene odor. Insoluble in water and denser than water. Hence sinks in water Fl.Pt. = 234.9°F
1,2,4-Trichlorobenzene	120-82-1	C 5 ppm	C 5 ppm (40 mg/m3)	None	N.D.	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, mucous membrane; In Animals: liver, kidney damage; possible teratogenic effects	Eyes, skin, respiratory system, liver, reproductive system	Colorless liquid or crystalline solid (below 63°F) with an aromatic odor BP: 416°F Fl.Pt. = 222°F LEL (302°F): 2.5% UEL (302°F): 6.6% Class IIIB Combustible Liquid: Fl.P. at or above 200°F. Combustible Solid
1,2-Dibromo-3-chloropropane	96-12-8	NA	Ca	TWA 0.001 ppm	Ca	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; drowsiness; nausea, vomiting; pulmonary edema; liver, kidney injury; sterility; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system, liver, kidneys, spleen, reproductive system, digestive system	Dense yellow or amber liquid with a pungent odor at high concentrations. [pesticide] [Note: A solid below 43°F.] BP: 384°F Fl.Pt. = (oc) 170°F LEL: NA UEL: NA Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.
1,2-Dibromoethane	106-93-4	None listed Skin	Ca TWA 0.045 ppm C 0.13 ppm [15-minute]	TWA 20 ppm C 30 ppm 50 ppm [5-minute maximum peak]	Ca [100 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; dermatitis with vesiculation; liver, heart, spleen, kidney damage; reproductive effects; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, reproductive system	Colorless liquid or solid (below 50°F) with a sweet odor. [fumigant] BP: 268°F Fl.Pt. = 50°F LEL: NA UEL: NA Noncombustible Liquid
1,2-Dichlorobenzene	95-50-1	TWA 25 ppm STEL 50 ppm	C 50 ppm (300 mg/m3)	C 50 ppm (300 mg/m3)	200 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; liver, kidney damage; skin blisters	Eyes, skin, respiratory system, liver, kidneys	Colorless to pale-yellow liquid with a pleasant, aromatic odor. [herbicide] BP: 357°F Fl.Pt. = 1°F LEL: 2.2% UEL: 9.2% Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.
1,2-Dichloroethane	107-06-2	TWA 10 ppm	Ca TWA 1 ppm (4 mg/m3) ST 2 ppm (8 mg/m3)	TWA 50 ppm C 100 ppm 200 ppm [5-minute maximum peak in any 3 hours]	Ca [50 ppm]	Inhalation, ingestion, skin absorption, skin and/or eye contact	Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	Eyes, skin, kidneys, liver, central nervous system, cardiovascular system	Colorless liquid with a pleasant, chloroform-like odor. [Note: Decomposes slowly, becomes acidic & darkens in color.] BP: 182°F Fl.Pt. = 56°F LEL: 6.2% UEL: 16% Class IB Flammable Liquid Fl.P. below 73°F and BP at or above 100°F.
1,2-Dichloropropane	78-87-5	TWA 10 ppm Dermal Sensitizer (DSEN)	Ca	TWA 75 ppm (350 mg/m3)	Ca [400 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; drowsiness, dizziness; liver, kidney damage; In Animals: central nervous system depression; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless liquid with a chloroform-like odor. [pesticide] BP: 206°F Fl.Pt. = 60°F LEL: 3.4% UEL: 14.5% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
1,3-Dichlorobenzene	541-73-1	https://cameochemicals.noaa.gov/chemical/8514				Inhalation, skin absorption, ingestion, skin and/or eye contact	INHALATION: Causes headache, drousiness, unsteadiness. Irritating to mucous membranes. EYES: Severe irritation. SKIN: Severe irritation. INGESTION: Irritation of gastric mucosa, nausea, vomiting, diarrhea, abdominal cramps and cyanosis.		Colorless liquid. Sinks in water. BP: 343°F Fl.Pt. = 146°F LEL: 2.02% UEL: 9.2%
1,4-Dichlorobenzene	106-46-7	TWA 10 ppm	Ca	TWA 75 ppm (450 mg/m3)	Ca [150 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; In Animals: liver, kidney injury; [potential occupational carcinogen]	Liver, respiratory system, eyes, kidneys, skin	Colorless or white crystalline solid with a mothball-like odor. [insecticide] BP: 345°F Fl.Pt. = 150°F LEL: 2.5% UEL: NA Combustible Solid, but may take some effort to ignite.
1,4-Dioxane	123-91-1	TWA 20 ppm [skin]	Ca C 1 ppm (3.6 mg/m3) [30-minute]	TWA 100 ppm (360 mg/m3) [skin]	Ca [500 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; drowsiness, headache; nausea, vomiting; liver damage; kidney failure; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys	Colorless liquid or solid (below 53°F) with a mild, ether-like odor. BP: 214°F Fl.Pt. = 55°F LEL: 2.0% UEL: 22% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F
2-Butanone	78-93-3	TWA 200 ppm STEL 300 ppm	TWA 200 ppm (590 mg/m3) ST 300 ppm (885 mg/m3)	TWA 200 ppm (590 mg/m3)	3000 ppm	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor BP: 175°F Fl.Pt. = 16°F LEL (200°F): 1.4% UEL (200°F): 11.4% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
2-Hexanone	591-78-6	TWA 5 ppm STEL 10 ppm [skin]	TWA 1 ppm (4 mg/m3)	TWA 100 ppm (410 mg/m3)	1600 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness	Eyes, skin, respiratory system, central nervous system, peripheral nervous system	Colorless liquid with an acetone-like odor BP: 262°F Fl.Pt. = 77°F LEL: NA UEL: 8.0% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F
4-Methyl-2-pentanone	108-10-1	TWA 20 ppm STEL 75 ppm	TWA 50 ppm (205 mg/m3) ST 75 ppm (300 mg/m3)	TWA 100 ppm (410 mg/m3)	500 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; In Animals: liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a pleasant odor BP: 242°F Fl.Pt. = 64°F LEL (200°F): 1.2% UEL (200°F): 8.0% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F
Acetone	67-64-1	TWA 250 ppm STEL 500 ppm	TWA 250 ppm (590 mg/m^3)	TWA 1000 ppm (2400 mg/m^3)	2500 ppm [10% LEL]	Inhalation, ingestion, skin and/or eye contact	irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a fragrant, mint-like odor BP: 133°F Fl.Pt. = 0°F LEL: 12.8% UEL: 2.5% Class IB Flammable liquid: Fl.P. below 73°F and BP at or above 100°F.
Benzene	71-43-2	TWA 0.5 ppm STEL 2.5 ppm	Ca TWA 0.1 ppm ST 1 ppm	TWA 1 ppm ST 5 ppm	Ca [500 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	Colorless to light yellow liquid with an aromatic odor [Note: Solid below 42 °F] BP: 176°F Fl.Pt. = 12°F LEL: 1.2% UEL: 7.8% Class IB Flammable liquid. Fl.P. below 73°F and BP at or above 100°F.
Bromochloromethane	74-97-5	TWA 200 ppm	TWA 200 ppm (1050 mg/m3)	TWA 200 ppm (1050 mg/m3)	2000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, throat; confusion, dizziness, central nervous system depression; pulmonary edema	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless to pale-yellow liquid with a chloroform-like odor. [Note: May be used as a fire extinguishing agent.] BP: 155°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid
Bromodichloromethane	75-27-4	https://cameochemicals.noaa.gov/chemical/16064				Inhalation, ingestion, skin and/or eye contact	Symptoms of exposure to this compound may include irritation of the skin, eyes, mucous membranes and respiratory tract. It may also cause narcosis. Other symptoms may include nausea, dizziness and headache.	Liver and kidney damage. Central nervous system effects may also occur.	Clear colorless liquid BP: 189°F Fl.Pt. = NA LEL: NA UEL: NA
Bromoform	75-25-2	TWA 0.5 ppm	TWA 0.5 ppm (5 mg/m3) [skin]	TWA 0.5 ppm (5 mg/m3) [skin]	850 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; central nervous system depression; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless to yellow liquid with a chloroform-like odor. [Note: A solid below 47°F.] BP: 301°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid
Bromomethane	74-83-9	TWA 1 ppm [skin]	Ca	C 20 ppm (80 mg/m3) [skin]	Ca [250 ppm]	Inhalation, skin absorption (liquid), skin and/or eye contact (liquid)	Irritation eyes, skin, respiratory system; muscle weak, incoordination, visual disturbance, dizziness; nausea, vomiting, headache; malaise (vague feeling of discomfort); hand tremor; convulsions; dyspnea (breathing difficulty); skin vesiculation; liquid: frostbite; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system	Colorless gas with a chloroform-like odor at high concentrations. [Note: A liquid below 38°F. Shipped as a liquefied compressed gas.] BP: 38°F Fl.Pt. = NA (Gas) LEL: 10% UEL: 16.0% Flammable Gas, but only in presence of a high energy ignition source.
Carbon disulfide	75-15-0	TWA 1 ppm [skin]	TWA 1 ppm (3 mg/m3) ST 10 ppm (30 mg/m3) [skin]	TWA 20 ppm C 30 ppm 100 ppm (30-minute maximum peak)	500 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Dizziness, headache, poor sleep, lassitude (weakness, exhaustion), anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects	Central nervous system, peripheral nervous system, cardiovascular system, eyes, kidneys, liver, skin, reproductive system	Colorless to faint-yellow liquid with a sweet ether-like odor. [Note: Reagent grades are foul smelling.] BP: 116°F Fl.Pt. = -22°F LEL: 1.3% UEL: 50.0% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
Carbon tetrachloride	56-23-5	TWA 5 ppm STEL 10 ppm [skin]	Ca ST 2 ppm (12.6 mg/m3) [60-minute]	TWA 10 ppm C 25 ppm 200 ppm (5-minute maximum peak in any 4 hours)	Ca [200 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]	Central nervous system, eyes, lungs, liver, kidneys, skin	Colorless liquid with a characteristic ether-like odor BP: 170°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid
Chlorobenzene	108-90-7	TWA 10 ppm	NA	TWA 75 ppm (350 mg/m3)	1000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; drowsiness, incoordination; central nervous system depression; In Animals: liver, lung, kidney injury	Eyes, skin, respiratory system, central nervous system, liver	Colorless liquid with an almond-like odor BP: 270°F Fl.Pt. = 82°F LEL: 1.3% UEL: 9.6% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Chloroethane	75-00-3	TWA 100 ppm [skin]	Handle with caution in the workplace	TWA 1000 ppm (2600 mg/m3)	3800 ppm [10%LEL]	Inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact	Incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage	Liver, kidneys, respiratory system, cardiovascular system, central nervous system	Colorless gas or liquid (below 54°F) with a pungent, ether-like odor. [Note: Shipped as a liquefied compressed gas.] BP: 54°F Fl.Pt. = NA (gas), -58°F (liquid) LEL: 3.8% UEL: 15.4% Flammable Gas
Chloroform	67-66-3	TWA 10 ppm	Ca ST 2 ppm (9.78 mg/m3) [60-minute]	C 50 ppm (240 mg/m3)	Ca [500 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	Liver, kidneys, heart, eyes, skin, central nervous system	Colorless liquid with a pleasant odor BP: 143°F Fl.Pt. = -82°F LEL: NA UEL: NA Noncombustible Liquid
Chloromethane	74-87-3	TWA 50 ppm STEL 100 ppm	Ca	TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 3 hours)	Ca [2000 ppm]	Inhalation, skin and/or eye contact (liquid)	Dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]	Central nervous system, liver, kidneys, reproductive system	Colorless gas with a faint, sweet odor which is not noticeable at dangerous concentrations. [Note: Shipped as a liquefied compressed gas.] BP: -12°F Fl.Pt. = NA (Gas) LEL: 8.1% UEL: 17.4% Flammable Gas
cis-1,2-Dichloroethene	156-59-2	TWA 200 ppm (All isomers)	TWA 200 ppm (790 mg/m3)	TWA 200 ppm (790 mg/m3)	1000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor. BP: 118-140°F Fl.Pt. = 36-39°F LEL: 5.6% UEL: 12.8% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F
cis-1,3-Dichloropropene	10061-01-5	https://cameochemicals.noaa.gov/chemical/20168				Inhalation, ingestion, skin and/or eye contact	Symptoms of exposure to this compound may include local irritation of the eyes skin and respiratory tract; dermatitis, gasping, coughing, substernal pain, extreme respiratory distress, lacrimation, central nervous system depression, skin irritation, acute gastrointestinal distress with pulmonary congestion and edema. It also may cause injury to the liver, kidneys and heart.	Skin, eyes, mucous membranes, liver, kidney, heart	Colorless to amber liquid with a sweetish odor. BP: 219.7°F Fl.Pt. = NA LEL: NA UEL: NA
Cyclohexane	110-82-7	TWA 100 ppm	TWA 300 ppm (1050 mg/m3)	TWA 300 ppm (1050 mg/m3)	1300 ppm [10%LEL]	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a sweet, chloroform-like odor. [Note: A solid below 44°F.] BP: 177°F Fl.Pt. = 0°F LEL: 1.3% UEL: 8.0% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
Dibromochloromethane	124-48-1	https://cameochemicals.noaa.gov/chemical/16183				Inhalation, ingestion, skin and/or eye contact	Symptoms of exposure to this compound may include irritation of the skin, eyes, mucous membranes and upper respiratory tract. It may also cause fatigue. Other symptoms may include central nervous system effects, lung and cornea irritation and liver and kidney damage. Prolonged exposure can cause nausea, dizziness, headache and narcosis.	Skin, eyes, mucous membranes, upper respiratory tract	Clear colorless to yellow-orange liquid BP: 246-248°F Fl.Pt. = Greater than 200°F LEL: NA UEL: NA
Dichlorodifluoromethane	75-71-8	TWA 1000 ppm	TWA 1000 ppm (4950 mg/m3)	TWA 1000 ppm (4950 mg/m3)	15,000 ppm	Inhalation, skin and/or eye contact (liquid)	Dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite	Cardiovascular system, peripheral nervous system	Colorless gas with an ether-like odor at extremely high concentrations. [Note: Shipped as a liquefied compressed gas.] BP: -22°F Fl.Pt. = NA LEL: NA UEL: NA Nonflammable Gas
Ethyl benzene	100-41-4	TWA 20 ppm	TWA 100 ppm (435 mg/m^3) ST 125 ppm (545 mg/m^3)	TWA 100 ppm (435 mg/m^3)	800 ppm [10%LEL]	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with an aromatic odor. BP: 277°F Fl.Pt. = 55°F LEL: 0.8% UEL: 6.7% Class IB Flammable Liquid below 73°F and BP at or above 100°F
Isopropyl benzene	98-82-8	TWA 5 ppm	TWA 50 ppm (245 mg/m3) [skin]	TWA 50 ppm (245 mg/m3) [skin]	900 ppm [10%LEL]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a sharp, penetrating, aromatic odor BP: 306°F Fl.Pt. = 96°F LEL: 0.9% UEL: 6.5% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F
Methyl Acetate	79-20-9	TWA 200 ppm STEL 250 ppm	TWA 200 ppm (610 mg/m3) ST 250 ppm (760 mg/m3)	TWA 200 ppm (610 mg/m3)	3100 ppm [10%LEL]	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; headache, drowsiness; optic nerve atrophy; chest tightness; In Animals: narcosis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a fragrant, fruity odor BP: 135°F Fl.Pt. = 14°F LEL: 3.1% UEL: 16% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Methylcyclohexane	108-87-2	TWA 400 ppm	TWA 400 ppm (1600 mg/m3)	TWA 500 ppm (2000 mg/m3)	1200 ppm [LEL]	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, drowsiness; In Animals: narcosis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a faint, benzene-like odor BP: 214°F Fl.Pt. = 25°F LEL: 1.2% UEL: 6.7% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
Methylene chloride	75-09-2	TWA 50 ppm [skin] STEL 100 ppm	Ca	[1910.1052] TWA 25 ppm ST 125 ppm	Ca [2300 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eyes, skin, cardiovascular system, central nervous system	Colorless liquid with a chloroform-like odor. [Note: A gas above 104°F.] BP: 104°F Fl.Pt. = NA LEL: 13% UEL: 23% Combustible Liquid
Methyl-t-butyl ether	1634-04-4	TWA 50 ppm	NA	NA	NA	Inhalation, skin absorption, ingestion, skin and/or eye contact	May cause dizziness or suffocation. Contact may irritate or burn eyes or skin. May be harmful if swallowed.	Eyes, skin	A colorless liquid with a distinctive anesthetic-like odor. BP: 131°F Fl.Pt. = -14°F LEL: NA UEL: NA
o-Xylene	95-47-6	TWA 20 ppm (All isomers)	TWA 100 ppm (435 mg/m3) ST 150 ppm (655 mg/m3)	TWA 100 ppm (435 mg/m3)	900 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	Colorless liquid with an aromatic odor BP: 292°F Fl.Pt. = 90°F LEL: 0.9% UEL: 6.7% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F
Styrene	100-42-5	TWA 10 ppm STEL 20 ppm OTO (ototoxicant)	TWA 50 ppm (215 mg/m3) ST 100 ppm (425 mg/m3)	TWA 100 ppm C 200 ppm 600 ppm (5-minute maximum peak in any 3 hours)	700 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eyes, skin, respiratory system, central nervous system, liver, reproductive system	Colorless to yellow, oily liquid with a sweet, floral odor BP: 293°F Fl.Pt. = 88°F LEL: 0.9% UEL: 6.8% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F
Tetrachloroethene	127-18-4	TWA 25 ppm STEL 100 ppm	Ca Minimize workplace exposure concentrations	TWA 100 ppm C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm	Ca [150 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless liquid with a mild, chloroform-like odor BP: 250°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene
Sodium Hydroxide	1310-73-2	Ceiling 2 mg/m^3	C 2 mg/m^3	TWA 2 mg/m^3	10 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; pneumonitis; eye, skin burns; temporary loss of hair	Eyes, skin, respiratory system	Colorless to white, odorless solid (flakes, beads, granular form). BP: 2534°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid, but when in contact with water may generate sufficient heat to ignite combustible materials
Sulfuric Acid	7664-93-9	TWA 0.2 mg/m^3 (as thoracic particulate mass)	TWA 1 mg/m^3	TWA 1 mg/m^3	15 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; eye, skin burns; dermatitis	Eyes, skin, respiratory system, teeth	Colorless to dark-brown, oily, odorless liquid.[Note: Pure compound is a solid below 51°F. Often used in an aqueous solution.] BP = 554°F Fl.Pt. = NA LEL = NA UEL = NA Noncombustible Liquid, but capable of igniting finely divided combustible materials.
trans-1,2-Dichloroethene	156-60-5	200 ppm (All isomers)	TWA 200 ppm (790 mg/m3)	TWA 200 ppm (790 mg/m3)	1000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor. BP: 118-140°F Fl.P: 36-39°F LEL: 5.6% UEL: 12.8% Class IB Flammable Liquid Fl.P. below 73°F and BP at or above 100°F.
trans-1,3-Dichloropropene	10061-02-6	https://cameochemicals.noaa.gov/chemical/18110				Inhalation, ingestion, skin and/or eye contact	Symptoms of exposure to this compound may include local irritation of the eyes skin and respiratory tract, dermatitis, gasping, coughing, substernal pain, extreme respiratory distress, lacrimation, central nervous system depression, acute gastrointestinal distress with pulmonary congestion and edema. It may also cause injury to the liver, kidneys and heart	Skin, eyes, mucous membranes, liver, kidney, heart	A clear colorless liquid with chloroform odor BP: 234°F Fl.P: NA LEL: NA UEL: NA
Toluene	108-88-3	TWA 20 ppm (ototoxicant)	TWA 100 ppm (375 mg/m^3) ST 150 ppm (560 mg/m^3)	TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)	500 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a sweet, pungent, benzene-like odor. BP: 232°F Fl.P: 40°F LEL: 1.1% UEL: 7.1% Class IB Flammable Liquid Fl.P. below 73°F and BP at or above 100°F.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Trichloroethene (TCE)	79-01-6	TWA 10 ppm STEL 25 ppm	Ca	TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)	Ca [1000 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Colorless liquid (unless dyed blue) with a chloroform-like odor. BP: 189°F Fl.Pt. = NA LEL(77°F): 8.0% UEL(77°F): 10.5% Combustible Liquid, but burns with difficulty
Trichlorofluoromethane	75-69-4	STEL C 1000 ppm	C 1000 ppm (5600 mg/m3)	TWA 1000 ppm (5600 mg/m3)	2000 ppm	Inhalation, ingestion, skin and/or eye contact	Incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Skin, respiratory system, cardiovascular system	Colorless to water-white, nearly odorless liquid or gas (above 75°F) BP: 75°F Fl.P: NA LEL: NA UEL: NA Noncombustible Liquid Nonflammable Gas
Vinyl Chloride (chloroethylene)	75-01-4	TWA 1 ppm	Ca	TWA 1 ppm C 5 ppm [15-minute]	Ca (ND)	Inhalation, skin and/or eye contact (liquid)	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Liver, central nervous system, blood, respiratory system, lymphatic system	Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations.[Note: Shipped as a liquefied compressed gas.] BP: 7°F Fl.Pt. = NA (Gas) LEL: 3.6% UEL: 33.0% Flammable Gas
Xylene (m, o & p isomers)	108-38-3, 95-47-6, 106-42-3	TWA 20 ppm	NA	NA	NA	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	Colorless liquid with an aromatic odor BP: 282°F, 292°F, 281°F Fl. Pt. 82°F, 90°F, 81°F LEL: 1.1%, 0.9%, 1.1% UEL: 7.0%, 6.7%, 7.0% Class IC Flammable Liquid at or above 73°F and below 100°F
Zinc Oxide (dust)	7440-66-6	TWA 2 mg/m3 (repsirable) STEL 10 mg/m^3 (respirable)	TWA 5 mg/m^3 C 15 mg/m^3	TWA 15 mg/m^3 (total dust) TWA 5 mg/m^3 (resp dust) TWA 5 mg/m^3 (fume)	500 mg/m^3	Inhalation	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Respiratory system	White, odorless solid. BP: NA Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid
SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)									
2-Chloronaphthalene	91-58-7	https://cameochemicals.noaa.gov/chemical/16185				Inhalation, ingestion, skin and/or eye contact	Chloracne, cysts, headache, fatigue, vertigo, anorexia and jaundice		Monoclinic plates or off-white crystalline powder BP: NA Fl.Pt. = NA LEL: NA UEL: NA
2-Methylnaphthalene	91-57-6	TWA 0.5 ppm TLV-SL 3 mg/100 cm2 [skin]	https://cameochemicals.noaa.gov/chemical/20668			Inhalation, ingestion, skin and/or eye contact	Headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and comatose	Skin, eyes, mucous membranes and upper respiratory tract	White crystalline solid Combustible solid BP: 466-468 ° F Fl.Pt. = 208 ° F LEL: NA UEL: NA
Acenaphthene	83-32-9	https://cameochemicals.noaa.gov/chemical/10358				Inhalation, ingestion, skin and/or eye contact	Irritation of the skin, eyes, mucous membranes and upper respiratory tract, vomiting	Skin, eyes, mucous membranes and upper respiratory tract	White needles BP: 534 ° F Fl.Pt. = NA LEL: 0.6% UEL: NA
Acenaphthylene	208-96-8	https://cameochemicals.noaa.gov/chemical/16157				Inhalation, ingestion, skin and/or eye contact			Colorless crystalline solid BP: 509 to 527 ° F at 760 mm Hg Fl.Pt. = NA LEL: NA UEL: NA
Anthracene (as coal tar pitch volatiles)	120-12-7	TWA 0.2 mg/m3 (as Benzene solubles)	Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m3 (benzene-soluble fraction) [1910.1002]	Ca [80 mg/m3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue BP: NA Fl.Pt. = NA LEL: NA UEL: NA Combustible Solids
Benzo[a]anthracene	56-55-3	https://cameochemicals.noaa.gov/chemical/16171				Inhalation, injestion, skin and/or eye contact			Colorless leaflets or plates or coarse gold powder with a greenish-yellow fluorescence. May reasonably be expected to be a carcinogen. BP: 815° F at 760 mm Hg Fl.Pt. = NA LEL: NA UEL: NA
Benzo[a]pyrene (as coal tar pitch volatiles)	50-32-8	TWA 0.2 mg/m3 (as Benzene solubles)	Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m3 (benzene-soluble fraction) [1910.1002]	Ca [80 mg/m3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue BP: NA Fl.Pt. = NA LEL: NA UEL: NA Combustible Solids
Benzo[b]fluoranthene	205-99-2	None listed	https://cameochemicals.noaa.gov/chemical/16172			Inhalation, injestion, skin and/or eye contact			Needles or yellow fluffy powder BP: NA Fl.Pt. = NA LEL: NA UEL: NA

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Benzo[g,h,i]perylene	191-24-2	https://cameochemicals.noaa.gov/chemical/16174				Inhalation, injestion, skin and/or eye contact	Inhalation of material may be harmful. Contact may cause burns to skin and eyes. Inhalation of Asbestos dust may have a damaging effect on the lungs. Fire may produce irritating, corrosive and/or toxic gases. Some liquids produce vapors that may cause dizziness or suffocation. Runoff from fire control may cause pollution.	Lungs, skin, eyes	Colorless to white crystalline solid. Water insoluble. BP: NA Fl.Pt. = NA LEL: NA UEL: NA
Benzo[k]fluoranthene	207-08-9	https://cameochemicals.noaa.gov/chemical/16173				Inhalation, injestion, skin and/or eye contact	When heated to decomposition this compound emits acrid smoke and irritating fumes.		Pale yellow needles or yellow crystalline solid BP: 896° F Fl.Pt. = NA LEL: NA UEL: NA
Chrysene (as coal tar pitch volatiles	218-01-9	TWA 0.2 mg/m3 (as Benzene solubles)	Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m3 (benzene-soluble fraction) [1910.1002]	Ca [80 mg/m3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue BP: NA Fl.Pt. = NA LEL: NA UEL: NA Combustible Solids
Dibenzo(a,h)anthracene	53-70-3	https://cameochemicals.noaa.gov/chemical/16192				Inhalation, injestion, skin and/or eye contact	Symptoms of exposure to this compound may include irritation. This compound is harmful if swallowed or inhaled. It may cause irritation. When heated to decomposition it emits acrid smoke, irritating fumes and toxic fumes of carbon monoxide and carbon dioxide.	Lungs	White crystals or pale yellow solid. Sublimes BP: 975° F Fl.Pt. = NA LEL: NA UEL: NA
Fluoranthene	206-44-0	https://cameochemicals.noaa.gov/chemical/16213				Inhalation, injestion, skin and/or eye contact	When heated to decomposition this compound emits acrid smoke and fumes.		Light yellow fine crystals BP: 482° F Fl.Pt. = NA LEL: NA UEL: NA
Fluorene	86-73-7	https://cameochemicals.noaa.gov/chemical/16214				Inhalation, injestion, skin and/or eye contact			White leaflets. Sublimes easily under a vacuum. Fluorescent when impure. BP: 563° F Fl.Pt. = NA LEL: NA UEL: NA
Indeno[1,2,3-cd]pyrene	193-39-5	https://cameochemicals.noaa.gov/chemical/16218				Inhalation, injestion, skin and/or eye contact			Yellow crystals BP: 997° F Fl.Pt. = NA LEL: NA UEL: NA
Naphthalene	91-20-3	TWA 10 ppm [skin]	TWA 10 ppm (50 mg/m3) ST 15 ppm (75 mg/m3)	TWA 10 ppm (50 mg/m3)	250 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	Colorless to brown solid with an odor of mothballs. [Note: Shipped as a molten solid.] BP: 424°F Fl.P: 174°F LEL: 0.9% UEL: 5.9% Combustible Solid, but will take some effort to ignite
Phenanthrene	85-01-8	https://cameochemicals.noaa.gov/chemical/16236				Inhalation, injestion, skin and/or eye contact	Symptoms following exposure to this compound may include skin sensitization, dermatitis, bronchitis, cough, dyspnea, respiratory neoplasm, kidney neoplasm, skin irritation, and respiratory irritation.	Skin, respiratory tract	Colorless monoclinic crystals with a faint aromatic odor. Solutions exhibit a blue fluorescence. BP: 642° F Fl.Pt. = 340° F LEL: NA UEL: NA
Pyrene (see coal tar pitch volatiles)	129-00-0	TWA 0.2 mg/m3 (as Benzene solubles)	Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m3 (benzene-soluble fraction) [1910.1002]	Ca [80 mg/m3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue BP: NA Fl.Pt. = NA LEL: NA UEL: NA Combustible Solids
METALS									
Aluminum	7429-90-5	TWA 1 mg/m3	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)	TWA 15 mg/m^3 (total) TWA 5 mg/m^3 (resp)	N.D.	Inhalation, skin and/or eye contact	Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system	Silvery-white, malleable, ductile, odorless metal BP: 4221°F Fl.Pt. = NA LEL: NA UEL: NA Combustible Solid, finely divided dust is easily ignited; may cause explosions
Antimony	7440-36-0	TWA 0.5 mg/m3 (as Sb)	TWA 0.5 mg/m3 [*Note: The REL also applies to other antimony compounds (as Sb).]	TWA 0.5 mg/m3 [*Note: The PEL also applies to other antimony compounds (as Sb).]	50 mg/m3 (as Sb)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly	Eyes, skin, respiratory system, cardiovascular system	Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder BP: 2975°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid in bulk form, but a moderate explosion hazard in the form of dust when exposed to flame.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Arsenic	7440-38-2	TWA 0.01 mg/m3	Ca C 0.002 mg/m3 [15-minute]	[1910.1018] TWA 0.010 mg/m3	Ca [5 mg/m3 (as As)]	Inhalation, skin absorption, skin and/or eye contact, ingestion	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid BP: Sublimes Fl.Pt. = NA LEL: NA UEL: NA Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame
Barium	7440-39-3	TWA 0.5 mg/m3	0.5 mg Ba/m3 TWA	0.5 mg Ba/m3 TWA	50 mg Ba/m3	Inhalation, ingestion, skin and/or eye contact	Inhalation or contact with vapors, substance or decomposition products may cause severe injury or death. Contact may cause burns to skin, eyes, and mucous membranes. May be toxic by ingestion, inhalation and skin absorption. Used to make other chemicals.	Lungs, skin, eyes, and mucous membrane	A silver to white metallic solid BP: 1337°F Fl.Pt. = NA LEL: NA UEL: NA
Beryllium	7440-41-7	TWA 0.00005 mg/m^3	Ca C 0.0005 mg/m^3	TWA 0.002 mg/m^3 C 0.005 mg/m^3 0.025 mg/m3 [30-minute maximum peak]	Ca [4 mg/m^3 (as Be)]	Inhalation, skin and/or eye contact	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen]	Eyes, skin, respiratory system	Hard, brittle, gray-white solid BP: 4532°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid in bulk form, but a slight explosion hazard in the form of a powder or dust
Cadmium	7440-43-9	TWA 0.01 mg/m^3 total dust TWA 0.002 mg/m^3 (as Cd) respirable fraction	Ca	TWA 0.005 mg/m^3	Ca [9 mg/m3 (as Cd)]	Inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Respiratory system, kidneys, prostate, blood	Silver-white/blue tinged lustrous, odorless solid. BP: 1409°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible - will burn in powder form
Calcium	7440-70-2	https://cameochemicals.noaa.gov/chemical/309				Inhalation, ingestion, skin and/or eye contact	Contact with eyes or skin produces caustic burns.	Eyes, skin	A silvery, soft metal that turns grayish white on exposure to air. BP: 2714°F Fl.Pt. = NA LEL: NA UEL: NA
Chromium	7440-47-3	TWA 0.5 mg/m^3 (metal) TWA 0.003 mg/m^3 (water-soluble Cr III compounds) TWA 0.0002 mg/m^3 (water-soluble Cr VI compounds) STEL 0.0005 mg/m3 (water-soluble Cr VI compounds)	TWA 0.5 mg/m^3	TWA 1 mg/m^3	250 mg/m^3 (as Cr)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; lung fibrosis (histologic)	Eyes, skin, respiratory system	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid. BP: 4788°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible - will burn in dust form if heated in a flame
Cobalt	7440-48-4	TWA 0.02 mg/m3 [DSEN] [RSEN]	TWA 0.05 mg/m3	TWA 0.1 mg/m3	20 mg/m3 (as Co)	Inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Skin, respiratory system	Odorless, silver-gray to black solid BP: 5612°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid in bulk form, but finely divided dust will burn at high temperatures.
Copper	7440-50-8	TWA 0.2 mg/m^3 (fume) TWA 1 mg/m3 (dusts and mists)	TWA 1 mg/m^3	TWA 1 mg/m^3	100 mg/m^3 (as Cu)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; In Animals: lung, liver, kidney damage; anemia	Eyes, skin, respiratory system, liver, kidneys (increased risk with Wilson's disease)	Reddish, lustrous, malleable, odorless solid. BP: 4703°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible - powdered form may ignite
Iron (as iron oxide)	7439-89-6	TWA 5 mg/m3 (respirable particulate mass)	TWA 1 mg/m^3	NA	NA	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting; possible liver damage	Eyes, skin, respiratory system, liver, gastrointestinal tract	Appearance and odor vary depending upon the specific soluble iron salt. BP: NA Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solids
Lead	7439-92-1	TWA 0.05 mg/m3	TWA (8-hour) 0.050 mg/m3	[1910.1025] TWA 0.050 mg/m3	100 mg/m3 (as Pb)	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid BP: 3164°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid in bulk form
Magnesium	7439-95-4	https://cameochemicals.noaa.gov/chemical/6949				Eye and/or skin contact	Dust irritates eyes in same way as any foreign material. Penetration of skin by fragments of metal is likely to produce local irritation, blisters, and ulcers which may become infected.	Eyes	A light silvery metal BP: 1202°F Fl.Pt. = NA LEL: NA UEL: NA
Manganese	7439-96-5	TWA 0.02 mg/m3 [R] TWA 0.1 mg/m3 [I]	TWA 1 mg/m3 ST 3 mg/m3	C 5 mg/m3	500 mg/m3 (as Mn)	inhalation, ingestion	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	respiratory system, central nervous system, blood, kidneys	A lustrous, brittle, silvery solid BP: 3564°F Fl.Pt. = NA LEL: NA UEL: NA Metal: Combustible Solid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Mercury	7439-97-6	TWA 0.1 mg/m3, as Hg Aryl compounds TWA 0.025 mg/m3 as Hg, inorganic forms including metallic mercury	Hg Vapor: TWA 0.05 mg/m3 [skin] Other: C 0.1 mg/m3 [skin]	TWA 0.1 mg/m3	10 mg/m3 (as Hg)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eyes, skin, respiratory system, central nervous system, kidneys	Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.] BP: 674°F Fl.Pt. = NA LEL: NA UEL: NA Metal: Noncombustible Liquid
Nickel	7440-02-0	TWA 1.5 mg/m^3 [elemental] TWA 0.1 mg/m^3 [soluble inorganic compound] TWA 0.2 mg/m^3 [insoluble inorganic compound] TWA 0.1 mg/m^3 [Nickel subsulfide]	Ca TWA 0.015 mg/m^3	TWA 1 mg/m^3	Ca [10 mg/m3 (as Ni)]	Inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Nasal cavities, lungs, skin	Lustrous, silvery, odorless solid. BP: 5139°F Fl.Pt. = NA LEL: NA UEL: NA Combustible Solid; nickel sponge catalyst may ignite spontaneously in air.
Potassium	9/7/7440	https://cameochemicals.noaa.gov/chemical/4289				Eye and/or skin contact	Will burn skin and eyes	Skin, eyes	Potassium is a soft silvery metal though normally grayish white due to oxidation BP: 1425°F Fl.Pt. = NA LEL: NA UEL: NA
Selenium	7782-49-2	TWA 0.2 mg/m3	TWA 0.2 mg/m3	TWA 0.2 mg/m3	1 mg/m3 (as Se)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; In Animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eyes, skin, respiratory system, liver, kidneys, blood, spleen	Amorphous or crystalline, red to gray solid. [Note: Occurs as an impurity in most sulfide ores.] BP: 1265°F Fl.Pt. = NA LEL: NA UEL: NA Combustible Solid
Silver	7440-22-4	TWA 0.1 mg/m3 [Metal, dust, and fume] TWA 0.01 mg/m3 [Soluble compounds, as Ag]	TWA 0.01 mg/m3	TWA 0.01 mg/m3	10 mg/m3 (as Ag)	Inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Nasal septum, skin, eyes	Metal: White, lustrous solid BP: 3632°F Fl.Pt. = NA LEL: NA UEL: NA Metal: Noncombustible Solid, but flammable in form of dust or powder
Sodium	7440-23-5	https://cameochemicals.noaa.gov/chemical/7794				Skin contact	Severe burns caused by burning metal or by caustic soda formed by reaction with moisture on skin	Skin	A silvery soft metal that becomes grayish white upon exposure to air BP: 1621°F Fl.Pt. = NA LEL: NA UEL: NA
Thallium	7440-28-0	0.02 mg/m3 inhallable particulate matter	TWA 0.1 mg/m3 [skin]	TWA 0.1 mg/m3 [skin]	15 mg/m3 (as Tl)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eyes, respiratory system, central nervous system, liver, kidneys, gastrointestinal tract, body hair	Appearance and odor vary depending upon the specific soluble thallium compound BP: NA Fl.Pt. = NA LEL: NA UEL: NA
Vanadium	7440-62-2	https://cameochemicals.noaa.gov/chemical/16147				Inhalation, skin absorption, ingestion, skin and/or eye contact	Highly toxic, may be fatal if inhaled, swallowed or absorbed through skin. Avoid any skin contact. Effects of contact or inhalation may be delayed. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution	Skin	Silvery-whitish powder BP: NA Fl.Pt. = NA LEL: NA UEL: NA
Zinc	7440-66-6	https://cameochemicals.noaa.gov/chemical/4814				Inhalation, skin absorption, ingestion, skin and/or eye contact	Inhalation or contact with vapors, substance or decomposition products may cause severe injury or death. May produce corrosive solutions on contact with water. Fire will produce irritating, corrosive and/or toxic gases. Runoff from fire control may cause pollution	Lungs	A grayish powder BP: NA Fl.Pt. = NA LEL: NA UEL: NA
PCBs									
PCBs (total)	11097-69-1, 53469-21-9	TWA 0.5 mg/m3 [skin] TWA 1 mg/m3 [skin]	Ca TWA 0.001 mg/m3 Ca TWA 0.001 mg/m3	TWA 0.5 mg/m3 [skin] TWA 1 mg/m3 [skin]	Ca [5 mg/m3] Ca [5 mg/m3]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]	Skin, eyes, liver, reproductive system	Colorless to pale-yellow, viscous liquid or solid (below 50°F) with a mild, hydrocarbon odor BP: 689-734°F, 617-691°F Fl.Pt. = NA, NA LEL: NA UEL: NA Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans, and chlorinated dibenzo-p-dioxins.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Petroleum Hydrocarbons									
Gasoline	86290-81-5	TWA 300 ppm STEL 500 ppm	Ca	None	Ca [N.D.]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Clear liquid with a characteristic odor BP: 102°F Fl.Pt. = -45°F LEL: 1.4% UEL: 7.6%

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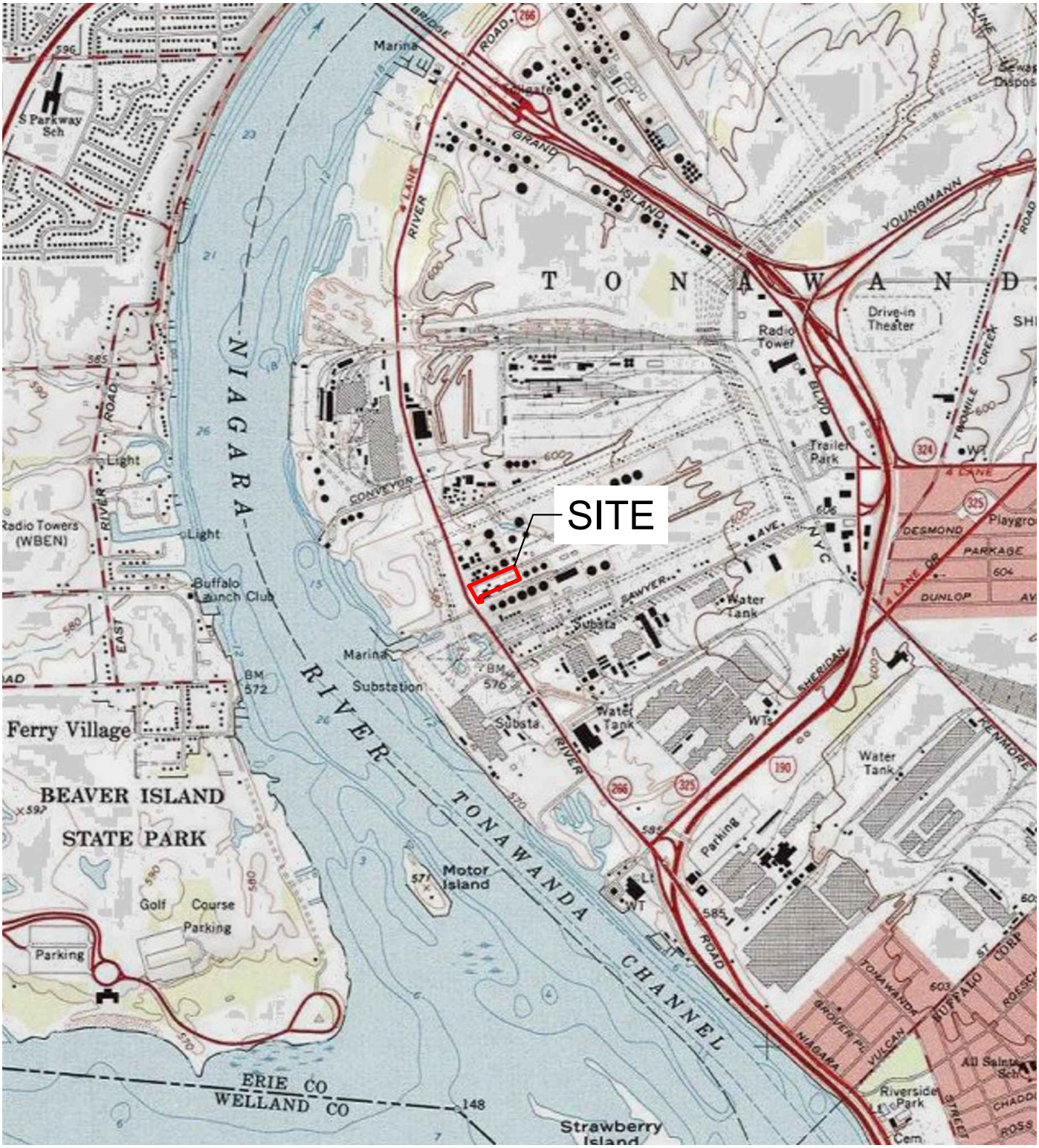
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Abbreviations:

ACGIH – American Conference of Governmental Industrial Hygienists.
BP – boiling point at 1 atmosphere, °F
C – Ceiling, is a concentration that should not be exceeded during and part of the working exposure.
Ca – Carcinogenic.
CAS# - Chemical Abstracts Service registry number which is unique for each chemical.
DSEN - Dermal Sensitization
Ft Pt. – Flash point
IDLH - Immediately Dangerous to Life and Health concentrations represent the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
LEL – Lower explosive (flammable) limit in air, % by volume (at room temperature)
mg/m^3 – Milligrams of substance per cubic meter of air
NIOSH - National Institute for Occupational Safety and Health.
OSHA – Occupational Safety and Health Administration
OTO - Ototoxicant
PEL - OSHA Permissible Exposure Limit (usually) a time weighted average concentration that must not be exceeded during any 8 hour work shift of a 40 hr work week.
ppm – parts per million
REL – NIOSH Recommended Limit indicated a time weighted average concentration that must not be exceeded during any 10 hour work shift of a 40 hr work week
RSEN - Respiratory Sensitization
SG - Specific Gravity
STEL – ACGIH Short-term exposure limit (ST)
TLV - ACGIH Threshold Limit Values (usually 8 hour time weighted average concentrations).
TWA – 8-hour, time-weighted average
UEL – Upper explosive (flammable) limit in air, % by volume (at room temperature)
VP - Vapor Pressure

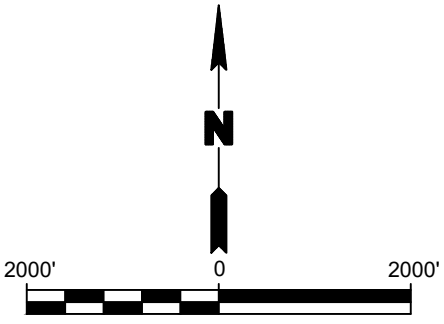
FIGURES

1. Site Location and Vicinity Map
2. Site Plan (Aerial) with Emergency Muster Areas
3. Hospital Route Map



MAP PER USGS BUFFALO NW QUADRANGLE, 2023.





Title: **SITE LOCATION AND VICINITY MAP**

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

HEALTH AND SAFETY PLAN

Prepared for:

3701 RIVER ROAD, LLC

ROUX

Compiled by: CMS	Date: MARCH 2026	FIGURE
Prepared by: CMS	Scale: AS SHOWN	1
Project Mgr: BWM	Project: 4369.0005B000	
File: FIGURE 1; SITE LOCATION AND VICINITY MAP.DWG		

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RWP\HASP\FIGURE 1; SITE LOCATION AND VICINITY MAP.DWG

F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\HASP\FIGURE 2; SITE PLAN (AERIAL) WITH EMERGENCY MUSTER AREA.DWG



LEGEND:

BCP SITE BOUNDARY

PARCEL BOUNDARY

N

100' 0 100'

MAP PER GOOGLE EARTH, JUNE 2024.

Title:

SITE PLAN (AERIAL) WITH EMERGENCY MUSTER AREA

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

HEALTH AND SAFETY PLAN

Prepared for:

3701 RIVER ROAD, LLC

ROUX

Compiled by: CMS	Date: MARCH 2026	FIGURE
Prepared by: CMS	Scale: AS SHOWN	2
Project Mgr: BWM	Project: 4369.0005B000	
File: FIGURE 2; SITE PLAN (AERIAL) WITH EMERGENCY MUSTER AREA.DWG		

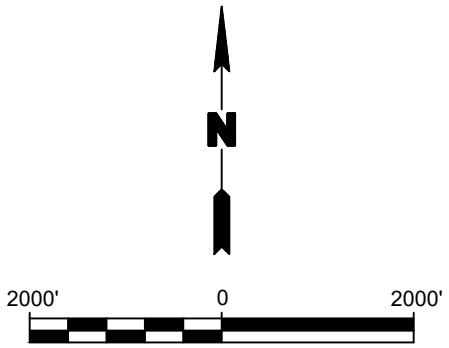
F:\CAD\0-ROUX\NEWMAN PROPERTIES LLC\3701 RIVER ROAD\RIWP\HASP\FIGURE 3; HOSPITAL ROUTE MAP.DWG



Route to Kenmore Mercy Hospital Emergency Room:

- Turn left onto River Road (southeast)
- Turn left onto Sheridan Drive (northeast)
- Turn right onto Elmwood Avenue (south)
- Turn right into Emergency Room parking/drop-off area

MAP PER GOOGLE EARTH, JUNE 2024.



Title:

HOSPITAL ROUTE MAP

3701 RIVER ROAD SITE
TONAWANDA, NEW YORK

HEALTH AND SAFETY PLAN

Prepared for:

3701 RIVER ROAD, LLC

ROUX

Compiled by: CMS	Date: MARCH 2026
Prepared by: CMS	Scale: AS SHOWN
Project Mgr: BWM	Project: 4369.0005B000
File: FIGURE 3; HOSPITAL ROUTE MAP.DWG	

FIGURE 3

ATTACHMENTS

ATTACHMENT A

Job Safety Analysis (JSA) Forms

JOB SAFETY ANALYSIS	Ctrl. No. GEN-003	DATE 05/22/2025	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY **GENERIC**	WORK TYPE **Construction - Excavation**	WORK ACTIVITY (Description) **Backfilling, Excavation & Compaction**		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: cut-resistant level 2
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION (as needed)	☒ PPE CLOTHING: ANSI-rated reflective vest	
☒ SAFETY GLASSES	☒ SAFETY TOE BOOTS		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Payloader, Backhoe, Dump Trucks, Mechanical gas-powered tampers, Excavator with hydraulic tamper. APR when tamping if dust is present. Two-way radios.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone (HEEZ) around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Pre-construction meeting: Review proposed excavation locations	**1a. CONTACT:** Potential for contact with subsurface utilities and above-ground utilities	1a. Call 811 for mark-out service and a one-call ticket. 1a. Obtain private utility mark-out service, as necessary. 1a. Review and mark proposed excavations with white paint. 1a. Identify all “Critical” zones. A Critical zone is any area within 10 feet of any operating utility. 1a. Complete subsurface clearance checklist. 1a. Soft dig must be conducted within three lateral feet of any suspected underground utility. 1a. Protection of aboveground utilities identified within the work zone must be coordinated with the client and the utility owner.
2. Secure Work Area	**2a. CONTACT:** Potential for personnel to enter the work area. Potential for equipment to contact or crush personnel. **2b. EXERTION:** Potential for muscle strain or tear while installing traffic cones and barrels	2a. Ensure the work area is secure and inform others of work activity. Establish a HEEZ using traffic cones, barrels & snow fencing or telescoping poles. Use of flag persons to maintain clear traffic and to minimize motorist confusion during the set-up of the new traffic pattern. HEEZ is to include the tip/swing radius of the equipment. 2a. Dump Truck/Excavator/Payloader/Backhoe equipment to be set up by personnel who are familiar with the machinery. Spotters shall be in place for all equipment. and to control access to the HEEZ 2a. Truck wheels are chocked when the driver is not in the truck and the engine is shut off. 2a. Personnel shall stay out of the exclusion zone (10’ minimum or greater than the equipment boom) while equipment is maneuvering. 2b. Keep back straight, keep load close to the body, and bend knees while lifting and working. If over 40 lbs., use 2 or more laborers for lifting or the use of equipment.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Backfilling the excavation and compaction	**3a. CONTACT:** Traffic and live equipment.	3a. Equipment and trucks shall be isolated from other workers, subcontractors, and third-party traffic with traffic cones, barricades, snow fencing or telescoping poles, and/or Jersey barriers. Spotters shall direct the dump truck for the placement of fill near the excavation. Pay loader/ Excavator, as directed by a spotter, shall move fill into the trench where it shall be placed in layers and compacted by mechanical means.
		3a. Spotters will wear fluorescent vests at all times.
		3a. Spotters will remain out of the exclusion zone, line-of-fire from equipment and third-party vehicles.
		3a. Spotters and operators will have radios for communication when other visual and/or hand signals are insufficient.
		3a. Locate all overhead utilities. All personnel and machinery should maintain a minimum 10-foot distance from overhead electric lines. Refer to the OSHA chart for distances and voltage.
		3a. For excavations engineered (shored, sloped, benched), all personnel, equipment, and materials must remain a minimum of 2 feet from the edge of the excavation.
	3b. EXPOSURE: Fumes from a gas-powered tamper	3b. Fueling of all equipment will be done outside of the work area in a well-ventilated area. Refueling will be done only after a 5-minute cool-down. Pads and wipes will be available to contain any potential drips from refueling.
	3c. FALL: Slips, trips, and fall hazards.	3c. The work area will be clean and free of any debris to remove slip, trip, and fall hazards. All tools will be kept in designated areas. Ensure the work area is well illuminated.
		3c. Workers' walking paths shall be maintained, and workers will watch their footing while entering and exiting excavation areas for uneven surfaces, loose materials, and debris.
		3c. All persons working at elevations over 6' shall maintain a 6-foot distance or use a guardrail system/ personal fall arrest system while within 6 feet of the edge of the excavation.
	3d. OVEREXERTION: Muscle strain or tear.	3d. Keep knees bent and back straight while transferring/ lifting/lowering the tamper from elevated areas. Utilize a co-worker to avoid straining muscles.
		3d. Keep knees bent and back straight while maneuvering the tamper. Utilize a co-worker to avoid straining muscles.
	3e. EXPOSURE: Noise from the tamper.	3e. Workers will wear hearing protection during compaction tamper activities.
	Dust inhalation.	3e. Wear a NIOSH-approved dust mask for personal comfort. If dust is visible for an extended time, limit by wetting down the area.
		3e. If dust continues, stop work and evaluate if an upgrade to APR is needed. Must have approval and medical clearance.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
4. Secure/leave site.	**4a. FALL:** Slip, trip, fall	4a. Clear work area of all debris and store all equipment in designated areas/containers before opening to traffic. 4a. Replace fencing and barricades as needed to secure the path before opening the roadway or area up to traffic(vehicle, pedestrian, and/or bicycle).

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS	Ctrl. No. GEN-006	DATE 11/13/25	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):
Generic	**Drilling**	**Direct Push Soil Borings / Well Installation**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel-toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing, long-sleeved shirt	☒ GLOVES: Nitrile and cut-resistant ☒ OTHER: Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Geoprobe or Truck-Mounted Direct Push Drill Rig, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Macrocore liners, Liner Opening Tool, 20 lb. Type ABC Fire Extinguisher, 42" Cones & traffic control paddles, "Work Area" Signs, Water.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents.

"SHOW ME YOUR HANDS"
The driller and helper should show that their hands are clear of controls and moving parts.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed)	**1a. CONTACT:** Equipment/property damage.	1a. The drill rig's tower/derrick will be lowered and secured before mobilization. 1a. A spotter should be utilized while moving the drill rig. If personnel move into the path of the drill rig, the drill rig will be stopped until the path is again clear. Use a spotter for all required backing operations. 1a. Set up the work area and position equipment to eliminate or reduce the need for backing support trucks and trailers. 1a. When backing up the truck rig with an attached trailer, use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility.
Secure Work Zone		1a. Inspect the driving path for uneven terrain. Level or avoid if needed. 1a. Ensure the work area is secure and inform others of work activity. Establish a HEEZ using traffic cones, barrels & snow fencing or telescoping poles. Use flag persons to maintain clear traffic and minimize motorist confusion during set-up. HEEZ is to include the tip/swing radius of the equipment.
	1b. FALL: Slip/trip/fall hazards.	1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions before mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1b. Use established pathways and walk on stable, secure ground.
	1c. CONTACT: Crushing from a rollover.	1c Geoprobe should cross all hills/obstructions head-on with the mast down to reduce the risk of rollover.
2. Raising the tower/derrick of the drill rig	**2a. CONTACT:** Overhead hazards.	2a. Before raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures that could come in contact with the rig's tower and/or drilling rods or tools. 2a. Maintain a minimum safe distance of 10' from overhead lines, material, or structures.
	2b. CONTACT: Pinch Points/Amputation Points when raising the rig, and the instability of the rig	2b. Inspect the equipment before use and avoid pinch/amputation points. 2b. Lower outriggers to ensure stability before raising the rig tower/derrick. 2b. If the rig needs to be mounted, use three points of contact.
3. Advancement of drilling equipment and sound installation	**3a. CONTACT:** Flying debris	3a. Be aware of and avoid potential line-of-fire hazards and wear required PPE such as eye, ear, and hand protection.
	3b. EXPOSURE: Noise and dust.	3b. Wet borehole area with sprayer to minimize dust. 3b. Stand upwind and keep your body away from the rig. 3b. If conditions warrant, a disposable dust mask (e.g., N95/P100) should be worn. 3b. Wear hearing protection when the drill rig is in operation.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Advancement of drilling equipment and well installation (Continued)	**3c. FALL:** Slip/trip/fall hazards.	3c. Contain drill cuttings and drilling water to prevent fall hazards from developing in the work area. 3c. See 1b.
	3d. CAUGHT: Limb/extremity pinching; abrasion/crushing.	3d. Ensure all Emergency Safety Stop buttons function properly. 3d. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 3d. Inspect the equipment prior to use for potential pinch/amputation points. Keep hands away from pinch/amputation points, and the use of tools is preferable compared to fingers and hands. 3d. Inspect the drill head for worn surface or missing teeth; replace it if damaged or blunt. 3d. Ensure all jewelry is removed, loose clothing is secured, and PPE is correctly fitted and secured close to the body. 3d. All non-essential personnel should stay away from the immediate work area; position the body out of the line-of-fire of equipment. 3d. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3d. Spinning rods/casing have an **exclusion zone of 24 inches** while in operation.
	3e. CONTACT: Equipment imbalance during the advancement of drill equipment.	3e. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3e. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. 3e. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (**minimum exclusion zone**).
	3f. EXPOSURE: Inhalation of contamination/vapors.	3f. Monitor ambient air for dangerous conditions using a calibrated photoionization detector (PID) to monitor the breathing zone of the work area. 3f. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings, and inform the Roux PM of the condition. The Roux PM will then recommend additional precautions in accordance with the site-specific health and safety plan. 3f. Use a multi-gas meter to monitor ambient air for dangerous conditions (i.e., unsafe levels of carbon monoxide when drilling indoors or the presence of explosive vapors).
	3g. EXERTION: Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods.	3g. Keep your back straight and bend at the knees. 3g. Utilize team lifting or mechanical means for objects over 40 lbs. 3g. Use a mechanical lifting device for odd-shaped objects.
4. Remove the sample liner.	**4a. EXERTION:** Potential for muscle strain/injury while removing the liner from the probe rod.	4a Utilize team lifting or mechanical means for objects over 40 lbs. 4a. Use the hydraulic liner extruder if available.
	4b. CONTACT: Pinch points and cuts	4b. Place the liner on the sturdy surface when opening. 4b. Don cut-resistant gloves and use an appropriate liner cutter when opening liners. 4b. Always cut away from the body.
	4c. EXPOSURE: Inhalation and/or dermal contact with contaminants.	4c. Wear chemical-resistant disposable gloves when handling liners. 4c. See 3f.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
5. Decontaminate equipment.	**5a. EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors).	5a. Wear chemical-resistant disposable gloves and safety glasses. 5a. Contain decontamination water so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Spray equipment from a side angle, not straight on, to avoid backsplash. 5a. See 3b and 3f.
	5b. EXPOSURE: The chemicals in the cleaning solution.	5b. See 4a. Review the SDS to ensure appropriate precautions are taken and understood.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-007	DATE 05/22/2025	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**General Site Activity**	**Driving**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☐ HARD HAT: when outside vehicle ☐ LIFELINE / BODY HARNESS ☐ SAFETY GLASSES: when outside vehicle	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☐ SAFETY TOE BOOTS: when outside vehicle	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☐ PPE CLOTHING: high visibility vest when outside vehicle	☐ GLOVES: Leather/ cut-resistant level 2 ☐ OTHER _____

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Motor Vehicle (i.e., car, truck, SUV)

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Driving to/leaving the Site	**1a. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc. *Common factors that may lead to a CONTACT incident, but not limited to: • distracted driving (cell phone, GPS, radio, billboards, "rubbernecking") • lack of situational awareness • unfamiliarity with traffic patterns/road layout • weather conditions (wet/icy roads, hydroplaning, black ice) • weariness • high speeds • obstructed vision (solar glare, debris on windshield, blind spots, large vehicle at the front) • changes in travel pathway (construction, snow banks, non-operational signals, potholes, detours, special events) • improper vehicle maintenance (non-operational signal light, worn tires, cracked windshield, ineffective wipers) • loose or unsecure objects	1a. PLAN AHEAD – review/make yourself familiar with maps and driving directions before beginning the drive to the Site. Do not attempt to drive and review maps/directions at the same time. Pull over and stop your vehicle before looking at maps/directions. 1a. If a Roux vehicle or a Roux-rented vehicle, complete a vehicle inspection form. If a personal vehicle, complete a basic 360 vehicle inspection before driving. Verify Inspection and Registration are current, tires and wipers are in good condition, all lights are functional, all glass/mirrors are undamaged, the horn is functional, roof/hood/trunk are free from accumulated snow, and visibility is not impaired due to snow/ice/frost/fog on windows. 1a. Do not hang items in the car that can obstruct your view or become projectiles in a collision. 1a. Do not get distracted using touch screen radios or GPS units built into newer models. Keep your eyes on the road and stay alert. 1a. Follow posted speed limits and obey traffic signals and roadway signs. 1a. Always wear your seat belt and shoulder harness when driving. 1a. When driving around large vehicles and trucks, maintain extra space as these vehicles may not be able to see a smaller car too close. 1a. Follow the "Rules of the Road," including: using your turn signals, coming to a complete stop, and allowing vehicles the right of way (yield) when required by traffic laws. 1a. Apply the Smith Five Keys® of safe driving • Aim High in Steering® - Expand eye lead time to a minimum of 15 seconds • Get the Big Picture® - Maintain a proper 4-second minimum following distance at all times - Scan mirrors every 5-8 seconds to achieve a circle of awareness - Position your vehicle so you can see relevant/non-relevant objects • Keep Your Eyes Moving® - Try to maintain about 180 degrees of visibility - Avoid blank and fixed stares. Avoid focusing on one object for more than 2 seconds • Leave Yourself an Out® - Avoid traveling in traffic clusters - Surround yourself with space - Anticipate the actions of others

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Driving to/leaving Site (cont'd)	**1a. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc.	• Make Sure They See You® - Maintain eye contact with oncoming vehicles/pedestrians - Use warning devices (e.g., hand signals, high-lights, horns, etc.) - Proper timing is essential 1a. Do not perform reconnaissance or inspections while driving. Your vehicle should be parked in a safe location when viewing or surveying the Site and vicinity 1a. Avoid sudden turns and stops. Do not drive recklessly – be in control of the vehicle at all times. 1a. In inclement weather, first determine if work can be POSTPONED. Otherwise, plan according to weather conditions, including checking the forecast along the entirety of the travel route (especially for long distances). Reduce speed as road conditions warrant. Travelling with winter car equipment in the winter is strongly recommended (i.e., shovel, scraper, brush, blanket, extra clothing, flashlight, bag of sand). If your vehicle has 4-wheel drive, review the operator's manual and understand the operating procedure prior to engaging 4-wheel drive. If at any point on your drive, the weather becomes too severe to proceed safely, pull over if safe to do so or seek nearest cover (e.g., overpass) 1a. If feeling drowsy or sleepy, do not drive. Pull over in a safe place to rest if you experience any signs of drowsiness. Make sure to get adequate sleep the night before an early drive. 1a. Never operate a vehicle under the influence of alcohol, illegal substances, or medications affecting your performance. 1a. Keep your eyes on the road. Do not call, text, or talk on cellular phones. Pull over to a safe location if you must answer or make a call. 1a. When parking, pull through when possible. If backing is required, visually inspect the area to ensure it is free from obstructions prior to backing in and relying solely on mirrors; use spotters when available.
2. Entering/Exiting Vehicle.	**2a. CAUGHT:** Personal injury (broken fingers/hand) while entering or exiting vehicles **2b. FALL:** Personal injury (twisted ankle, deep contusion, concussion, broken wrist/arm, etc.) from a slip/fall on an uneven, unstable, or slippery surface while exiting/entering the vehicle **2c. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc.	2a. Open and close doors slowly. Never put hands or feet in between the door and the vehicle to avoid pinch points. 2b. When exiting the vehicle, make sure your feet are on firm footing and weight is evenly distributed before exiting/standing. In inclement weather, use your hands to support yourself by holding the car door and/or steering wheel when exiting the vehicle. 2c. Check both directions for traffic before opening the door. Do not exit the vehicle if traffic does not permit you to exit safely 2c. Check the anticipated path of the door prior to opening. Do not open the door into any obstructions (e.g., bollards, high curbs)

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-009	DATE: 05/23/2025	☐ NEW ☒ REVISED	PAGE 1 of 1
JSA TYPE CATEGORY **Generic**	WORK TYPE **O&M**	WORK ACTIVITY (Description) **Movement of 55-Gallon Drums/Drum Handling with Mobile Carrier**		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant gloves level II
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER:
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent long-sleeve shirt or shirt and reflective safety vest.	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel or composite toe		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Mobile Drum Carrier, over-pack drum container, safety cones, and caution tape

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Preparing for an Inspection of the Drum	**1a. FALL:** Tripping/falling due to uneven surface. Loose debris/garbage in the work area.	1a. Clear the area of loose garbage and debris. Inspect 55-gal drums for proper condition, labeling, check drum ring and bolts for tightness, and inspect mobile drum carrier. 1a. Do a Test Lift to get a general sense of the weight of the drum. 1a. Inspect and use established pathways to avoid uneven terrain, weather-related hazards (i.e., debris, puddles, ice, etc.), and other obstructions. 1a. Secure a work area and coordinate and communicate the planned work activities with other personnel working in the area. 1a. Delineate work area with safety cones and caution tape
	1b. CONTACT/EXPOSURE: Drums could potentially be damaged or contain hazardous material. A mobile drum carrier could potentially be in poor working condition, causing malfunctioning during operation.	1b. Prior to inspecting drums, don cut-resistant gloves. If the drum is not properly labeled, do not open it and cease all drum transport activities. Immediately contact the project manager and inform him/her of the drum situation. 1b. Do not continue drum transport activities until the project manager determines further actions. 1b. If the drum is properly labeled, but leaking, improperly sealed, or in poor condition, place the drum in an overpack drum. 1b. Inspect the mobile drum carrier to ensure its overall integrity. Look for rust marks or potential weak points where the drum carrier could malfunction. Inspect the wheels to ensure that they easily turn and nothing is impeding their movement.
	1c. EXERTION/CAUGHT: Potential pinching/exertion hazards while securing the ring/ tightening bolts	1c. Keep back straight and knees slightly bent while securing the drum ring/tightening bolt. Wear cut-resistant gloves.
2. Position the drum clamp tightly in between the drum ribs, securing the drum clamp to the drum with the chain	**2a. CAUGHT:** Pinching fingers between the drum clamp and the handle/chain.	2a. Attach drum clamp with chain and tighten until snug. Do not place hands between the drum clamp and the drum as the chain is tightened; wear cut-resistant gloves. Keep face away from the drum when handling in case of escaping vapors.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Disengage safety latches on handle, pull handle down until drum is lifted off the ground, and safety latches are reengaged; slightly suspend drum off the ground	**3a. EXERTION/ CONTACT:** Potential muscle strain associated with lifting/engaging the drum/handle. The drum could shift/slip downward and crush toes.	3a. Ascertain whether the drum is overweight; if it is, then two people are needed to lower the handle while the drum is secured with the clamp so that safety latches can be engaged. Keep body out of the line-of-fire of the handle (do not position the head above the handle) as it is being pushed down. Do not allow feet/toes to be positioned under the drum as it is being lifted; wear steel/composite-toed boots.
	3b. CAUGHT: Fingers could be pinched while engaging/disengaging the safety latches on the handle	3b. Wear cut-resistant gloves while disengaging/reengaging safety latches. 3b. Avoid placing hands in pinch points.
4. Transport drums to the designated location and disengage the drum clamp (repeat Step 3 in reverse order)	**4a. FALL:** Tripping/ falling due to obstructions and uneven terrain. Potential for the drum to fall during transport.	4a. Ensure the transport path is free of potential obstructions that may cause the drum/carrier to become unstable. Position the drum clamp between the ribs on the drum to prevent possible slipping.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-010	DATE 05/28/2025	☐ NEW ☒ X REVISED	PAGE 1 of 2
JSA TYPE CATEGORY **Generic**	WORK TYPE **Surveying**	WORK ACTIVITY (Description) **Elevation Surveying**		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant or leather
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☒ OTHER:
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel-toe boots		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Surveying equipment (i.e., leveling rod/measuring ruler, tripod and auto level).

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Check in with Site manager/ property owner.	**1a. CONTACT/EXPOSURE/FALL:** Lack of communication could result in H&S incident.	1a. Inform Site personnel of work scope, timeline and location(s). 1a. Inquire about other activities taking place at the Site. 1a. If applicable, obtain General Work permit for the day.
2. Locate surveying position for instrument and rod and set-up work area	**2a. FALL:** Slip/trip hazards	2a. Inspect area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.) and obstructions prior to setting up at the survey location. Keep eyes engaged with walking surface while in movement. Remember "Walking is Working." 2a. Conduct housekeeping and maintain clear paths to walk in and remove debris as required.
	2b. CONTACT: Traffic (surveying locations could potentially be in parking areas and sidewalks)	2b. Be aware of oncoming traffic. Utilize a flagman / spotter for locations in streets or high-traffic areas. 2b. Place Traffic cones around the work area and delineate work zone with caution tape, snow fencing or safety bars, if necessary. 2b. Wear appropriate PPE including high visibility clothing and reflective safety vest when exposed to traffic and vehicles. 2b. Face traffic, maintain eye contact with oncoming vehicles and establish a safe exit route.
	2c. OVEREXERTION: Hazard due to carrying, lifting, and bending while transporting equipment	2c. Use proper body positioning and lifting techniques; keep back straight, lift with legs, keep load close to body, and never reach with a load. 2c. Avoid carrying too much equipment at one time and team-lift equipment that is heavier than 50 lb.
	2d. CAUGHT/CONTACT: Pinch Points / sharp edges associated with setting up the tripod	2d. Wear cut resistant gloves when handling the tripod and keep fingers away from pinch points located near moving parts of the tripod. Do not carry tripod by the pointed ends.
	2e. OVEREXERTION: Hazard due to bending awkwardly to look through the autolevel	2e. When practical, set the height of the auto level optic so as to minimize bending at the waist.
3. Open / close manhole cover to well that is being surveyed (if necessary).	**3a. OVEREXERTION:** Muscle strain	3a. See 2c. Bend knees when reaching to open well. Use manhole lifting hook or pry bar to avoid bending.
	3b. CAUGHT: Pinch points associated with removing / replacing manholes and working with hand tools	3b. Wear leather gloves or cut resistant gloves when working with well cover and hand tools. 3b. Use proper tools (ratchet and crowbar, pry bar or magnet for well cover) and inspect before use. 3b. Do not put fingers under well cover.
	3c. EXPOSURE: To potentially hazardous vapors To biological hazards	3c. No open flames/heat sources. 3c. To minimize exposure to vapors, allow well to vent after opening it and before survey activities begin. 3c. Work on the upwind side of manhole/well. 3.c Use caution while opening lids to inspect work area for bees and insects inside of covers. 3c. Use insect/tick repellent, as necessary.
	3d. CONTACT: With traffic	3d. See 2b.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
4. Perform survey.	**4a. FALL:** Slip/trip hazards	4a. See 2a.
	4b. CONTACT: Traffic (surveying locations could be potentially located in parking areas and sidewalks)	4b. See 2b. 4b. Personnel using the scope will be devoting most of their attention to the surveying activity and shall be aware of vehicular and pedestrian traffic. Personnel holding the measuring stick should be extra vigilant of survey personnel and communicate any potential hazards to the instrument person via handheld radio or similar means. Ensure reflective safety vest is worn.
	4c. ENERGY SOURCES: Electrical shock from survey rod striking overhead electric lines or lights	4c. Prior to raising and extending the survey rod, personnel should thoroughly inspect the area above the measuring point. If overhead electrical lines are encountered within 10 feet of the measuring rod tip ; stop work and consult with the Office Health and Safety Officer.
5. Break down work area.	**5a. CONTACT:** Traffic (surveying locations can potentially be in parking areas and sidewalks)	5a. See 2b.
	5b. EXERTION: Hazard due to carrying, lifting, and bending while transporting equipment	5b. See 2c.
	5c. CONTACT: Personal injury or equipment damage by striking surroundings with an extended rod or unsecured tripod leg	5c. Ensure rod is entirely collapsed prior to mobilization / demobilization between survey points. 5c. Ensure tripod legs are fully collapsed and secured with strap prior to mobilization / demobilization between set-ups.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-011	DATE: 05/28/2025	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**Construction - Excavation**	**Excavation / Trenching**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: cut resistant level II
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER
☒ LONG SLEEVED SHIRT	HEARING PROTECTION (as needed)	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility long sleeved clothing	
☐ LIFELINE / BODY HARNESS	☒ SAFETY SHOES: Steel-toe boots		
☒ SAFETY GLASSES			

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Jackhammer, Excavator, Backhoe, Hand Tools, Photoionization Detector, barrels, 42” traffic cones, snow fencing, telescoping poles, temporary chain link fence, ladders, shovels, digging bars, power tools (cut-off saw), Two-way radios, Sheeting, Trench box, Retractable lanyard, Harness

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

EXCLUSION ZONE (EZ): Maintain Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, tip zone of the equipment, fall zone of the equipment and contents, distance that debris may travel during demolition activities and/or footprint of a structure to be demolished.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Pre-Clearance Protocol.	**1a. CONTACT:** Damage to underground utility.	1a. Confirm that (if applicable) “Call Before You Dig” and local utility companies were contacted prior to trenching in order to confirm utility mark outs. Must have a case # before digging.
	1b. ENERGY SOURCE/CONTACT: Property damage; Pressurized water mains may cause lacerations or broken bones. Pressurized gas mains may explode, causing serious injury or death. Underground electric may cause severe burns, shock, or death.	**1b. Complete subsurface clearance checklist**. 1b. For excavations, all utilities need to be marked and then exposed by hand, following the protocols in this program. Pre-clearing for excavations may be performed by the “moat” technique (i.e., soft digging around the perimeter). In these cases, dig in small lifts (<12” for the first five feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes to expose the utility. Once structures have been verified, a minimum clearance of three feet must be maintained between the utility and any powered equipment.
	1c. FALL: Slip, Trip or Fall may cause muscle strains or tears, abrasions, lacerations, or broken bones.	1c. Be aware of the conditions when walking or loading equipment and working. Walk within an established pathway, avoiding uneven surfaces. Remove potential slip/trip/fall hazards.
2. Set up work zone.	**2a. CONTACT/CAUGHT:** Cuts/lacerations from equipment. Broken bones from contact by vehicle/equipment.	2a. Isolate work area from hazards with cones, barricades, snow fencing, telescoping poles, or a temporary chain link fence. Utilize a flag person when necessary (i.e., third-party traffic in the area). Install traffic signs in roadways and for detours. Spotters will maintain and enforce the exclusion zone.
	2b. FALL: Slip, Trip or Fall may cause muscle strains or tears, abrasions, lacerations, or broken bones.	2b. See 1c.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Trenching Activity.	**3a. CONTACT:** Serious injury, including broken bones, muscle strains or tears, and possibly death, due to contact with the machine.	3a. Spotter(s) required for all heavy equipment operation. No worker shall be allowed inside the exclusion zone or along the trench/excavation area while any equipment is in operation. A minimum exclusion zone greater than the length of the equipment boom must be established. Workers are only allowed in the exclusion zone if the operator is in "Hands Off "mode. The operator will not operate the equipment until the worker is out of the exclusion zone. Spotters and operators will have radios for communication when either loses sight of one another, and/or in case of emergency.
	3b. FALL: Slip, Trip or Fall may cause muscle strains or tears, abrasions, lacerations, or broken bones	3b. Any trench/excavation deeper than 3' must have a ladder within 25' of any worker in the excavation. At least 3'(rungs) of the ladder shall be above the top of the excavation. All equipment, tools, material, and spoil piles shall be maintained 2' minimum from the edge of the excavation. 3b. Any trench/excavation deeper than 6' must have fall protection, a retractable lanyard for ladder use, and a 42" high guardrail system along the edge of the trench/excavation.
	3c. EXPOSURE: Noise, Dust, concrete-asphalt, and petroleum hydrocarbon vapors may cause damage to the ears and lungs	3c. Air monitoring using a calibrated photoionization detector (PID) will be used to monitor the breathing zone of the work area. If a reading of >5ppm is recorded, the oversight personnel must temporarily cease work and instruct all Site personnel to step away from the area of elevated readings.
4. Setting Trench protections if necessary.	**4a. CAUGHT:** Injury due to contact with a failed trench may include muscle strains or tears, abrasions or lacerations, broken bones, and possibly death.	4a. To prevent cave-ins and avoid being caught/between, excavations over 5' in depth, unless working in stable rock, shall have engineer-approved shoring, sheeting, or trench box. The top of protection shall be at least 18" above the top of the excavation.
	4b. CONTACT/CAUGHT: Injury due to rigging activities and entering the exclusion zone during lifting and/or transport of shoring/trench box/material may include muscle strains or tears, abrasions or lacerations, broken bones, and possibly death. Pinch/ Amputation points.	4b. Use only inspected rigging with 2, 3, or 4 lift points; wear cut-resistant gloves. Rigging to be hooked up to factory-installed hookup points on equipment. Control load with non-conductive tag lines with workers out of the exclusion zone. Do not stand underneath a suspended load; wear steel-toed boots and a hard hat. Keep hands and extremities out of pinch/amputation points/ line of fire areas.
	4c. FALL: Possible injuries due to a fall into an excavation may include muscle strains or tears, abrasions or lacerations, or broken bones. Impact/ impalement hazard	4c. Shoring to be set and sides will be backfilled to avoid fall hazards before workers are allowed to enter area. The operator will be in "HANDS OFF" mode before workers enter the work area to unhook the rigging. An inspected ladder extending 3' above the top of the shoring will be used to enter and exit the excavation. Workers will use three points of contact when using the ladder. Cover/ cap vertical impalement hazards.
5. Secure/Leave Site. If backfilling, see excavation backfilling and compaction JSA for potential hazards and critical actions.	**5a. FALL:** Potential Slip, Trip or Fall - may cause muscle strains, tears, abrasions or lacerations, or broken bones.	5a. See 1c. 5a. All open excavations must be backfilled or secured prior to departure with steel plates, orange construction fence, or temporary chain link fencing.

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JOB SAFETY ANALYSIS Ctrl. No. GEN-013	DATE 05/28/2025	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE:	WORK ACTIVITY (Description):
Generic	**Gauging and Sampling**	**Gauging and Sampling**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☒ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Composite-toed or steel-toed boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: , Nitrile and cut-resistant level II ☒ OTHER: Knee pads, Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Traffic Safety Cones, Caution Tape, Interface Probe with Ground Clamp, and/or Water Level Meter, 20-lb. type ABC Fire Extinguisher, Buckets. Tools as needed: Socket Wrench, Screw Driver, Crow Bar, Mallet, and Wire Brush.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization to monitoring well(s).	**1a. FALL:** Personal injury from slip/trip/fall due to uneven terrain and/or obstructions.	1a. Inspect the pathway and plan for the most suitable designated pathway prior to mobilization. 1a. Use established pathways, walk and/or drive on stable, secure ground, and avoid steep hills or uneven terrain. 1a. If working near open water with an unguarded edge, wear a personal flotation device (PFD).
	1b. CONTACT: With traffic/third parties.	1b. Identify potential traffic sources and delineate the work area with traffic safety cones. Position the vehicle to protect against oncoming traffic. Use caution tape to provide a more visible delineation of the work area if necessary. 1b. Wear appropriate PPE, including high visibility clothing and reflective vest, when exposed to traffic 1b. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.
	1c. EXERTION: Muscle strain from lifting equipment	1c. Use proper lifting techniques when handling/moving equipment; bend knees and keep back straight. 1c. Use mechanical assistance or team lifting techniques when equipment is 40 lbs. or heavier. 1c. Make multiple trips to carry equipment.
	1d. EXPOSURE: To biological hazards.	1d. Inspect work area for bees and insects. 1d. Use insect/tick repellent, as necessary. 1d. Treat clothing with permethrin prior to mobilization. 1d. Don Tyvek/mosquito nets, as applicable.
2. Open/close well.	**2a. EXERTION:** Muscle strain.	2a. Use proper lifting techniques; keep back straight, lift with legs, and bend knees when reaching to open/close the well.
	2b. CAUGHT: Pinch/crush points associated with removing/replacing manholes and working with hand tools.	2b. Wear cut-resistant level II gloves when working with well cover and hand tools. 2b. Use proper tools (ratchet and pry bar or magnet for well cover) and inspect before use. 2b. Do not put fingers under the well cover.
	2c. CAUGHT: Pinch points associated with placing the J-plug back onto the PVC pipe.	2c. See 2b. 2c. Keep fingers out of line-of-fire when securing cap.
	2d. EXPOSURE: To potential hazardous vapors.	2d. No open flames/heat sources. 2d. To minimize exposure to vapors, allow the well to vent after opening it and before sampling activities begin. 2d. Stand upwind if possible, to avoid inhaling vapors. 2d. Monitor atmosphere with multi-gas meter/PID.
3. Gauge well.	**3a. CONTACT:** With contamination (e.g., contaminated groundwater).	3a. Wear chemical-resistant disposable gloves (over cut-resistant gloves) and safety glasses when gauging well. 3a. Insert and remove the probe slowly to avoid splashing. 3a. Use an absorbent pad to clean probe.
	3b. CONTACT: With traffic.	3b. See 1b.
	3c. Exposure: To static electricity, fire, or explosion.	3c. Ground interface probe to a designated grounding point/rod, well casing, or electrically conductive surface to dissipate static electricity.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
4. Purge and sample well	**4a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors) and/or sample preservatives.	4a. Open and fill sample jars slowly to avoid splashing and contact with preservatives. 4a. Wear cut-resistant gloves and chemical-resistant disposable gloves when sampling. 4a. Fill sample containers over the purge container to avoid spilling water onto the ground. 4a. Use an absorbent pad to clean spills. 4a. When using a bailer to purge a well, pull the bailer slowly from the well to avoid splash hazards. 4a. When sampling or purging the water using a bailer, pour water slowly to reduce the potential for splash hazards with groundwater. 4a. When using a tubing valve, always remove the valve slowly after sample collection to release any pressure and avoid pressurized splash hazards. 4a. When collecting a groundwater sample, always point the sampling apparatus (tubing, bailer, etc.) away from the face and body.
	4b. CONTACT: Personal injury from cuts, abrasions, or punctures by glassware or sharp objects.	4b. To avoid spills or breakage, place sampleware on an even surface. 4b. Do not over-tighten caps on glass sampleware. 4b. Wear chemical-resistant nitrile disposable gloves over cut-resistant (i.e., Kevlar) gloves when sampling and handling glassware (i.e., VOA vials) or when using approved cutting tools.
	4c. EXERTION: Muscle strain while carrying equipment.	4c. Use proper lifting techniques when handling/moving equipment, bend knees, and keep back straight. 4c. Use mechanical assistance or team lifting techniques when equipment is 40 lbs. or heavier. 4c. Make multiple trips to carry equipment.
	4d. CONTACT: With traffic.	4d. See 1b.
	4e. CONTACT: Pinch points with groundwater pump components (i.e., wheel, line, clamps).	4e. Wear cut-resistant gloves when working with groundwater pumps. 4e. Never place hands on or near pinch points such as the wheel, clamps, or other moving parts during pump operations. 4e. Use the correct mechanisms, such as a pump reel, to lower the pump into the well. 4e. Never attempt to manually stop any moving part of equipment, including hose reels and/or tubing.
	4f. EXERTION: Muscle strain from repetitive motion of bailing and sampling a well.	4f. See 4c. 4f. Include a stretch break when repetitive motions are part of the task.
5. Management of purge water.	**5a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors).	5a. Do not overfill the container, and pour liquids slowly so that they do not splash. 5a. Properly dispose of used materials/PPE in an appropriate container in the designated storage area.
	5b. EXERTION: Muscle strain from lifting/carrying, and moving containers.	5b. Use proper lifting techniques when lifting/carrying or moving container(s) (see 4c.). 5b. Do not overfill container(s).
6. Decontaminate equipment.	**6a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors).	6a. Work on the upwind side, where possible, of the decon area. 6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Use an absorbent pad to clean spills.
	6b. CAUGHT: Pinch points associated with handling hand tools	6b. See 2b. 6b. Inspect hand tools for sharp edges before decontaminating.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-014	DATE: 05/28/2025	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):
Generic	**Drilling**	**Hollow Stem Auger Soil Borings / Well Installation**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☒ GOGGLES: Spoggles required if winds exceed 15 mph. ☐ FACE SHIELD HEARING PROTECTION: (as needed). ☐ SAFETY SHOES: Steel or Composite Toe.	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent long-sleeve shirt or long-sleeve shirt and reflective safety vest.	☒ GLOVES: Cut-Resistant, and Nitrile. ☒**Error! Bookmark not defined.** OTHER: Insect Repellant, Sunscreen (as needed).

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Truck-Mounted Drilling Rig or Track Rig, Saw, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Interface Probe, 20 lb. Type ABC Fire Extinguisher, Traffic Cones/barrels, Caution Tape & Flags, "Work Area" Signs.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents.

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization/demobilization and establish a work area.	**1a. See Mobilization/ Demobilization JSA GEN-015.**	1a. See Mobilization / Demobilization JSA GEN-015.
2. Raising the tower/derrick of the drilling rig.	**2a. CONTACT:** Overhead hazards.	2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for overhead hazards (wires, tree limbs, piping, or other structures) that may be contacted by the rig's tower or drilling rods. 2a. The tower/derrick must not be raised beneath overhead power lines unless approved by the Roux PM. 2a. Maintain a minimum of 10' from all overhead structures. 2a. Do not move the rig while the tower/derrick is raised.
	2b. CONTACT: Amputation/crush points when raising the rig and the instability of the rig.	2b. Inspect the equipment prior to use and avoid any potential amputation points. 2b. Lower outriggers to ensure stability prior to raising the rig tower derrick. Keep feet and body out of the line of fire when lowering outriggers. 2b. Inspect the set-up location for uneven terrain. Level or avoid the area if needed. 2b. If the rig needs to be mounted, be sure to use three points of contact.
3. Advancement of augers for soil boring installation.	**3a. CONTACT:** Equipment imbalance during advancement of drill equipment.	3a. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3a. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. **3a. Drillers will maintain the "Purple Zone" policy surrounding augers to ensure no personnel come into contact with augers while in use. Workers can spray paint a 3' semi-circle surrounding the augers to visually show that no personnel should enter the "Purple Zone" while drilling activities are being conducted.** 3a. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (minimum exclusion zone of 20 feet).
	3b. CONTACT: Flying/spraying debris.	3b. Wear all required PPE (especially hand, eye, and ear protection). 3b. Maintain minimum EZ distance (i.e., swing/tip radius of rig) when rig is in operation to avoid potential line of fire hazards from flying materials or debris.
	3c. CAUGHT: Limb/extremity amputation, abrasion, and crushing.	3c. Inspect the equipment prior to use for potential pinch points. 3c. Test all emergency shutdown devices prior to drilling. 3c. Inspect the drill head for worn surface or missing teeth; replace it if damaged or blunt. 3c. Inspect augers; do not use if the auger flight is damaged or bent.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Advancement of augers for soil boring installation (Continued).	**3c. CAUGHT:** Limb/extremity amputation, abrasion, and crushing.	3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3c. All non-essential personnel should stay away from the immediate work area; position the body out of the line-of-fire of equipment, particularly when installing auger flights and steel override casings. 3c. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3c. Spinning augers should have an exclusion zone of 20 feet when in operation.
	3d. FALL: Slip/trip/fall hazards.	3d. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 3d. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 3d. Use established pathways and walk on stable, secure ground. 3d. Use three points of contact when mounting or dismounting the rig. 3d. Remove soil cuttings to avoid a tripping hazard from developing near augers.
	3e. EXPOSURE: Inhalation of contamination/vapors.	3e. Air monitoring using a calibrated photoionization detector (PID) and multi-gas meter to monitor the breathing zone of the work area. 3e. The Action Level for breathing zone air is five (5) parts per million (sustained) as detected by the PID. 3e. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings, and inform the Roux PM of the condition. The Roux PM will then recommend additional appropriate precautions in accordance with the site-specific health and safety plan.
	3f. EXPOSURE: Noise and dust.	3f. Wet borehole area with sprayer to minimize dust. Stand upwind and keep your body positioned away from the rig. 3f. Wear hearing protection while the drill rig is operating or the noise levels exceed 85 dBA.
	3g. EXERTION: Installing well casings and lifting augers.	3g. Keep back straight and bend at the knees. 3g. Utilize team lifting for objects heavier than 40 lbs. 3g. Use a mechanical lifting device for odd-shaped objects.
4. Installation of well materials.	**4a. CONTACT:** Installing well materials while also pulling up augers.	4a. Potential contact with augers during the installation of well materials. 4a. Keep distance from augers and do not place any materials while augers are in motion.
	4b. CAUGHT: Possible pinch or crush hazard assembling PVC and sending down the borehole.	4b. Keep all body parts out of potential pinch points while placing PVC together and sending down borehole.
	4c. FALL: Slip/trip/fall hazards with hand tools and materials.	4c. See 3d.
	4d. EXPOSURE: Potential contamination, harmful vapors, dust, and/or noise.	4d. See 3e and 3f. 4d. Stand upwind to avoid exposure to dust generated from packing materials.
	4e. EXERTION: Lifting heavy bags of materials to backfill the borehole.	4e. See 3g.
5. Cleaning the auger flights	**5a. CONTACT:** Cuts/scrapes or puncture wounds from contacting the auger.	5a. Follow the "Show Me Your Hands" Procedure and make sure the auger is out of gear before contacting the auger with the tool or hand. 5a. Pull the cleaning tool across your body with the handle away from your body; do not push toward the auger. 5a. Do not clean more than ¾ turn around the auger at a time. 5a. Wear cut-resistant and nitrile gloves. 5a. Always use two hands to operate the cleaning tool. 5a. Inspect the tool before use and remove from service if the handle or metal is cracked/fatigued. 5a. Stand out of the line of fire.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
6. Decontaminate equipment.	**6a. EXPOSURE / CONTACT:** To contamination (e.g., contaminated groundwater, vapors).	6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Contain decontamination water so that it does not spill. 6a. Use an absorbent pad to clean spills, if necessary.
	6b. EXPOSURE: To chemicals in cleaning solution (including ammonia).	6b. See 3e. Wear all appropriate PPE and stand upwind of any exposed cleaning solutions.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-015	DATE: 05/28/2025	☐NEW ☒REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Site Recon**	**Mobilization/Demobilization**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION (as needed) ☒ SAFETY SHOES: Steel Toe or composite toe	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest of high-visibility clothing; long-sleeved shirt; long pants	☒ GLOVES: Cut-resistant Level II, nitrile ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Varies

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EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilize/demobilize and establish a work area	**1a. FALL:** Slip/trips/falls from obstructions, uneven terrain, weather conditions, heavy loads, and/or poor housekeeping.	1a. Use 3 points-of-contact/ensure secure footing when entering and exiting the vehicle. 1a. Inspect walking path for uneven terrain, steep hills, obstructions, and/or weather-related hazards (i.e., ice, snow, and puddles) prior to mobilizing equipment. Use established pathways. Walk on stable/secure ground. 1a. Do not climb over stored materials/equipment; walk around. Practice good housekeeping; organize and store equipment neatly in one area at its lowest potential energy. 1a. Wear boots with adequate treads. 1a. Delineate unsafe areas with traffic safety cones, caution tape, and/or flagging.
	1b. CONTACT: Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities.	1b. Observe and maintain the posted speed limits. 1b. When first arriving onsite, park vehicles in designated parking spaces and/or out of the way locations. Use parking brake on all vehicles and tire chocks on work trucks and trailers. 1b. Check in with Site Manager/Supervisor to ensure coordination with other Site activities and to discuss any special hazards. Ensure that short-service employees (SSE) are identified. 1b. Identify potential traffic sources. 1b. Wear PPE, including high visibility clothing or reflective vest, when around vehicles or operating equipment 1b. Use a spotter while moving work vehicles; plan to avoid backing whenever possible. 1b. Maintain a minimum exclusion zone when vehicles are in motion (i.e., greater than the swing/tip radius of the equipment). When backing up the truck rig with an attached trailer, use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver-to-spotter visibility. 1b. Delineate work area with traffic cones, flags, caution tape, and/or other barriers. 1b. Position “Work Area” signs at Site entrances, if possible, or at either side of the work area. 1b. Position the largest vehicle to protect against oncoming traffic. 1b. Face traffic, maintain eye contact with oncoming vehicles, use a spotter, and establish a safe exit route.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
		1b. Observe potential overhead and ground surface features that may interfere with moving equipment. Clear the path of physical hazards prior to initiating mobilization.
	1c. CAUGHT: Personal injury from pinch points and being in the line of fire of the vehicle and/or equipment.	1c. Make sure the driver has engaged the parking brake and placed wheel chocks in a position to prevent movement. Be sure that the vehicle is parked in front/down gradient (positioned to block oncoming traffic) of the work area. 1c. Wear cut-resistant gloves (Kevlar or similar) when handling objects/tools or equipment, 1c. Keep body parts away from line-of-fire of equipment. 1c. Always carry tools by the handles and/or designated carrier. Ensure sharp-edged tools are sheathed/secure. 1c. Remove any loose jewelry. Avoid wearing loose clothing and/or ensure loose clothing is secure. 1c. Secure all items on the equipment, tighten up any items or features that have the potential to shift or break during mobilization.
	1d. OVEREXERTION: Muscle strains while lifting/carrying equipment.	1d. Use body positioning and lifting techniques that avoid muscle strain; keep back straight, lift with legs, turn with whole body, keep load close to body, and never reach with a load. 1d. Ensure that loads are balanced. Use assistance (mechanical or additional person) to carry equipment that is either unwieldy or over 50 lbs.
	1e. EXPOSURE: Personal injury from exposure to biological and environmental hazards.	1e. Inspect the area to avoid contact with biological hazards (i.e., poisonous plants, stinging insects, ticks, etc.). 1e. Wear long-sleeved clothes that can be treated with Permethrin, apply insect repellent (may contain DEET) to exposed skin, and inspect clothes and skin for ticks during and after work. 1e. Apply sunscreen (SPF 15+) if exposure to the sun for 30 minutes or more is expected.
	1f. EXPOSURE: Weather-related injuries.	1f. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, nausea, rapid and shallow breathing). Take breaks in cool places and hydrate as needed. 1f. Watch for cold stress symptoms (severe shivering, slowing body movement, weakness, stumbling or inability to walk, collapse). Take breaks in warm areas as needed. 1f. Wear clothing appropriate for weather and temperature conditions (e.g., rain jackets, snow pants, multiple layers). 1f. If lightning is observed, wait 30 minutes in a sheltered location (car is acceptable) before resuming work.
	1g. EXPOSURE: Personal injury from noise hazards.	1g. Wear hearing protection if sound levels exceed 85 dBA (if you must raise your voice for normal conversation).

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-017	DATE: 05/28/2025	☐NEW ☒REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):
GENERIC	**Drilling**	**Monitoring and Recovery Well Development**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION (as needed) ☒ SAFETY SHOES: Composite-toe or steel-toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Cut-resistant level II and Nitrile ☒ OTHER: Insect repellent, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment as needed: Truck Rig or support truck, Trailer, Traffic Safety cones and flags, Caution Tape, Interface Probe, Power Source, Submersible Pump, Surge Block/Plunger, 20 lb. Type ABC Fire Extinguisher, Holding Tanks and/or Buckets, Absorbent Pads, 5-gas meter, Tools as needed: Socket and Pipe Wrench, Screw Driver, Pry Bar, Ratchet, Vault Key, Clamp or Vice Grip.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

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"SHOW ME YOUR HANDS"
The driller and helper should show that their hands are clear of controls and moving parts.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization / Demobilization (**Review Mobilization and Demobilization JSA - GEN-015**)	**1a. CONTACT:** Equipment/property damage.	1a. The truck rig's tower/derrick will be lowered and secured prior to mobilization. 1a. Set up the work area/position equipment in a manner that eliminates or reduces the need for backing of trucks and trailers. 1a. All non-essential personnel should **maintain an exclusion zone greater than the swing/tip radius of the equipment.** 1a. Beep horn twice before backing up. 1a. When backing up with an attached trailer, use a spotter Position if able to avoid backing up and pull through.
	1b. FALL: Slip/trip/fall hazards.	1b Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Store equipment at the lowest potential energy.
2. Open/close well.	**2a. EXERTION:** Muscle strain (some wells have large vault covers).	2a. Keep back straight, lift with legs, keep the load close to the body, and never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use the buddy system or mechanical means when lifting objects heavier than 50 lbs or when the shape makes the object difficult to lift.
	2b. CAUGHT: Pinch points are associated with removing/replacing manholes and working with hand tools.	2b. Wear cut-resistant gloves when working with well vault/cover and hand tools. Do not put fingers under the well vault/cover. 2b. Use ratchet and pry bar for the well cover and inspect before use.
	2c. EXPOSURE: Potentially hazardous vapors.	2c. No open flames/heat sources. 2c. Allow the well to vent after opening it and before starting development activities to minimize exposure to vapors. Air monitoring must be performed prior to set up and during the well development activities. Work on the upwind side of the well.
	2d. CONTACT: Traffic.	2d. Wear required PPE, including high visibility clothing or reflective vest. 2d. Delineate work area with safety cones and/or other barriers. Position the vehicle to protect against oncoming traffic. 2d. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Develop well (mechanical surging).	**3a. CAUGHT:** Cut hazards and finger pinch points.	3a See 2b. 3a. Use required PPE, including cut-resistant level II gloves, when handling development equipment. Identify finger/hand pinch points. Keep hands away from active surge equipment. 3a. All non-essential personnel should **maintain an exclusion zone greater than the swing/tip radius of the equipment.**
	3b. CONTACT/EXPOSURE: Contamination (e.g., SPH, contaminated groundwater, vapors).	3b. See 2c. 3b. Wear Nitrile gloves and safety glasses. Insert and remove the surge block/plunger and line/cable slowly to avoid splashing at the surface. 3b. Use an absorbent pad to clean any spills.
	3c. EXERTION: Muscle strain from lifting equipment.	3c. See 2a. 3c. Use mechanical device to insert and remove surge block/plunger if greater than 40 lb.
	3d. CONTACT: Injury while handling wench line/cable, or with active surging equipment.	3d. If using a drill rig, inspect all wench lines/cables for any kinks or fraying prior to use. Replace any damaged lines/cables. Review the **Drill Rig checklist prior to development activities**. 3d. See 3a.
4. Purging well (pumping water to holding tanks/drums/buckets).	**4a. CAUGHT:** Pinch points are associated with connecting the hose to the tank. Pinch points are associated with handling the pump and hoses.	4a. See 3a. 4a. Ensure that fingers are not placed near the coupling when attaching and securing the hose(s). Do not place fingers under the pump/hoses. Wear cut-resistant gloves when handling pump/hose(s). 4a. Keep hands clear of any line of fire.
	4b. FALL: Using a side-mounted ladder when attaching a hose to the tank. Slip, trip, or fall from lines/hoses	4b. Inspect ladder steps to make sure steps are not bent/damaged and free of debris/fluid. 4b. Use three points of contact always when using a ladder. 4b. Use a hoist or other mechanical means to secure and move hoses. 4b. Utilize anti-whip cords and secure couplings on all pressurized hoses. Keep hoses and lines coiled and organized out of designated walking paths around the work zone.
	4c. CONTACT: Contamination (e.g., SPH, contaminated groundwater).	4c. Secure water hose to holding tanks/drums/buckets with clamp, vice grip, or similar tool. 4c. Do not overfill tanks, and purge/transfer liquids in such a manner that they do not splash. (See 3b). 4c. Dispose of used materials/PPE in the designated impacted PPE container.
	4d. EXERTION: Muscle strain from lifting/carrying equipment.	4d. See 2a.
	4e. FALL: Spilled purge water.	4e. Clean up any spills using absorbent pads or spill kits.
5. Decontaminate equipment	**5a. CONTACT/EXPOSURE:** Contamination (e.g., SPH, contaminated groundwater, vapors).	5a. See 3b.
	5b. EXPOSURE/CONTACT: Chemicals in the cleaning solution	5b. Decontaminate equipment in a well-ventilated area. Wear nitrile gloves to avoid skin contact with cleaning solutions.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

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JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Site Reconnaissance**	**Site Walk and Inspection**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: earplugs/muffs as necessary ☒ SAFETY SHOES: Steel or composite toed	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: High-visibility vest or high-vis outerwear	☒ GLOVES: /cut-resistant (level II)/chemical resistant ☒ OTHER: Tyvek and rubber boots as necessary, dust mask as necessary

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Site map, emergency contact list, documentation of urgent care/hospital routes, and/or guide familiar with Site, operating cell phone or walkie-talkie if Site allows, and bug spray.

Commitment to Safety – All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents.

SITE SECURITY: Before site inspection, verify the appropriate method to address Site Security concerns related to potential criminal activity, homeless population, and/or isolation concerns. Work with the Project Principal and/or Project Manager to address appropriately.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Check in with the Site contact.	**1a. CONTACT/EXPOSURE/FALL:** Personal injury caused by a lack of awareness of site-specific hazards.	1a. Inquire about hazards and other activities taking place at the Site. 1a. Inform Site contact of work scope, timeline, and location(s). 1a. Discuss emergency evacuation procedures and muster points with the Site contact.
2. Traversing the Site	**2a. CONTACT:** Property damage and personal injury caused by obstructions/vehicles or unauthorized personnel at remote Sites.	2a. All equipment must be stowed and secured prior to moving. 2a. Maintain speed limit as posted on-site. 2a. When possible, drive on established roadways. 2a. Yield to all pedestrians. 2a. Use pull-through spots or back into parking spots. 2a. Don high-visibility clothing/safety vest. If working at a remote Site, add orange accessories during hunting season.
	2b. FALL: Uneven terrain and weather conditions. Overgrown shrubs and vines. Equipment in the work zone.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 2b. Use established pathways and walk on stable, secure ground when possible. 2b. Communicate traversing hazards with others.
	2c. OVEREXERTION: Muscle strain while carrying equipment.	2c. When carrying equipment to/from the work area, use proper lifting techniques; keep back straight, lift with legs, keep the load close to the body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use the buddy system or mechanical means to maneuver items heavier than 40 lbs. If necessary, make multiple trips to carry equipment.
	2d. EXPOSURE: Biological hazards – ticks, bees/wasps, poison ivy, insects; (Ticks are most active whenever the temperature is above freezing, typically from March to November.)	2d. Inspect the area to avoid contact with biological hazards. 2d. Ticks: • Treat outer clothing, including pants, shirts, socks, boots, and hats, the evening before with Permethrin (allowing at least two hours before use). • Apply DEET or equivalent to exposed skin before travelling to the Site and reapply after two hours. • Wear light colored clothing and visually check for ticks during and after work. 2d. Bees: • Use bee spray as appropriate to deter/eliminate bees. • Protect exposed skin with insect repellent.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
		2d. Poison Ivy: • Identify areas of poison ivy and spray with weed killer. Don Tyvek and rubber boots while traversing poison ivy areas. • If skin comes into contact with poison ivy, wash the skin thoroughly with soap and water.
	2e. EXPOSURE: Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions.	2e. Wear sunscreen with SPF 15 or greater on exposed skin whenever 30 minutes or more of sun exposure is expected. 2e. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 2e. Watch for cold stress symptoms (severe shivering, slowing body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 2e. Wear appropriate rain gear as needed. 2e. Take frequent breaks if tired, wet, or cold/hot. Drink water. 2e. If lightning is observed, wait 30 minutes after the last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again.
3. Walking near heavy equipment and machinery.	**3a. CONTACT:** Personal injury from Site and roadway traffic. Personal injury from flying debris	3a. See 2a. 3a. Maintain an exclusion zone of at least 10 feet from all engaged equipment. Increase distance to include swing tip radius. 3a. Keep body parts out of the line-of-fire of pinch points. 3a. Wear appropriate PPE always.
	3b. OVEREXERTION: Personal injury from lifting/moving/rotating equipment.	3b. See 2c.
	3c. EXPOSURE: Hearing damage from noise-generating equipment/processes. Inhalation/exposure to hazardous vapors and or dust.	3c. Wear hearing protection if >85 dBA. (i.e., noise levels which require you to raise your voice to communicate) 3c. Always wear cut-resistant gloves when handling any tools or equipment. 3c. Always wear appropriate PPE based on the chemicals present.
	3d. EXPOSURE: Working in a remote area.	3d. Use the "buddy system" whenever possible. If working alone, contact PM upon arrival/departure and during work activities prior to commencing work if applicable. 3d. Always carry a communication device (i.e., cell phone, walkie-talkie) or directional (i.e., map, compass, etc.) when traversing remote areas. 3d. If available, follow Lone Worker Protocol/Procedure.
4. Working in adverse weather conditions.	**4a. EXPOSURE:** Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions.	4a. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 4a. Watch for cold stress symptoms (severe shivering, slowing body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 4a. Wear appropriate rain gear as needed. 4a. Take frequent breaks if tired, wet, or cold/hot. Drink water. 4a. If lightning is observed, wait 30 minutes after the last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again.
5. Departing Site.	**5a. EXPOSURE:** Exposure to unnecessary hazards should prompt personnel to believe Roux is on-site during an emergency and conduct a search.	5a. Sign out or notify the Site contact and Roux Project Manager of your departure.

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JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):
GENERIC	**Gauging & Sampling**	**Soil Sampling**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES ☒ FLAME RESISTANT CLOTHING (as needed)	☐ GOGGLES ☐ FACE SHIELD: ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel-toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: , Nitrile and cut resistant level II ☒ OTHER: Insect repellent, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Recommended Equipment: traffic safety cones, caution tape, trowel

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Secure location	**1a. CONTACT:** Personnel and vehicular traffic may enter the work area.	1a. If in an area with foot or vehicle traffic, delineate the work area with traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity. 1a. Wear a reflective vest and/or high visibility clothing. 1a. Face the direction of any vehicular traffic. Position the vehicle to protect the worker from traffic. 1a. Communicate work activity with adjacent work areas.
	1b. FALL: Tripping/falling due to uneven terrain or entry/exit from excavations.	1b. Inspect pathways and work area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions. 1b. Use established pathways and walk on stable, secure ground. 1b. Stage equipment and tools in a convenient, stable, and orderly manner. Store equipment at the lowest potential energy. 1b. Roux employees should stay 6 feet from in-progress excavations and trenches. Should entry to an excavation be required (when stabilization is complete), ladders must be employed for steep embankments, excavations, pits, and trenches.
	1c. EXPOSURE: Exposure to sun and excessive heat, possibly causing sunburn, heat exhaustion, or heat stroke. Exposure to cold temperatures may cause cold stress. Skin burn as a result of fire, if applicable. Exposure to explosive vapors due to tank farm operations. Exposure to airborne dust due to high wind speeds. Biological hazards - ticks, bees/wasps, poison ivy, thorns, insects, etc.	1c. Wear sunscreen with an SPF 15 or greater whenever 30 minutes or more of exposure is expected. 1c. Use a tent to shade the work area from direct sunlight, particularly when warm temperatures are expected. 1c. Be aware of the location of all Site personnel. 1c. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). 1c. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). 1c. Take breaks for rest and water as necessary. Move to an area that is well shaded or a climate-controlled area (i.e., car, site trailer, etc.). 1c. No open flames/heat sources. 1c. Conduct air monitoring and ensure that harmful vapor concentrations are within the levels detailed in the Site Specific HASP. Follow the procedures detailed in HASP for exceedances. 1c. Flame retardant clothing must be worn when specified by Site policy. 1c. Cell phones should be disabled when specified by Site policy. 1c. Pre-treat field clothing with Permethrin prior to site visit to kill ticks and insects. 1c. Wear long-sleeved shirts and tuck in (or tape) pant legs into socks or boots to prevent ticks from reaching skin. 1c. Spray insect repellent containing DEET or equivalent on exposed skin when working in overgrown areas of the Site. 1c. Inspect the area to avoid contact with biological hazards. 1c. Wear cut-resistant gloves when handling material, equipment, or branches, shrubs, etc. that may lie within the walking path. 1c. Wear spoggles if the average wind speeds are above 15 mph. 1c. Personnel shall examine themselves and their co-workers' outer clothing for ticks periodically when on-site. 1c. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water. If rash persists after washing, immediately notify your supervisor, the OM, and OHSM for possible consultation with a physician at an approved Occupational Health Clinic.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
2. Collect Soil Sample	**2a. CONTACT:** Personal injury from pinch points, cuts, and abrasions from sampling equipment, tools, and material within the soil sample. Personal injury from contact with moving equipment while sampling. Personal injury from contact with glass sample jars.	2a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant (nitrile) disposable gloves when handling soil samples and sampling jars. 2a. Where possible, use a trowel or equivalent tool to avoid contact with soil. 2a. If sampling from a bucket of heavy equipment, ensure all equipment is off and the operator utilizes the "show me your hands" policy. 2a. See 1a.
	2b. EXPOSURE: Exposure to contamination (impacted soil) and/or lab preservatives.	2b. Wear chemical-resistant (nitrile) disposable gloves over cut-resistant gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas. 2b. Wear safety glasses to protect eyes from dust or air-borne contaminants that may result from disturbing the soil. 2b. Where possible, remain upgradient from the sample location if collecting soil samples from stockpile, drill rig, etc., to avoid breathing contaminant vapors, if they are present. 2b. When collecting a soil sample from a hand auger, put a large zip lock bag over the entire auger to prevent soil from spilling onto the ground. 2b. Open sample jars slowly and fill carefully to avoid contact with preservatives.
	2c. EXERTION: Exertion due to repetitive motion and ergonomics.	2c. Utilize a table or raised surface for soil sampling if multiple soil samples are going to be taken to minimize repetitive bending motion.
3. Decontaminate equipment	**3a. EXPOSURE/CONTACT:** Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated vapors, and/or soil). **3b. EXPOSURE:** Chemicals in the cleaning solution include ammonia.	3a. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3a. Use an absorbent pad to clean spills. 3a. Properly dispose of used materials/PPE in the provided drums in the designated drum storage area. 3a. Remain upwind of the sample and avoid breathing contaminant vapors, if they are present. 3b. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3b. Work on the upwind side of the decontamination area. 3b. Use an absorbent pad to clean spills. 3b. Properly dispose of used materials/PPE in the provided drums in the designated drum storage area. Ensure that all drums are properly labeled and secured.

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JSA TYPE CATEGORY:	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Gauging and Sampling**	**Soil Vapor Sampling (Permanent Monitoring Points)**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Steel-toe composite safety boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Cut-resistant level ii & Nitriles ☒ OTHER: Bug Spray, Sun Screen, Knee Pads, or kneeling pad

REQUIRED AND / OR RECOMMENDED EQUIPMENT

9/16" Socket and Wrench, Non-Toxic Clay, Teflon-Lined Tubing, Masterflex Tubing, Air Pump with Low Flow, Dry Cal, Enclosure (Bucket with 2 holes), Helium Gas Canister, Summa Canisters and Flow Controllers, MultiRAE Photo Ionization Detector (PID), Helium Detector, Tubing Cutter, Traffic/Safety Cones, Caution Tape or Retractable Cone Bars

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

Work Zone (WZ): A 5-foot exclusion zone will be maintained for non-essential personnel.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Define and secure a work area.	**1a. FALL:** Potential tripping hazards.	1a. Ensure work area is secure and inform others (third party) of work activity. 1a. Remove tripping hazards and inspect the walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
	1b. CONTACT: Potential contact with moving vehicles or pedestrians.	1b. If working alongside roads, look both ways before entering roadways, face traffic, and utilize the work vehicle to protect employees. 1b. Delineate work area (including vehicles) with traffic safety cones and caution tape or retractable cone bars. 1b. Maintain a 5-foot exclusion zone. 1b. Wear high visibility clothing or a reflective safety vest.
	1c. EXERTION: Muscle strain while lifting and carrying equipment.	1c. When carrying equipment to/from the work area, keep back straight, lift with legs, keep the load close to the body, never reach with a load. Ensure that loads are balanced. Use the buddy system or mechanical means to maneuver loads heavier than 40 lbs. If necessary, make multiple trips to carry equipment.
2. Remove well cover / close well cover.	**2a. CONTACT/CAUGHT:** Pinch points and scrapes associated with hand tools and well covers.	2a. Keep hands away from pinch points. 2a. Use hand tools with extensions or a magnet to remove and replace well covers. 2a. Wear cut-resistant gloves. 2a. Use knee pads or a kneeling pad when repetitive kneeling on rough ground is anticipated.
	2b. FALL: Potential tripping hazards associated with installing bolts.	2b. Place security bolts in a secure location so as not to create tripping hazards. Replace security bolts so that they fit flush with monitoring well covers.
	2c. EXERTION: Physical exertion is required to remove bolts that were over-torqued or stripped.	2c. Replace any security bolts that show signs of stripping. Do not over-tighten. 2c. Use body positioning and bending techniques that minimize muscle strain; keep back straight, bend at the knees. 2c. See 2a.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Screen vapor point with PID.	**3a. FALL:** Potential tripping hazards associated with equipment.	3a. Place the equipment in one area close to the sampling location. 3a. Identify an area where the equipment is to be stored within the work area (away from the main walking path). 3a. Do not leave equipment on the ground. Return equipment to the storage area between uses.
	3b. EXPOSURE: Inhalation of soil vapor	3b. Replace brass caps immediately upon completion to avoid soil vapors migrating to the surface through sample tubing. 3b. Stand upwind of the sample point during screening activities.
4. Remove/replace brass caps at the end of the sample tubing.	**4a. CONTACT:** Pinch points are associated with hand tools and brass caps.	4a. Use a wrench to remove and replace brass caps. 4a. Wear cut-resistant gloves to protect against pinch points and scrapes.
	4b. EXPOSURE: Potential pathway for vapors to migrate to the land surface.	4b. See 3b. 4b. Stand upwind of the sample point location.
5. Set up soil vapor sampling equipment and calibration of meters.	**5a. FALL:** Potential tripping hazards associated with equipment and tubing.	5a. See 3a. 5a. Keep tubing slack to a minimum and locate the summa canister as close to the sampling location as possible. 5a. Avoid stepping over equipment and tubing.
	5b. CONTACT: Pinch points associated with handling equipment.	5b. Do not place fingers/hands under sampling equipment. 5b. Make multiple trips when unloading equipment in the work area. 5b. Wear cut-resistant gloves to protect against pinch points while handling sampling equipment.
	5c. EXPOSURE: Inhalation of calibration gas and helium.	5c. Review the SDS for each type of calibration gas used before calibrating. 5c. Calibrate meters in a well-ventilated area and keep the air flow regulator away from your face. 5c. Close valve on canisters after use to avoid inhalation of excess helium or calibration gas. 5c. Stand upwind of the bucket during the helium tracer gas test.
6. Cleaning Work Area.	**6a. FALL:** Potential tripping hazards are associated with equipment and tubing.	6a. See 3a. 6a. See 3b.
	6b. CONTACT: Storing and transport of equipment in car.	6b. Ensure that the equipment is placed securely in the vehicle. Do not stack equipment on top of each other. Secure the equipment so that it will not slide while being transported. 6b. Wear cut-resistant gloves while handling/loading equipment.

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JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Drilling**	**Pre-Drilling Clearance, Vactron, and Air Knife**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☒ FACE SHIELD (While Air Knifing) ☒ HEARING PROTECTION (As needed) ☒ SAFETY SHOES: Composite toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing; long-sleeve shirt	☒ GLOVES: Nitrile, cut-resistant Level II ☒ OTHER: Dusk mask, insect repellent, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Vac-Truck or Vac Drum, Compressor, Jack Hammer, Air Knife. Circular Saw, Hand Tools, Dust Mask, Photoionization Detector, Multi Gas Meter, Traffic safety cones and flags, Retractable Cone Bars, Caution Tape, 20 lb. Fire Extinguisher, "Work Area" Signs, Pressurized Water Sprayer

Commitment to Safety – All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

EXCLUSION ZONE: All non-essential personnel must maintain a distance of 10 feet from drilling equipment while it is in motion or engaged.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Verify pre-clearance protocol	**1a. CONTACT:** Underground utility damage; property damage; personal injury.	1a. Confirm "Call Before You Dig" and local utility companies were contacted before starting work to confirm utility mark outs. Must have a case # before digging. 1a Walk the Site to evaluate utility markings and review maps (see Site Walk Inspection JSA - GEN-019). Utilities are not always adequately marked out; ensure the use of observational skills through the pre-clearing checklist. 1a. Review the pre-clearing checklist form and the sub-surface clearance form. The pre-clearing protocol indicates that clearance must be conducted to a minimum of 5 vertical feet below the ground surface or 10 vertical feet below the ground surface in the critical zone using hand tools.
	1b. ENERGY SOURCE/CONTACT: Property damage; Pressurized water mains may cause lacerations or broken bones. Pressurized gas mains may explode, causing serious injury or death. Underground electric may cause severe burns, shock, or death.	1b. MUST Complete subsurface clearance checklist before pre-clearance. 1b. Pre-clearing of each soil boring/monitoring well location must be conducted to a minimum of 5 vertical feet below the ground surface (10 feet minimum for Critical Zone) using hand tools (shovel and non-metallic dig bar and hand auger) before drilling. The supervisor should be contacted to discuss the appropriate pre-clearing depth.
	1c. FALL: Slip, Trip, or Fall may cause muscle strains or tears, abrasions, lacerations, or broken bones.	1c. Be aware of the conditions when walking or loading equipment and working. Walk within an established pathway, avoiding uneven surfaces. Remove potential slip, trip, and fall hazards.
2. Mobilize/demobilize and establish a work area	**2a. SEE MOBILIZATION / DEMOBILIZATION JSA – GEN-015**	2a. See Mobilization / Demobilization JSA.
3. Concrete saw cutting, jackhammer, and hand clearance with hand tools, air knife	**3a. CONTACT:** Flying debris striking the face or body	3a Maintain a 10' minimum exclusion zone. Use the required PPE (i.e., cut-resistant gloves, safety glasses, and face shield). 3a. Use anti-whip devices on compressor hoses. Ensure hose couplings are secure. 3a Wear a face shield to protect your face from flying debris when using the air knife. 3a. Utilize a traffic cone, cage, or physical barriers over the hole during air knife activities to keep flying debris close to the ground.
	3b. EXPOSURE: Inhalation/exposure to hazardous vapors and/or concrete dust, noise exposure	3b. Monitor breathing zone with a calibrated PID and/or multi-gas meter. If meters sustain readings greater than recommended in the HASP for the specific contaminant of concern (COCs), the Roux field personnel must temporarily cease work and instruct all Site personnel to step away from the area of elevated readings. Contact PM. 3b. Wet concrete while using a saw to minimize dust, and may require donning respiratory protection. 3b. Stand upwind and keep your body behind the saw. Observers and helpers should stay out of the line of fire from the saw blade. Always cut away from the body. 3b. No open flames/heat sources. 3b. Wear hearing protection when a saw, jackhammer, or air compressor is in operation; otherwise, if sound levels exceed 85 dB, put on hearing protection.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
	3c. ENERGYSOURCE/CONTACT: Property damage; Pressurized water mains may cause lacerations or broken bones. Pressurized gas mains may explode, causing serious injury or death. Underground electric may cause severe burns, shock, or death.	3c. For air knifing, ensure extension/lance tip reaches the full 5 feet bgs. Air knife should be advanced **AT A MINIMUM** in all four corners of the expected boring location to find any possible arrangement of utilities. 3c. Ensure the diameter of the soil preclearance hole is at a **MINIMUM 2x** the diameter of any drilling or hard dig equipment that will be entering the hole, which rotates. For direct push applications (CPT, Geoprobe®, etc.), the borehole clearance diameter shall be at least 125% of the diameter of the largest tool being pushed through the subsurface (e.g., tip, rod, sampler, etc.). 3c. See the Complete subsurface clearance protocol for information provided above.
	3d. ERGONOMICS/EXERTION: Muscle strain due to poor body positioning when handling equipment and materials	3d. Use body positioning and lifting techniques that minimize muscle strain; keep back straight, lift with legs, keep load close to body, and never reach with a load. 3d. Ensure that loads are balanced to reduce the potential for muscle strain. 3d. Two people or a mechanical lifting aid are required when lifting objects over 40 lbs. or when the shape makes the object difficult to lift.
	3e. FALL: Tripping/falling due to uneven terrain, weather conditions, and materials/equipment stored at the Site	3e. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions before mobilizing equipment—mobilization/Demobilization JSA. 3e. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 3e. Use established pathways and walk on stable, secure ground. 3e. Equipment and tools will be stored at the lowest point of potential energy and out of the walkway and immediate work area (i.e., tools should not be propped against walls or nearby equipment or vehicles). 3e. Equipment and tools that are not anticipated to be used will be returned to a storage area that is out of the immediate work area. 3e. Ensure power cords and compressed air lines are grouped when used within the work area. 3e. The pre-cleared location will be finished flush to grade to prevent a slip/trip hazard, or it will be coned and taped off.
	3f. CAUGHT: Amputation points associated with the equipment and vacuum hose	3f. Always wear cut-resistant gloves when making connections, using hand tools, or when handling cutting tools. 3f. Inspect the equipment before use for potential pinch points. 3f. Test all emergency shutdown devices before working with the equipment. 3f. Inspect saw blade for worn surface or missing teeth; switch blade if damaged or blunt. 3f. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3f. All non-essential personnel shall maintain a 10-foot exclusion zone; position the body out of the line-of-fire of equipment. 3f. Drillers and helpers will understand and comply with the “Show Me Your Hands Policy”.
4. Move the drum to the staging area using the drum cart	**4a. EXPOSURE/CONTACT:** Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, soil)	4a. Wear Nitrile chemical-resistant gloves under cut-proof gloves. 4a. Do not overfill drums. Ensure that the drum lids are attached securely. 4a. All drums will be staged in the designated storage area.
	4b. EXERTION: Muscle strain while maneuvering drums with drum cart/lift gate	4b. See 3d. Do not overfill drums. Use the lift gate on the back of the truck to load and unload drums. Use a drum dolly to move the drum.
	4c. CAUGHT: Pinch points associated with handling the drum lid	4c. Ensure that fingers are not placed under the lid of the drum. Wear cut resistant gloves. Use appropriate ratchet while sealing drum lid.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
5. Decontaminate equipment.	**5a. EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors).	5a. Wear chemical-resistant disposable gloves and safety glasses. 5a. Contain decontamination water so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Spray equipment from side angle, not straight on, to avoid backsplash. 5a. See 3b.
	5b. EXPOSURE: To chemicals in cleaning solution.	5b. See 4a. Review SDS to ensure appropriate precautions are taken and understood.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-029	DATE: 05/29/2025	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Preclearing/Sampling**	**Hand Augering**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Steel or composite-toed boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Long-sleeved high-visibility clothing	☒ GLOVES: Cut Resistant level II / Nitrile / Chemical resistant ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Hand Auger Tools (buckets, rods), 5-gallon buckets, hand tools (hammer, etc.)

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

Assess [1] JOB STEPS	Analyze [2] POTENTIAL HAZARDS	Act [3] CRITICAL ACTIONS
1. Drive/walk to hand clearing/hand augering location	**1a. CONTACT:** Property damage and personal injury caused by obstructions/vehicles	1a. Maintain speed limit on-site. 1a. All equipment must be stowed and secured prior to moving. 1a. Drive on established roadways. 1a. Do not back up the vehicle without a spotter where visibility is limited; use pull-through spots or back into parking spots; use an audible signal (horn/back-up alarm) when backing up vehicles.
	1b. FALL: Personal injury from tripping/falling due to uneven terrain, weather conditions, and materials/equipment stored at portions of the Site	1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Use established pathways and walk on stable, secure ground. 1b. Use the established ramp when descending into/ascending from impoundment areas. 1b. Keep tools and equipment in a designated area. When not in use, tools and equipment must be returned to their proper storage location. Keep the work area clear of obstructions.
	1c. EXERTION: Muscle strain/exhaustion while carrying equipment (i.e., hand auger, post-hole digger, shovel, pry bar)	1c. When carrying equipment to/from the work area, use proper lifting techniques; keep back straight, lift with legs, keep the load close to the body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment.
	1d. EXPOSURE: Exposure to the sun, possibly causing sunburn. Biological hazards - bees/wasps, poison oak, thorns, insects, etc.	1d. Wear sunscreen with an SPF of at least 15 whenever 30 minutes or more of exposure is expected. 1d. Inspect the area to avoid contact with biological hazards. 1d. Wear cut-resistant gloves when handling material, debris, branches, shrubs, etc. that may lie within the walking path. 1d. Avoid any areas on-site that have poison oak.
Assess [1] JOB STEPS	**Analyze [2] POTENTIAL HAZARDS**	**Act [3] CRITICAL ACTIONS**
2. Secure location	**2a. CONTACT:** Personnel and vehicular traffic may enter the work area.	2a. Delineate the work area with traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity. 2a. Wear a reflective vest and/or fluorescent clothing. 2a. Face the direction of vehicular traffic. Position the vehicle to protect the worker from traffic. 2a. Communicate work activity with adjacent work areas.
	2b. FALL: Tripping/falling due to uneven terrain, and materials /equipment stored within the work area	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment to the impoundments. 2b. Equipment and tools will be staged in a convenient, stable, and orderly manner. 2b. Equipment and tools will be stored at the lowest point of potential energy and out of the walkway and immediate work area (i.e., tools should not be propped against walls or nearby equipment or vehicles). 2b. Equipment and tools that are not anticipated to be used will be returned to an appropriate storage area that is out of the immediate work area.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Verify pre-clearance protocol; review completed Subsurface Utility Checklist and utility verification site walkthrough.	**3a. ENERGY SOURCE:** Underground utility damage; property damage; personal injury	3a. Confirm that "Call Before You Dig"/811 and local utility companies were contacted prior to hand augering. 3a. Walk the Site to evaluate utility markings and review maps.
4. Augering/advancing borehole	**4a. EXPOSURE:** Contaminated soil/water/vapor	4a. Monitor the breathing zone with a PID when VOCs are a concern. If vapors exceed site-specific action levels, upgrade PPE as per the HASP. 4a. Wear chemical-resistant disposable gloves and safety glasses when handling impacted materials. 4a. Place excavated soil on plastic sheeting and store soil waste in a designated area. 4a. Work on the upwind side of the boring.
	4b. EXERTION: Muscle strain from lifting, bending, repetitive motion.	4b. Body positioning and rotating with the auger to reduce strain. Do not twist back.
	4c. CAUGHT: Personal injury as a result of jewelry/loose clothing caught on equipment, well covers, machinery, hand auger, pry bar, etc.	4c. No form of jewelry should be worn while on-site. 4c. Clothing must be appropriately sized so that it is not loose-fitting.
	4d. CONTACT/CAUGHT: Pinch points, abrasions	4d. Keep head and upper body clear when lifting hand auger, pry bar/post-hole digger. Ensure not to be overly aggressive when using the pry bar. 4d. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.
5. Lithologic observation and soil sampling	**5a. EXPOSURE:** Contact with contamination (impacted soil and/or lab preservatives)	5a. Wear chemical-resistant disposable gloves to protect hands when handling samples; wear safety glasses when on site and/or goggles when handling any preservatives; use containment material or plastic sheeting to protect surrounding areas. 5a. When collecting a soil sample from a hand auger, put a large zip lock bag over the entire auger to prevent the spillage of soil onto the ground. 5a. Open sample jars slowly and fill them carefully to avoid contact with preservatives.
6. Decontaminate equipment	**6a. EXPOSURE:** Contact with contamination (impacted soil and/or lab preservatives, decontamination solution)	6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Use an absorbent pad to clean spills. 6a. Properly dispose of used materials/PPE trash bags. 6a. Refer to the SDS for the decontamination solution for proper handling.
	6b. CONTACT/CAUGHT: pinch points and cuts/abrasions	6b. Keep fingers/hands out of pinch points when disassembling the hand auger during decontamination.

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ATTACHMENT B

Safety Data Sheets (SDSs) for Chemicals Used

SAFETY DATA SHEET

US OSHA Hazard Communication Standard (29 CFR 1910.1200) and Canada WHMIS 2015 which includes the amended Hazardous Products Act (HPA) and the Hazardous Products Regulation (HPR)

Issuing Date 15-Aug-2023 **Revision Date** 15-Aug-2023 **Revision Number** 1

1. Identification

Product identifier

Product Name Alconox

Other means of identification

Product Code(s) 1101, 1103, 1104, 1104-1, 1112, 1112-1, 1125, 1150

Synonyms None

Recommended use of the chemical and restrictions on use

Recommended use Cleaning agent; Detergent

Restrictions on use Do not mix with other detergents unless otherwise specified

Details of the supplier of the safety data sheet

Supplier Address
Alconox Inc.
30 Glenn St., Suite 309
White Plains, NY 10603 USA
914-948-4040

E-mail cleaning@alconox.com

Emergency telephone number

Emergency telephone ChemTel Inc.: North America: 1-888-255-3924
International: +1-813-248-0573

2. Hazard(s) identification

Classification

Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2A

Label elements

Warning

Hazard statements
Harmful if swallowed.
Causes skin irritation.
Causes serious eye irritation.



Precautionary Statements - Prevention
Wash face, hands and any exposed skin thoroughly after handling.
Do not eat, drink or smoke when using this product.
Wear protective gloves, eye protection and face protection.
Precautionary Statements - Response
Specific treatment (see information on this label).
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice and attention.
Skin
IF ON SKIN: Wash with plenty of water and soap.
If skin irritation occurs: Get medical advice and attention.
Take off contaminated clothing and wash it before reuse.
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor if you feel unwell.
Rinse mouth.
Precautionary Statements - Disposal
Dispose of contents and container to an approved waste disposal plant.

Unknown acute toxicity

Other information
May be harmful in contact with skin. Harmful to aquatic life with long lasting effects.

3. Composition/information on ingredients

Substance

Not applicable.

Mixture

Chemical name	CAS No.	Weight-%	Hazardous Material Information Review Act registry number (HMIRA registry #)	Date HMIRA filed and date exemption granted (if applicable)
Benzenesulfonic acid, mono-C10-16-alkyl derivs., sodium salts	68081-81-2	10-30	-	-
Sodium carbonate	497-19-8	7-13	-	-
Sodium Dodecyl Sulphate	151-21-3	0.5-1.5	-	-
Tetrasodium EDTA	64-02-8	0.1-1	-	-

*The exact percentage (concentration) of composition has been withheld as a trade secret.

4. First-aid measures

Description of first aid measures

General advice Show this safety data sheet to the doctor in attendance.

Inhalation Remove to fresh air. Get medical attention immediately if symptoms occur.

Eye contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

	Remove contact lenses, if present and easy to do. Continue rinsing. Keep eye wide open while rinsing. Do not rub affected area. Get medical attention if irritation develops and persists.
Skin contact	Wash off immediately with soap and plenty of water for at least 15 minutes. Get medical attention if irritation develops and persists.
Ingestion	Do NOT induce vomiting. Rinse mouth. Never give anything by mouth to an unconscious person. Call a physician.
Self-protection of the first aider	Avoid contact with skin, eyes or clothing. Wear personal protective clothing (see section 8).

Most important symptoms and effects, both acute and delayed

Symptoms	May cause redness and tearing of the eyes. Burning sensation.
Effects of Exposure	No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians	Treat symptomatically.

5. Fire-fighting measures

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	No information available.
Specific hazards arising from the chemical	No information available.
Hazardous combustion products	Sodium oxides, Carbon oxides, Sulfur oxides, Phosphorus oxides, Nitrogen oxides (NOx).

Explosion data

Sensitivity to mechanical impact	None.
Sensitivity to static discharge	None.

Special protective equipment and precautions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required.
Other information	Refer to protective measures listed in Sections 7 and 8.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Pick up and transfer to properly labeled containers.
Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

7. Handling and storage

Precautions for safe handling

Advice on safe handling	Avoid breathing dust. Handle in accordance with good industrial hygiene and safety

practice. Avoid contact with skin, eyes or clothing. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Keep out of the reach of children.

8. Exposure controls/personal protection

Control parameters

Exposure Limits This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering controls Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/face protection If splashes are likely to occur, wear safety glasses with side-shields.

Hand protection Wear nitrile or rubber gloves. Wear suitable gloves. Impervious gloves.

Skin and body protection Wear suitable protective clothing. Long sleeved clothing.

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.

General hygiene considerations Avoid breathing dust. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Avoid contact with skin, eyes or clothing.

9. Physical and chemical properties

Information on basic physical and chemical properties

Appearance	Off-white powder
Physical state	Solid
Color	Off-white
Odor	No information available
Odor threshold	No information available

Property	Values	Remarks • Method
pH	9.5 (1% Solution)	No data available
Melting point / freezing point		No data available
Initial boiling point and boiling range		No data available
Flash point		No data available
Evaporation rate		No data available
Flammability		No data available
Flammability Limit in Air		
Upper flammability or explosive limits		No data available
Lower flammability or explosive limits		No data available
Vapor pressure		No data available
Relative vapor density		No data available
Relative density		No data available
Water solubility		No data available

Solubility(ies)	No data available
Partition coefficient	No data available
Autoignition temperature	No data available
Decomposition temperature	No data available
Kinematic viscosity	No data available
Dynamic viscosity	No data available

Other information

Explosive properties	No information available.
Oxidizing properties	No information available.
Softening point	No information available
Molecular weight	No information available
VOC content	0 %
Liquid Density	No information available
Bulk density	No information available

10. Stability and reactivity

Reactivity None under normal use conditions.

Chemical stability Stable under normal conditions.

Possibility of hazardous reactions None under normal processing.

Conditions to avoid None known based on information supplied.

Incompatible materials Strong acids, Strong bases, Strong oxidizing agents.

Hazardous decomposition products None known based on information supplied.

11. Toxicological information

Information on likely routes of exposure

Product Information

Inhalation Specific test data for the substance or mixture is not available. May cause irritation of respiratory tract.

Eye contact Specific test data for the substance or mixture is not available. Causes serious eye irritation. (based on components). May cause redness, itching, and pain.

Skin contact Specific test data for the substance or mixture is not available. Causes skin irritation. (based on components).

Ingestion Specific test data for the substance or mixture is not available. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Harmful if swallowed. (based on components).

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms Redness. May cause redness and tearing of the eyes.

Acute toxicity Harmful if swallowed.

Numerical measures of toxicity

The following values are calculated based on chapter 3.1 of the GHS document:

ATEmix (oral)	1,962.10 mg/kg
ATEmix (dermal)	2,660.40 mg/kg
ATEmix (inhalation-dust/mist)	6.95 mg/l

Unknown acute toxicity

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Sodium carbonate	= 4090 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 2300 mg/m³ (Rat) 2 h
Sodium Dodecyl Sulphate	= 1288 mg/kg (Rat)	= 200 mg/kg (Rabbit)	> 3900 mg/m³ (Rat) 1 h
Tetrasodium EDTA	= 1658 mg/kg (Rat)	-	-

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Classification based on data available for ingredients. Causes skin irritation.

Serious eye damage/eye irritation Classification based on data available for ingredients. Causes serious eye irritation.

Respiratory or skin sensitization No information available.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

12. Ecological information

Ecotoxicity Harmful to aquatic life with long lasting effects.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Sodium carbonate 497-19-8	-	LC50: =300mg/L (96h, Lepomis macrochirus) LC50: 310 - 1220mg/L (96h, Pimephales promelas)	-	EC50: =265mg/L (48h, Daphnia magna)
Sodium Dodecyl Sulphate 151-21-3	EC50: =53mg/L (72h, Desmodesmus subspicatus) EC50: 30 - 100mg/L (96h, Desmodesmus subspicatus) EC50: =117mg/L (96h, Pseudokirchneriella subcapitata) EC50: 3.59 - 15.6mg/L (96h, Pseudokirchneriella subcapitata)	LC50: 15 - 18.9mg/L (96h, Pimephales promelas) LC50: 8 - 12.5mg/L (96h, Pimephales promelas) LC50: 22.1 - 22.8mg/L (96h, Pimephales promelas) LC50: 4.3 - 8.5mg/L (96h, Oncorhynchus mykiss) LC50: =4.62mg/L (96h, Oncorhynchus mykiss) LC50: =4.2mg/L (96h, Oncorhynchus mykiss) LC50: =7.97mg/L (96h, Brachydanio rerio) LC50: 9.9 - 20.1mg/L (96h, Brachydanio rerio) LC50: 4.06 - 5.75mg/L	-	EC50: =1.8mg/L (48h, Daphnia magna)

		(96h, Lepomis macrochirus) LC50: 4.2 - 4.8mg/L (96h, Lepomis macrochirus) LC50: =4.5mg/L (96h, Lepomis macrochirus) LC50: 5.8 - 7.5mg/L (96h, Pimephales promelas) LC50: 10.2 - 22.5mg/L (96h, Pimephales promelas) LC50: 6.2 - 9.6mg/L (96h, Pimephales promelas) LC50: 13.5 - 18.3mg/L (96h, Poecilia reticulata) LC50: 10.8 - 16.6mg/L (96h, Poecilia reticulata) LC50: =1.31mg/L (96h, Cyprinus carpio)		
Tetrasodium EDTA 64-02-8	-	LC50: =41mg/L (96h, Lepomis macrochirus) LC50: =59.8mg/L (96h, Pimephales promelas)	-	-

Persistence and degradability No information available.

Bioaccumulation

Component Information

Chemical name	Partition coefficient
Sodium Dodecyl Sulphate 151-21-3	1.6

Other adverse effects No information available.

13. Disposal considerations

Disposal methods

Waste from residues/unused products Dispose of in accordance with local regulations, Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

California waste information This product contains one or more substances that are listed with the State of California as a hazardous waste.

14. Transport information

DOT Not regulated

TDG Not regulated

IATA Not regulated

IMDG Not regulated

15. Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

International Inventories
Contact supplier for inventory compliance status

US Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories
Should this product meet EPCRA 311/312 Tier reporting criteria at 40 CFR 370, refer to Section 2 of this SDS for appropriate classifications.

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
Pentasodium Triphosphate 7758-29-4	-	X	X
Tetrasodium pyrophosphate 7722-88-5	X	X	X

U.S. EPA Label Information

EPA Pesticide Registration Number Not applicable

16. Other information

NFPA	**Health hazards** 2	**Flammability** 0	**Instability** 0	**Special hazards** -
HMIS	**Health hazards** 2	**Flammability** 0	**Physical hazards** 0	**Personal protection** X

(M)SDS Number UL-NOX-003

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend
SVHC: Substances of Very High Concern for Authorization:
PBT: Persistent, Bioaccumulative, and Toxic (PBT) Substances
vPvB: Very Persistent and very Bioaccumulative (vPvB) Substances
STOT: Specific Target Organ Toxicity
ATE: Acute Toxicity Estimate
LC50: 50% Lethal Concentration
LD50: 50% Lethal Dose

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitizers		

Key literature references and sources for data used to compile the SDS
U.S. Environmental Protection Agency ChemView Database
European Food Safety Authority (EFSA)
Environmental Protection Agency
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australia National Industrial Chemicals Notification and Assessment Scheme (NICNAS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
U.S. National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
World Health Organization

Issuing Date 15-Aug-2023

Revision Date 15-Aug-2023

Revision Note Initial Release.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Diesel Fuel

Product Use: Blendstock, Chemical Feedstock, Fuel Oil, Fuel
Synonyms: #2 ULSD; Dyed Diesel Fuel; Fuel Oil; #1 ULSD; CARB Diesel; CARB Diesel; Diesel; Diesel fuel – all grades; Diesel Fuels; Fuel Oil #1; Fuel Oil #2; Heating oil; HO; HSHO; Kero; Kerosene; LSHO; No. 1 ULSD; No. 2 ULSD; Off Road Diesel Fuel, B2 – B20 Diesel; R2 – R20 Diesel Fuel; SDS 900; ULS No. 1 Diesel; ULS No. 2 Diesel; ULSD; ULSK; Ultra Low Sulfur Diesel; Winter diesel
Company Identification
REG Marketing & Logistics Group, LLC
416 South Bell Avenue
Ames, IA 50010
United States of America

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency & Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
Product Information: Phone: 1 888.734.8686 / Email: REG-SDSDistribution@chevron.com

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION:
- Flammable liquid: Category 3.
- Acute inhalation toxicant: Category 4.
- Aspiration toxicant: Category 1.
- Carcinogen: Category 2.
- Skin irritation: Category 2.
- Target organ toxicant (central nervous system): Category 3.
- Target organ toxicant (repeated exposure): Category 2.
- Target organ toxicant (respiratory irritant): Category 3.
- Acute aquatic toxicant: Category 2.
- Chronic aquatic toxicant: Category 2.



Signal Word: Danger
Physical Hazards:
- Flammable liquid and vapour.

Health Hazards:

- May be fatal if swallowed and enters airways.
- Causes skin irritation.
- Harmful if inhaled.
- May cause respiratory irritation.
- May cause drowsiness or dizziness.
- Suspected of causing cancer.
- May cause damage to organs (Blood/Blood Forming Organs, Liver, Thymus) through prolonged or repeated exposure.

Environmental Hazards:
- Toxic to aquatic life with long lasting effects.

PRECAUTIONARY STATEMENTS:
Prevention:
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
- Keep container tightly closed.
- Keep cool.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- Do not breathe dust/fume/gas/mist/vapours/spray.
- Wash thoroughly after handling.
- Use only outdoors or in a well-ventilated area.
- Avoid release to the environment.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Use personal protective equipment as required.

Response:
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- IF ON SKIN: Wash with plenty of soap and water.
- IF INHALED: Remove person to fresh air and keep comfortable for breathing.
- IF exposed or concerned: Get medical advice/attention.
- Specific treatment (see Notes to Physician on this label).
- Do NOT induce vomiting.
- If skin irritation occurs: Get medical advice/attention.
- Take off contaminated clothing and wash it before reuse.
- In case of fire: Use media specified in the SDS to extinguish.
- Collect spillage.

Storage:
- Store in a well-ventilated place. Keep container tightly closed.
- Store locked up.

Disposal:
- Dispose of contents/container in accordance with applicable local/regional/national/international regulations.

HAZARDS NOT OTHERWISE CLASSIFIED: Not Applicable

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT

Fuel Oil, No. 2	68476-30-2	0 - 100 %weight
Kerosene	8008-20-6	0 - 100 %weight
Fatty acids, C14-18 and C16-18-unsatd., Methyl esters	67762-26-9	0 - 95 %weight
Fuels, diesel, C9-18 alkane branched and linear	1159170-26-9	0 - 95 %weight
Naphthalene	91-20-3	< 3 %weight

SECTION 4 FIRST AID MEASURES

Description of first aid measures
Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: Wash skin with water immediately and remove contaminated clothing and shoes. Get medical attention if any symptoms develop. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: If swallowed, get immediate medical attention. Do not induce vomiting. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue or if any other symptoms develop.

Most important symptoms and effects, both acute and delayed
IMMEDIATE HEALTH EFFECTS
Eye: Contact with the eyes may cause irritation. Not expected to cause prolonged or significant eye irritation.
Skin: Contact with the skin causes irritation. Skin contact may cause drying or defatting of the skin. Symptoms may include pain, itching, discoloration, swelling, and blistering. Contact with the skin is not expected to cause an allergic skin response.
Ingestion: Highly toxic; may be fatal if swallowed. Because of its low viscosity, this material can directly enter the lungs, if swallowed, or if subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death. May be irritating to mouth, throat, and stomach. Symptoms may include pain, nausea, vomiting, and diarrhea.
Inhalation: The vapor or fumes from this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty breathing. Excessive or prolonged breathing of this material may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death. If this material is heated, fumes may be unpleasant and produce nausea and irritation of the eye and upper respiratory tract.

DELAYED OR OTHER HEALTH EFFECTS:
Cancer: Prolonged or repeated exposure to this material may cause cancer. Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).
Target Organs: Contains material that may cause damage to the following organ(s) following repeated inhalation at concentrations above the recommended exposure limit: Liver Blood/Blood Forming Organs Thymus
Medical Conditions Aggravated by Exposure: Exposure to naphthalene may aggravate existing blood disorders. Individuals with congenital erythrocyte glucose-6-phosphate dehydrogenase deficiency may be particularly susceptible to the hemolytic effects of naphthalene.

See Section 11 for additional information. Risk depends on duration and level of exposure.

Indication of any immediate medical attention and special treatment needed
Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames. Do not use water spray or a direct stream of water.
Unusual Fire Hazards: See Section 7 for proper handling and storage.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: This material will burn although it is not easily ignited. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion. Combustion may form oxides of: Hydrocarbons, Nitrogen, Sulfur.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Precautionary Measures: Liquid evaporates and forms vapor (fumes) which can catch fire and burn with explosive force. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches.
Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Do not breathe vapor or fumes. Wash thoroughly after handling.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.

Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

General Storage Information: DO NOT USE OR STORE near heat, sparks, flames, or hot surfaces . USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the workplace when designing engineering controls and selecting personal protective equipment (PPE). If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, refer to PPE information below.

Factors that affect PPE include, but are not limited to: properties of the chemical, other chemicals which may contact the same PPE, physical requirements (fit & sizing, cut/puncture protection, dexterity, thermal protection, etc.), and potential allergic reactions to the PPE material. It is the responsibility of the user to read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances. Refer to appropriate CEN standards.

ENGINEERING CONTROLS:
Use general ventilation, local exhaust ventilation, or a combination of both.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: Wear protective equipment to prevent eye contact. Selection of protective equipment may include safety glasses, chemical goggles, face shields, or a combination depending on the work operations conducted.
Skin Protection: Wear chemical personal protective equipment (PPE) to prevent skin contact. Selection of chemical protective clothing should be performed by an Occupational Hygienist or Safety Professional and be based upon applicable standards (ASTM F739 or EN 374). Using chemical PPE depends upon operations conducted and may include chemical gloves, boots, chemical apron, chemical suit, and complete facial protection. **Refer to PPE manufacturers to obtain breakthrough time information to determine how long PPE can be used before it needs to be replaced.** Unless specific glove manufacturer data indicates otherwise, the below table is based upon available industry data to assist in the glove selection process and is intended to be used as reference only.

Chemical Glove Material	Thickness (mm)	Typical Breakthrough Time (minutes)
Nitrile	0.5	5
Viton Butyl	0.3	60

Butyl	**Not recommended for use**
Neoprene	**Not recommended for use**
Polyvinyl Chloride (PVC)	**Not recommended for use**

Respiratory Protection: Determine if airborne concentrations are below the recommended occupational exposure limits for jurisdiction of use. If airborne concentrations are above the acceptable limits, wear an approved respirator that provides adequate protection from this material, such as: Air-Purifying

Respirator for Organic Vapors.

Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	Form	TWA	STEL	Ceiling	Notation
Fuel Oil, No. 2	ACGIH	Inhalable fraction and vapor	100 mg/m3	--	--	Skin total hydrocarbon
Kerosene	ACGIH	Vapor	200 mg/m3	--	--	Skin
Fuel Oil, No. 2	ACGIH	Vapor and aerosol	100 mg/m3	--	--	Skin total hydrocarbon
Kerosene	CVX	Vapor	200 mg/m3	--	--	Skin
Fuel Oil, No. 2	CVX	Vapor and aerosol	100 mg/m3	--	--	--
Naphthalene	ACGIH	--	10 ppm	--	--	Skin
Naphthalene	ACGIH	Vapor	10 ppm	15 ppm	--	A4 Skin
Naphthalene	OSHA Z-1	--	50 mg/m3	--	--	--

Consult local authorities for appropriate values.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Varies depending on specification
Physical State: Liquid
Odor: Petroleum naphtha odor
Odor Threshold: No data available
pH: Not Applicable
Vapor Pressure: <13 psia
Relative Vapor Density: No data available
Initial Boiling Point: >130°C (266°F)
Solubility: Negligible
Freezing Point: No data available
Melting Point: No data available
Specific Gravity: 67 @ 15.6°C (60°F)
Particle Characteristics: Not applicable
Density: No data available
Kinematic Viscosity: 1.3 mm2/s - 4.1 mm2/s @ 40°C (104°F)
Coefficient of Therm. Expansion / °F: No data available
Evaporation Rate: Not Applicable
Decomposition temperature: No data available
Partition coefficient n-octanol/water (logarithmic value): No data available

FLAMMABLE PROPERTIES:
Flammability (solid, gas): No Data Available

Flashpoint: > 38 °C (> 100 °F)
Autoignition: > 210 °C (> 410 °F)
Flammability (Explosive) Limits (% by volume in air): Lower: 0.4 Upper: 8

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Conditions to Avoid: Do not store near sources of ignition. Do not heat above flash point. Avoid contact with mineral acid/alkali.
Incompatibility With Other Materials: Not applicable
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects
Serious Eye Damage/Irritation: The material is not considered an eye irritant. The product has not been tested. The statement is based on evaluation of data for similar materials or product components.

Skin Corrosion/Irritation: This material causes skin irritation. The product has not been tested. The statement is based on evaluation of data for similar materials or product components.

Skin Sensitization: The material is not considered a skin sensitizer. The product has not been tested. The statement is based on evaluation of data for similar materials or product components.

Acute Dermal Toxicity: LD50: >2000 mg/kg (rabbit).

Acute Oral Toxicity: LD50: >5000 mg/kg (rat).

Acute Inhalation Toxicity: LC50: 1 - 5 mg/l (rat).
Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The material is not considered a mutagen. The product has not been tested. The statement is based on evaluation of data for similar materials or product components.

Carcinogenicity: This material is suspected of causing cancer. The product has not been tested. The statement is based on evaluation of data for similar materials or product components. Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Reproductive Toxicity: The material is not considered a reproductive toxicant. The product has not been tested. The statement is based on evaluation of data for similar materials or product components.

Specific Target Organ Toxicity - Single Exposure: This material may cause drowsiness or dizziness. The product has not been tested. The statement is based on evaluation of data for similar materials or product components.
This material may cause respiratory irritation. The product has not been tested. The statement is based on evaluation of data for similar materials or product components.

Specific Target Organ Toxicity - Repeated Exposure: This material may cause damage to organs through prolonged or repeated exposure. The product has not been tested. The statement is based on evaluation of data for similar materials or product components.

Aspiration Hazard: This material is considered an aspiration hazard based on the kinematic viscosity of the material.

ADDITIONAL TOXICOLOGY INFORMATION:

This product contains naphthalene.

GENERAL TOXICITY: Exposure to naphthalene has been reported to cause methemoglobinemia and/or hemolytic anemia, especially in humans deficient in the enzyme glucose-6-phosphate dehydrogenase. Laboratory animals given repeated oral doses of naphthalene have developed cataracts.

REPRODUCTIVE TOXICITY AND BIRTH DEFECTS: Naphthalene did not cause birth defects when administered orally to rabbits, rats, and mice during pregnancy, but slightly reduced litter size in mice at dose levels that were lethal to the pregnant females. Naphthalene has been reported to cross the human placenta. GENETIC TOXICITY: Naphthalene caused chromosome aberrations and sister chromatid exchanges in Chinese hamster ovary cells, but was not a mutagen in several other in-vitro tests.CARCINOGENICITY: In a study conducted by the National Toxicology Program (NTP), mice exposed to 10 or 30 ppm of naphthalene by inhalation daily for two years had chronic inflammation of the nose and lungs and increased incidences of metaplasia in those tissues. The incidence of benign lung tumors (alveolar/bronchiolar adenomas) was significantly increased in the high-dose female group but not in the male groups. In another two-year inhalation study conducted by NTP, exposure of rats to 10, 30, and 60 ppm naphthalene caused increases in the incidences of a variety of nonneoplastic lesions in the nose. Increases in nasal tumors were seen in both sexes, including olfactory neuroblastomas in females at 60 ppm and adenomas of the respiratory epithelium in males at all exposure levels. The relevance of these effects to humans has not been established. No carcinogenic effect was reported in a 2-year feeding study in rats receiving naphthalene at 41 mg/kg/day.

This product contains kerosene. CONCAWE (product dossier 94/106) has summarized current health, safety and environmental data available for a number of kerosenes (typically straight-run kerosene, CAS 8008-20-6, or hydrodesulfurized kerosene, CAS 64742-81-0). ACUTE/SUBCHRONIC: Following acute exposure to kerosene, signs observed in rats and rabbits were of a low order of toxicity: central nervous system depression occurred following oral exposure, skin irritation (ranging from slight to severe irritation) occurred with dermal exposure, and respiratory tract irritation occurred with inhalation exposure. None of the kerosenes tested produced more than slight eye irritation and none were skin sensitizers. However, intratracheal administration or artificial aspiration of small volumes (0.1 to 0.2 ml) of kerosene into the lungs of rats, chickens and primates resulted in lung damage and/or death. In a study in which rats, mice, rabbits and cats were exposed to kerosene aerosol concentrations in the range 0.05 to 120 mg/l for up to four weeks, reductions in respiratory rate, pulmonary hyperaemia, leucocytosis, monocytosis and decreased erythrocyte sedimentation rate were observed, and histological examination revealed inflammatory changes in the respiratory tract (tracheitis, bronchitis and pneumonia).

CANCER: Chronic (3 to 24 months) mouse dermal toxicity studies of kerosenes and jet fuels produced mild to moderate skin irritation, while long-term (2+ years) studies showed moderate to severe skin damage as well as an increased incidence of tumors after long latency periods (probably due to a secondary mechanism related to skin irritancy). DEVELOPMENTAL/REPRODUCTION: Hydrodesulfurized kerosene was tested by the Petroleum Product Stewardship Council in a OECD Guideline 421 Reproductive/Developmental Toxicity Study. The kerosene sample was diluted to 494 (60%), 330 (40%),and 165 (20%) mg/kg/day in food grade mineral oil and applied daily during pre-mating and mating to day 19 of gestation. There was no apparent maternal, reproductive, or developmental toxicity at any dose. Males treated for eight weeks had increased relative kidney weights in the high dose group but no microscopic changes in testes or epididymides. No gross anomalies were observed in the pups.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY

This material is expected to be toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

The product has not been tested. The statement has been derived from the properties of the individual

components.

MOBILITY
No data available.

PERSISTENCE AND DEGRADABILITY
This material is expected to be readily biodegradable. The product has not been tested. The statement has been derived from the properties of the individual components.

POTENTIAL TO BIOACCUMULATE
Bioconcentration Factor: No data available.
Partition coefficient n-octanol/water (logarithmic value): No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by international, country, or local laws and regulations.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: UN1202, DIESEL FUEL, 3, III

IMO/IMDG Shipping Description: UN1202, DIESEL FUEL, 3, III, (FLASH POINT SEE SECTION 9), MARINE
POLLUTANT (DIESEL FUEL)

ICAO/IATA Shipping Description: UN1202, DIESEL FUEL, 3, III

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:
Not applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:
Acute toxicity (any route of exposure)
Aspiration Hazard
Carcinogenicity
Flammable (gases, aerosols, liquids, or solids)
Skin Corrosion or Irritation
Specific target organ toxicity (single or repeated exposure)

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	05=MA RTK
01-2A=IARC Group 2A	06=NJ RTK
01-2B=IARC Group 2B	07=PA RTK
02=NTP Carcinogen	08-1=TSCA 5(e)
03=EPCRA 313	08-2=TSCA 12(b)

04=CA Proposition 65

The following components of this material are found on the regulatory lists indicated.

Fuel Oil, No. 2	06, 07
Kerosene	05, 06, 07
Naphthalene	01-1, 01-2B, 02, 03, 04, 05, 06, 07

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: DSL (Canada), TSCA (United States).

One or more components does not comply with the following chemical inventory requirements: AIIC (Australia), EINECS (European Union), ENCS (Japan), IECSC (China), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TCSI (Taiwan).

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 2 Flammability: 2 Reactivity: 0

HMIS RATINGS: Health: 2* Flammability: 2 Reactivity: 0
(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

REVISION STATEMENT: This is a new Safety Data Sheet.
No revision information

Revision Date: December 01, 2023

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	PNOS - Particles Not Otherwise Specified

Prepared according to the 29 CFR 1910.1200 (2012) by Chevron Technical Center, 6001 Bollinger Canyon Road, San Ramon, CA 94583.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility

for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

SAFETY DATA SHEET

Helium

Section 1. Identification

GHS product identifier : Helium

Chemical name : Helium

Other means of identification : helium (dot); Helium-4; He; o-Helium; UN 1046,Helium USP

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : helium (dot); Helium-4; He; o-Helium; UN 1046,Helium USP

SDS # : 001025

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : GASES UNDER PRESSURE - Compressed gas

GHS label elements

Hazard pictograms :



Signal word : Warning

Hazard statements : Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction.

Prevention : Not applicable.

Response : Not applicable.

Storage : Protect from sunlight. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : Helium

Other means of identification : helium (dot); Helium-4; He; o-Helium; UN 1046,Helium USP

Product code : 001025

CAS number/other identifiers

CAS number : 7440-59-7

Ingredient name	%	CAS number
Helium	100	7440-59-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous.

Section 7. Handling and storage

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Helium	**ACGIH TLV (United States, 3/2019). Oxygen Depletion [Asphyxiant].**

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls/personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Odor : Odorless.

Odor threshold : Not available.

pH : Not available.

Melting point : -272.2°C (-458°F)

Boiling point : -268.9°C (-452°F)

Critical temperature : -267.9°C (-450.2°F)

Flash point : [Product does not sustain combustion.]

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Not available.

Vapor pressure : Not available.

Vapor density : 0.14 (Air = 1) Liquid Density@BP: 7.8 lb/ft3 (125 kg/m3)

Specific Volume (ft ^{3}/lb) : 96.1538

Gas Density (lb/ft ^{3}) : 0.0104

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : Not available.

Partition coefficient: n-octanol/water : 0.28

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Molecular weight : 4 g/mole

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 10. Stability and reactivity

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Section 11. Toxicological information

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Helium	0.28	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1046	UN1046	UN1046	UN1046	UN1046
UN proper shipping name	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED
Transport hazard class(es)	2.2 	2.2 	2.2 	2.2 	2.2 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : **Limited quantity** Yes.
Quantity limitation Passenger aircraft/rail: 75 kg. Cargo aircraft: 150 kg.

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
Passenger Carrying Road or Rail Index 75

IATA : **Quantity limitation** Passenger and Cargo Aircraft: 75 kg. Cargo Aircraft Only: 150 kg.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

Section 15. Regulatory information

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

This product does not require a Safe Harbor warning under California Prop. 65.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS)**: Not determined.
Japan inventory (ISHL): Not determined.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Taiwan : This material is listed or exempted.

Thailand : Not determined.

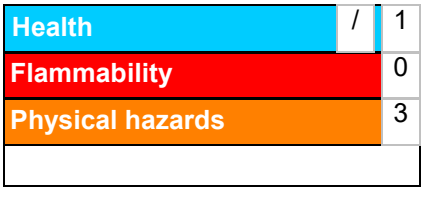
Turkey : Not determined.

United States : This material is active or exempted.

Viet Nam : This material is listed or exempted.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



Section 16. Other information

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
GASES UNDER PRESSURE - Compressed gas	Expert judgment

History

Date of printing : 1/27/2021

Date of issue/Date of revision : 1/27/2021

Date of previous issue : 4/23/2018

Version : 1.02

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

Creation Date 24-Aug-2009 **Revision Date** 13-Oct-2023 **Revision Number** 8

1. Identification

Product Name **Hydrochloric acid**

Cat No. : **A481-212; A481-212LC; S71942SC; S71943; S71943ND; S80036; S80038; SA49**

CAS No 7647-01-0
Synonyms Muriatic acid; Hydrogen chloride; HCl (Technical/Certified ACS Plus/Optima/NF/FCC)

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Skin Corrosion/Irritation	Category 1 B
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
May be corrosive to metals

Causes severe skin burns and eye damage
May cause respiratory irritation



Precautionary Statements
Prevention
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Keep only in original container
Response
Immediately call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in corrosive resistant polypropylene container with a resistant inliner
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Water	7732-18-5	62-65
Hydrochloric acid	7647-01-0	35-38

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Remove to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a

pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.

Ingestion Do NOT induce vomiting. Call a physician or poison control center immediately.

Most important symptoms and effects Causes burns by all exposure routes. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature No information available
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Corrosive material. Causes burns by all exposure routes. Thermal decomposition can lead to release of irritating gases and vapors.

Hazardous Combustion Products
Hydrogen chloride gas.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Ensure adequate ventilation. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Do not get in eyes, on skin, or on clothing.

Environmental Precautions Should not be released into the environment. See Section 12 for additional Ecological Information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Do not breathe mist/vapors/spray. Do not get in eyes, on skin, or on clothing. Do not ingest. If swallowed then seek immediate medical assistance.

Storage. Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area. Incompatible Materials. Metals. Strong oxidizing agents. Bases. sodium hypochlorite. Amines. Fluorine. Cyanides. Alkaline.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH	Mexico OEL (TWA)
Hydrochloric acid	Ceiling: 2 ppm	Ceiling: 5 ppm Ceiling: 7 mg/m^3 (Vacated) Ceiling: 5 ppm (Vacated) Ceiling: 7 mg/m^3	IDLH: 50 ppm Ceiling: 5 ppm Ceiling: 7 mg/m^3	Ceiling: 2 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Recommended Filter type: Particulates filter conforming to EN 143. or. Acid gases filter: Type E, Yellow.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	pungent
Odor Threshold	No information available
pH	< 1
Melting Point/Range	-35 °C / -31 °F
Boiling Point/Range	57 °C / 135 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	125 mbar @ 20 °C
Vapor Density	1.27
Specific Gravity	1.18
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	1.8 mPa.s @ 15°C
Molecular Formula	HCl

Molecular Weight 55.55

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat.

Incompatible Materials Metals, Strong oxidizing agents, Bases, sodium hypochlorite, Amines, Fluorine, Cyanides, Alkaline

Hazardous Decomposition Products Hydrogen chloride gas

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions Contact with metals may evolve flammable hydrogen gas.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Dermal LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Vapor LC50 Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	-	-	-
Hydrochloric acid	238 - 277 mg/kg (Rat)	> 5010 mg/kg (Rabbit)	1.68 mg/L (Rat) 1 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed
Hydrochloric acid	7647-01-0	Not listed	Not listed	Not listed	Not listed	Not listed

IARC (International Agency for Research on Cancer)

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. Large amounts will affect pH and harm aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Hydrochloric acid	-	282 mg/L LC50 96 h Gambusia affinis mg/L LC50 48 h Leucscus idus	-	56mg/L EC50 72h Daphnia

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN1789
Proper Shipping Name HYDROCHLORIC ACID
Hazard Class 8
Packing Group II

TDG

UN-No UN1789
Proper Shipping Name HYDROCHLORIC ACID
Hazard Class 8
Packing Group II

IATA

UN-No UN1789
Proper Shipping Name Hydrochloric acid
Hazard Class 8
Packing Group II

IMDG/IMO

UN-No UN1789
Proper Shipping Name Hydrochloric acid
Hazard Class 8
Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Water	7732-18-5	X	ACTIVE	-
Hydrochloric acid	7647-01-0	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA - Per 40 CFR 751, Regulation of Certain Chemical Substances & Mixtures, Under TSCA Section 6(h) (PBT) Not applicable

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Water	7732-18-5	X	-	231-791-2	X	X		X	X	KE-35400
Hydrochloric acid	7647-01-0	X	-	231-595-7	X	X	X	X	X	KE-20189

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313

Component	CAS No	Weight %	SARA 313 - Threshold Values %
Hydrochloric acid	7647-01-0	35-38	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Hydrochloric acid	X	5000 lb	-	-

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Hydrochloric acid	X		-

OSHA - Occupational Safety and Health Administration Not applicable

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Hydrochloric acid	-	TQ: 5000 lb

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Hydrochloric acid	5000 lb	5000 lb

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Water	-	-	X	-	-
Hydrochloric acid	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ):	Y
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security This product contains the following DHS chemicals:
Legend - STQs = Screening Threshold Quantities, APA = A placarded amount

Component	DHS Chemical Facility Anti-Terrorism Standard
Hydrochloric acid	Release STQs - 15000lb (concentration >=37%) Release STQs - 5000lb (anhydrous) Theft STQs - 500lb (anhydrous)

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Component	CAS No	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Water	7732-18-5	-	-	-
Hydrochloric acid	7647-01-0	-	Use restricted. See item 75. (see link for restriction details)	-

REACH links
https://echa.europa.eu/substances-restricted-under-reach

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Water	7732-18-5	Listed	Not applicable	Not applicable	Not applicable
Hydrochloric acid	7647-01-0	Listed	Not applicable	Not applicable	Not applicable

Contains component(s) that meet a 'definition' of per & poly fluoroalkyl substance (PFAS)?
Not applicable

Other International Regulations

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Water	7732-18-5	Not applicable	Not applicable	Not applicable	Not applicable
Hydrochloric acid	7647-01-0	25 tonne	250 tonne	Not applicable	Annex I - Y34

16. Other information

Prepared By Regulatory Affairs

Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date	24-Aug-2009
Revision Date	13-Oct-2023
Print Date	13-Oct-2023
Revision Summary	SDS sections updated. 2. 3. 11.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Hydrogen Sulfide

Airgas
an Air Liquide company

Section 1. Identification

GHS product identifier : Hydrogen Sulfide

Chemical name : hydrogen sulphide

Other means of identification : Hydrogen sulfide; Sulfuretted hydrogen; Sewer gas; Hydrosulfuric acid; dihydrogen sulfide; hydrosulphuric acid; sulphuretted hydrogen; HYDROGEN SULFIDE H2S; Sulfur hydride; Hydrogen sulfide (H2S); Sulfuric acid

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : Hydrogen sulfide; Sulfuretted hydrogen; Sewer gas; Hydrosulfuric acid; dihydrogen sulfide; hydrosulphuric acid; sulphuretted hydrogen; HYDROGEN SULFIDE H2S; Sulfur hydride; Hydrogen sulfide (H2S); Sulfuric acid

SDS # : 001029

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas
ACUTE TOXICITY (inhalation) - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3
AQUATIC HAZARD (ACUTE) - Category 1

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : Extremely flammable gas.
Contains gas under pressure; may explode if heated.
Fatal if inhaled.
May cause respiratory irritation.
Very toxic to aquatic life.

Extended exposure to gas reduces the ability to smell sulfides.
May form explosive mixtures with air.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Do not depend on odor to detect presence of gas. Approach suspected leak area with caution.

Section 2. Hazards identification

Prevention : In case of inadequate ventilation wear respiratory protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Do not breathe gas.

Response : Collect spillage. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. In case of leakage, eliminate all ignition sources. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor.

Storage : Store locked up. Store in a well-ventilated place. Keep container tightly closed. Protect from sunlight.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : hydrogen sulphide

Other means of identification : Hydrogen sulfide; Sulfuretted hydrogen; Sewer gas; Hydrosulfuric acid; dihydrogen sulfide; hydrosulphuric acid; sulphuretted hydrogen; HYDROGEN SULFIDE H2S; Sulfur hydride; Hydrogen sulfide (H2S); Sulfuric acid

Product code : 001029

CAS number/other identifiers

CAS number : 7783-06-4

Ingredient name	%	CAS number
hydrogen sulfide	100	7783-06-4

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Section 4. First aid measures

Inhalation : Fatal if inhaled. May cause respiratory irritation.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : Adverse symptoms may include the following:, respiratory tract irritation, coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. This material is very toxic to aquatic life. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
sulfur oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Do not breathe gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

Section 6. Accidental release measures

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities. Collect spillage.

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Do not get in eyes or on skin or clothing. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Use only non-sparking tools. Avoid release to the environment. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Do not breathe gas.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Store locked up. Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
hydrogen sulfide	**ACGIH TLV (United States, 3/2019).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **NIOSH REL (United States, 10/2016).** CEIL: 15 mg/m³ 10 minutes. CEIL: 10 ppm 10 minutes. **OSHA PEL 1989 (United States, 3/1989).** STEL: 21 mg/m³ 15 minutes. STEL: 15 ppm 15 minutes. TWA: 14 mg/m³ 8 hours.

Section 8. Exposure controls/personal protection

	TWA: 10 ppm 8 hours. **OSHA PEL Z2 (United States, 2/2013).** AMP: 50 ppm 10 minutes. CEIL: 20 ppm

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Odor : Rotten eggs.

Odor threshold : Not available.

pH : Not available.

Melting point : -82°C (-115.6°F)

Section 9. Physical and chemical properties

Boiling point : -60°C (-76°F)

Critical temperature : 100.5°C (212.9°F)

Flash point : Not available.

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 4.3%
Upper: 45%

Vapor pressure : 252 (psig)

Vapor density : 1.19 (Air = 1)

Specific Volume (ft ^{3}/lb) : 11.236

Gas Density (lb/ft ^{3}) : 0.089

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 5 g/l

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : 270°C (518°F)

Decomposition temperature : Not available.

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Molecular weight : 34.08 g/mole

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Oxidizers

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
hydrogen sulfide	LC50 Inhalation Gas.	Rat	712 ppm	1 hours

Irritation/Corrosion

Not available.

Sensitization

Section 11. Toxicological information

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
hydrogen sulfide	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : Fatal if inhaled. May cause respiratory irritation.

Skin contact : No known significant effects or critical hazards.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : Adverse symptoms may include the following:, respiratory tract irritation, coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Section 11. Toxicological information

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Route	ATE value
Inhalation (gases)	356 ppm

Other information : IDLH : 100 ppm

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
hydrogen sulfide	Acute EC50 62 µg/l Fresh water Acute LC50 2 µg/l Fresh water	Crustaceans - Gammarus pseudolimnaeus Fish - Coregonus clupeaformis - Yolk-sac fry	2 days 96 hours

Persistence and degradability

Not available.

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

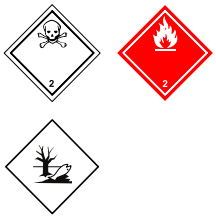
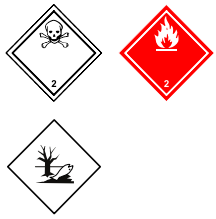
Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Hydrogen sulfide; Hydrogen sulfide H2S	7783-06-4	Listed	U135

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1053	UN1053	UN1053	UN1053	UN1053
UN proper shipping name	HYDROGEN SULFIDE	HYDROGEN SULFIDE; OR HYDROGEN SULPHIDE	HYDROGEN SULFIDE	HYDROGEN SULPHIDE	HYDROGEN SULPHIDE
Transport hazard class(es)	2.3 (2.1) 	2.3 (2.1) 	2.3 (2.1) 	2.3 (2.1) 	2.3 (2.1) 
Packing group	-	-	-	-	-
Environmental hazards	No.	Yes.	Yes. The environmentally hazardous substance mark is not required.	Yes.	Yes. The environmentally hazardous substance mark is not required.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : Toxic - Inhalation hazard Zone B
Reportable quantity 100 lbs / 45.4 kg. Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.
Limited quantity Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: Forbidden.
Special provisions 2, B9, B14

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2), 2.13-2.17 (Class 2), 2.7 (Marine pollutant mark).
The marine pollutant mark is not required when transported by road or rail.
Explosive Limit and Limited Quantity Index 0
ERAP Index 0
Passenger Carrying Vessel Index Forbidden
Passenger Carrying Road or Rail Index Forbidden

IMDG : The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg.

IATA : The environmentally hazardous substance mark may appear if required by other transportation regulations.
Quantity limitation Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: Forbidden.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Water Act (CWA) 311: hydrogen sulphide

Clean Air Act (CAA) 112 regulated toxic substances: hydrogen sulphide

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

Name	%	EHS	SARA 302 TPQ		SARA 304 RQ	
			(lbs)	(gallons)	(lbs)	(gallons)
hydrogen sulfide	100	Yes.	500	-	100	-

SARA 304 RQ : 100 lbs / 45.4 kg

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	hydrogen sulphide	7783-06-4	100
Supplier notification	hydrogen sulphide	7783-06-4	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

This product does not require a Safe Harbor warning under California Prop. 65.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

Section 15. Regulatory information

UNECE Aarhus Protocol on POPs and Heavy Metals

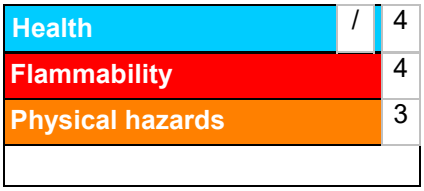
Not listed.

Inventory list

Australia	:	This material is listed or exempted.
Canada	:	This material is listed or exempted.
China	:	This material is listed or exempted.
Europe	:	This material is listed or exempted.
Japan	:	**Japan inventory (ENCS)**: This material is listed or exempted. **Japan inventory (ISHL)**: Not determined.
New Zealand	:	This material is listed or exempted.
Philippines	:	This material is listed or exempted.
Republic of Korea	:	This material is listed or exempted.
Taiwan	:	This material is listed or exempted.
Thailand	:	Not determined.
Turkey	:	Not determined.
United States	:	This material is active or exempted.
Viet Nam	:	This material is listed or exempted.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)



Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Section 16. Other information

Classification	Justification
FLAMMABLE GASES - Category 1	Expert judgment
GASES UNDER PRESSURE - Liquefied gas	Expert judgment
ACUTE TOXICITY (inhalation) - Category 2	On basis of test data
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3	Expert judgment
AQUATIC HAZARD (ACUTE) - Category 1	Expert judgment

History

Date of printing : 2/11/2021

Date of issue/Date of revision : 2/11/2021

Date of previous issue : 11/30/2017

Version : 1.01

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

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SAFETY DATA SHEET

Isobutylene

Section 1. Identification

GHS product identifier : Isobutylene

Chemical name : 2-methylpropene

Other means of identification : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

SDS # : 001031

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response : Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Protect from sunlight. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : 2-methylpropene

Other means of identification : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

Product code : 001031

CAS number/other identifiers

CAS number : 115-11-7

Ingredient name	%	CAS number
Isobutylene	100	115-11-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Use only non-sparking tools. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Isobutylene	**ACGIH TLV (United States, 3/2017).** TWA: 250 ppm 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Melting point : -140.7°C (-221.3°F)

Boiling point : -6.9°C (19.6°F)

Critical temperature : 144.75°C (292.6°F)

Flash point : Closed cup: -76.1°C (-105°F)

Evaporation rate : Not available.

Flammability (solid, gas) : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.

Lower and upper explosive (flammable) limits : Lower: 1.8%
Upper: 9.6%

Vapor pressure : 24.3 (psig)

Vapor density : 1.94 (Air = 1)

Specific Volume (ft ^{3}/lb) : 6.6845

Gas Density (lb/ft ^{3}) : 0.1496 (25°C / 77 to °F)

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 0.26 g/l

Partition coefficient: n-octanol/water : 2.34

Auto-ignition temperature : 465°C (869°F)

Decomposition temperature : Not available.

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Molecular weight : 56.12 g/mole

Aerosol product

Heat of combustion : -45029034 J/kg

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Oxidizers

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Isobutylene	LC50 Inhalation Vapor	Rat	550000 mg/m³	4 hours

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Section 11. Toxicological information

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Isobutylene	2.34	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Section 12. Ecological information

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1055	UN1055	UN1055	UN1055	UN1055
UN proper shipping name	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : **Limited quantity** Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: 150 kg.
Special provisions 19, T50

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
ERAP Index 3000
Passenger Carrying Ship Index Forbidden
Passenger Carrying Road or Rail Index Forbidden
Special provisions 29

IATA : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: 150 kg.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act (CAA) 112 regulated flammable substances: Isobutylene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS)**: This material is listed or exempted.
Japan inventory (ISHL): Not determined.

Malaysia : Not determined.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Section 15. Regulatory information

Taiwan : This material is listed or exempted.

Thailand : Not determined.

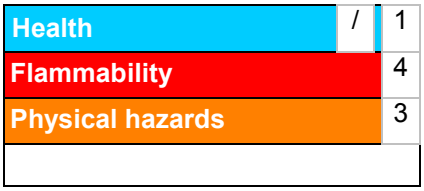
Turkey : Not determined.

United States : This material is listed or exempted.

Viet Nam : Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



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National Fire Protection Association (U.S.A.)



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Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Liquefied gas	Expert judgment Expert judgment

History

Date of printing : 5/10/2018

Date of issue/Date of revision : 5/10/2018

Date of previous issue : 7/11/2016

Version : 0.02

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IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973

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UN = United Nations

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Safety Data Sheet

Nitric Acid 20% w/w

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Nitric Acid 20% w/w

Synonyms/Generic Names: None

Product Number: 3800

Product Use: Industrial, Manufacturing or Laboratory use

Manufacturer: Columbus Chemical Industries, Inc.
N4335 Temkin Rd.
Columbus, WI. 53925

For More Information: 920-623-2140 (Monday-Friday 8:00-4:30)
www.columbuschemical.com

In Case of Emergency Call: CHEMTREC - 800-424-9300 or 703-527-3887 (24 Hours/Day, 7 Days/Week)

2. HAZARDS IDENTIFICATION

Hazard Not Otherwise Classified (HNOC): None

Signal Words: Danger

Pictograms:



GHS Classification:

Skin corrosion	Category 1A
Serious eye damage	Category 1

GHS Label Elements, including precautionary statements:

Hazard Statements:

H314	Causes severe skin burns and eye damage.

Precautionary Statements:

P260	Do not breathe dusts or mists.
P264	Wash hands thoroughly after handling.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331	IF SWALLOWED: Rinse mouth. Do not induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER/doctor/physician.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local regulations.

Potential Health Effects

Eyes	Causes eye irritation.
Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Ingestion	May be harmful if swallowed.

NFPA Ratings

Health	3
Flammability	0
Reactivity	1
Specific hazard	Not Available

HMIS Ratings

Health	3
Fire	0
Reactivity	1

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	Weight %	CAS #	EINECS# / ELINCS#	Formula	Molecular Weight
Nitric Acid	19-21	7697-37-2	231-714-2	HNO_3	63.01 g/mol
Water	Balance	7732-18-5	231-791-2	H_2O	18.00 g/mol

4. FIRST-AID MEASURES

Eyes	Rinse with plenty of water for at least 15 minutes and seek medical attention immediately.
Inhalation	Move casualty to fresh air and keep at rest. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention immediately.
Skin	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and wash using soap. Get medical attention immediately.
Ingestion	**Do Not Induce Vomiting!** Never give anything by mouth to an unconscious person. If conscious, wash out mouth with water. Get medical attention immediately.

5. FIRE-FIGHTING MEASURES

Suitable (and unsuitable) extinguishing media	Product is not flammable. Use appropriate media for adjacent fire. Cool containers with water.
Special protective equipment and precautions for firefighters	Wear self-contained, approved breathing apparatus and full protective clothing, including eye protection and boots.
Specific hazards arising from the chemical	Emits toxic fumes (nitrogen oxides) under fire conditions. (See also Stability and Reactivity section).

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	See section 8 for recommendations on the use of personal protective equipment.
Environmental precautions	Prevent spillage from entering drains. Any release to the environment may be subject to federal/national or local reporting requirements.
Methods and materials for containment and cleaning up	Neutralize spill with sodium bicarbonate or lime. Absorb spill with noncombustible absorbent material, then place in a suitable container for disposal. Clean surfaces thoroughly with water to remove residual contamination. Dispose of all waste and cleanup materials in accordance with regulations.

7. HANDLING AND STORAGE

Precautions for safe handling
See section 8 for recommendations on the use of personal protective equipment. Use with adequate ventilation. Wash thoroughly after using. Keep container closed when not in use. Avoid formation of aerosols.

Conditions for safe storage, including any incompatibilities
Store in a cool, dry, well ventilated area. Keep away from incompatible materials (see section 10 for incompatibilities).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational exposure controls:

Component	Exposure Limits	Basis	Entity
Nitric Acid	2 ppm 5.2 mg/m^3	TLV	ACGIH
	4 ppm 10 mg/m^3	STEL	ACGIH
	2 ppm 5 mg/m^3	PEL	OSHA
	2 ppm 5 mg/m^3	REL	NIOSH
	4 ppm 10 mg/m^3	STEL	NIOSH
	25 ppm	IDLH	NIOSH

TWA: Time Weighted Average over 8 hours of work.
TLV: Threshold Limit Value over 8 hours of work.
REL: Recommended Exposure Limit
PEL: Permissible Exposure Limit
STEL: Short Term Exposure Limit during x minutes.
IDLH: Immediately Dangerous to Life or Health
WEEL: Workplace Environmental Exposure Levels
CEIL: Ceiling

Personal Protection

Eyes	Wear chemical safety glasses or goggles and face shield if splashing is likely to occur.
Inhalation	Provide local exhaust, preferably mechanical. If exposure levels are excessive, use an approved respirator.
Skin	Wear nitrile or rubber gloves and a full body suit.

Other	Not Available

Other Recommendations
Provide eyewash stations, quick-drench showers and washing facilities accessible to areas of use and handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance (physical state, color, etc.)	Colorless liquid.
Odor	Not Available
Odor threshold	Not Available
pH	Not Available
Melting point/freezing point	Not Available
Initial boiling point and boiling range	Not Available
Flash point	Not Flammable
Evaporation rate	Not Available
Flammability (solid, gas)	Not Flammable
Upper/lower flammability or explosive limit	Not Explosive
Vapor pressure	Not Available
Vapor density	Not Available
Specific gravity	1.13 – 1.14g/cm^3 at 20°C (68°F)
Solubility (ies)	Soluble in water.
Partition coefficient: n-octanol/water	Not Available
Auto-ignition temperature	Not Available
Decomposition temperature	Not Available

10. STABILITY AND REACTIVITY

Chemical Stability	Stable
Possibility of Hazardous Reactions	Will not occur.
Conditions to Avoid	May discolor on exposure to air and light.
Incompatible Materials	Alkali metals, organic materials, acetic anhydride, acetonitrile, alcohols, acrylonitrile.
Hazardous Decomposition Products	Nitrogen oxides.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Skin	Not Available
Eyes	Not Available
Respiratory	Not Available
Ingestion	Not Available

Carcinogenicity

IARC	No components of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH	No components of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP	No components of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA	No components of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Signs & Symptoms of Exposure

Skin	Itching, swelling, redness, burning.
Eyes	Itching, redness, burning, watering eyes.
Respiratory	Burning, choking, shortness of breath, coughing, wheezing, dizziness.
Ingestion	Burning, choking, nausea, vomiting, pain.

Chronic Toxicity	Not Available
Teratogenicity	Not Available
Mutagenicity	Not Available
Embryotoxicity	Not Available
Target Organ(s)	Lungs, Teeth, Cardiovascular system
Reproductive Toxicity	Not Available
Respiratory/Skin Sensitization	Not Available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Aquatic Vertebrate	Not Available
Aquatic Invertebrate	Not Available
Terrestrial	Not Available

Persistence and Degradability	Not Available
Bioaccumulative Potential	Not Available
Mobility in Soil	Not Available
PBT and vPvB Assessment	Not Available
Other Adverse Effects	Not Available

13. DISPOSAL CONSIDERATIONS

Waste Product or Residues	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product or residue.
Product Containers	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product container.

The information offered in section 13 is for the product as shipped. Use and/or alterations to the product may significantly change the characteristics of the material and alter the waste classification and proper disposal methods.

14. TRANSPORTATION INFORMATION

US DOT	UN2031, Nitric acid, 8, pg II
TDG	UN2031, NITRIC ACID, 8, PG II
IMDG	UN2031, NITRIC ACID, 8, PG II
Marine Pollutant	No
IATA/ICAO	UN2031, Nitric acid, 8, pg II

15. REGULATORY INFORMATION

TSCA Inventory Status	All ingredients are listed on the TSCA Active inventory.
DSL / NDSL	All ingredients are listed on the DSL inventory.
California Proposition 65	Not Listed
Rhode Island: Hazardous Substance List	Listed: Nitric Acid
Massachusetts: Toxic or Hazardous Substance List, Right to Know	Listed: Nitric Acid
Pennsylvania: Hazardous Substance List	Listed: Nitric Acid
New Jersey: Right to Know Hazardous Substance List	Listed: Nitric Acid
SARA 302	Listed: Nitric Acid
SARA 304	Listed: Nitric Acid
SARA 311	Acute Health Hazard.
SARA 312	Acute Health Hazard.
SARA 313	Listed: Nitric Acid
WHMIS Canada	Class C: Oxidizing material. Class E: Corrosive material.

16. OTHER INFORMATION

Revision	Date
Original	10/11/2017
Revision 1	01/03/2022

Disclaimer: The information provided in this Safety Data Sheet (“SDS”) is correct to the best of our knowledge, information, and belief at the date of publication. The information in this SDS relates only to the specific Product identified under Section 1, and does not relate to its use in combination with other materials or products, or its use as to any particular process. Those handling, storing, or using the Product should satisfy themselves that they have current information regarding the particular way the Product is handled, stored or used and that the same is done in accordance with federal, state and local law. WE DO NOT MAKE ANY WARRANTY, EXPRESS OR IMPLIED, INCLUDING (WITHOUT LIMITATION) WARRANTIES WITH RESPECT TO THE COMPLETENESS OR CONTINUING ACCURACY OF THE INFORMATION CONTAINED HEREIN OR WITH RESPECT TO FITNESS FOR ANY PARTICULAR USE. WE DO NOT ASSUME RESPOSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, INJURY, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THIS PRODUCT.

SAFETY DATA SHEET

Creation Date 16-Jun-2009 **Revision Date** 07-Sep-2023 **Revision Number** 8

1. Identification

Product Name **Sodium hydroxide**

Cat No. : **BP359-500; BP359-212**

CAS No 1310-73-2
Synonyms Caustic soda

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Skin Corrosion/Irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
May be corrosive to metals
Causes severe skin burns and eye damage
May cause respiratory irritation



Precautionary Statements
Prevention
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Keep only in original container
Response
Immediately call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in corrosive resistant polypropylene container with a resistant inliner
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Sodium hydroxide	1310-73-2	100

4. First-aid measures

General Advice Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required. Keep eye wide open while rinsing.

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Call a physician immediately.

Inhalation Remove to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Call

a physician or poison control center immediately.

Ingestion Do NOT induce vomiting. Immediate medical attention is required. Never give anything by mouth to an unconscious person. Drink plenty of water.

Most important symptoms and effects Causes burns by all exposure routes. . Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Not combustible. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media Do not use a solid water stream as it may scatter and spread fire

Flash Point No information available
Method - No information available

Autoignition Temperature No information available
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
The product causes burns of eyes, skin and mucous membranes. Reacts violently with water. Contact with metals may evolve flammable hydrogen gas.

Hazardous Combustion Products
Hydrogen. Sodium oxides.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	1	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Evacuate personnel to safe areas. Avoid contact with skin, eyes or clothing.

Environmental Precautions Do not allow material to contaminate ground water system. Should not be released into the environment. Do not flush into surface water or sanitary sewer system. See Section 12 for additional Ecological Information.

Methods for Containment and Clean Up Avoid dust formation. Sweep up and shovel into suitable containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Use only under a chemical fume hood. Do not get in eyes, on skin, or on clothing. Do not breathe dust. Do not ingest. If swallowed then seek immediate medical assistance.

Storage. Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area.

Incompatible Materials. Strong oxidizing agents. Acids. Metals. Water.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH	Mexico OEL (TWA)
Sodium hydroxide	Ceiling: 2 mg/m³	Ceiling: 2 mg/m³ TWA: 2 mg/m³	IDLH: 10 mg/m³ Ceiling: 2 mg/m³	Ceiling: 2 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. Tight sealing safety goggles. Face protection shield.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Recommended Filter type: Particulates filter conforming to EN 143.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Solid
Appearance	White
Odor	Odorless
Odor Threshold	No information available
pH	14 (5 %)
Melting Point/Range	318 °C / 604.4 °F
Boiling Point/Range	1390 °C / 2534 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	Not flammable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	1 mbar @ 700 °C
Vapor Density	Not applicable
Specific Gravity	No information available
Bulk Density	2.13 g/cm3
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	H Na O

Molecular Weight 40

10. Stability and reactivity

Reactive Hazard Yes

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat.

Incompatible Materials Strong oxidizing agents, Acids, Metals, Water

Hazardous Decomposition Products Hydrogen, Sodium oxides

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium hydroxide	140 - 340 mg/kg (Rat)	1350 mg/kg (Rabbit)	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes severe burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Sodium hydroxide	1310-73-2	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. Large amounts will affect pH and harm aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Sodium hydroxide	Not listed	LC50: = 45.4 mg/L, 96h static (Oncorhynchus mykiss)	Not listed	Not listed

Persistence and Degradability Soluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN1823
Proper Shipping Name SODIUM HYDROXIDE, SOLID
Hazard Class 8
Packing Group II

TDG

UN-No UN1823
Proper Shipping Name SODIUM HYDROXIDE, SOLID
Hazard Class 8
Packing Group II

IATA

UN-No UN1823
Proper Shipping Name Sodium hydroxide, solid
Hazard Class 8
Packing Group II

IMDG/IMO

UN-No UN1823
Proper Shipping Name Sodium hydroxide, solid
Hazard Class 8
Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Sodium hydroxide	1310-73-2	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA - Per 40 CFR 751, Regulation of Certain Chemical Substances & Mixtures, Under TSCA Section 6(h) (PBT) Not applicable

TSCA 12(b) - Notices of Export Not applicable

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Sodium hydroxide	1310-73-2	X	-	215-185-5	X	X	X	X	X	KE-31487

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Sodium hydroxide	X	1000 lb	-	-

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Sodium hydroxide	1000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Sodium hydroxide	X	X	X	-	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Component	CAS No	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Sodium hydroxide	1310-73-2	-	Use restricted. See item	-

			75. (see link for restriction details)	

https://echa.europa.eu/substances-restricted-under-reach

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Sodium hydroxide	1310-73-2	Listed	Not applicable	Not applicable	Not applicable

Contains component(s) that meet a 'definition' of per & poly fluoroalkyl substance (PFAS)?
Not applicable

Other International Regulations

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Sodium hydroxide	1310-73-2	Not applicable	Not applicable	Not applicable	Annex I - Y35

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 16-Jun-2009
Revision Date 07-Sep-2023
Print Date 07-Sep-2023
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

Safety Data Sheet

according to Regulation (EC) No 1907/2006

26597-42 StablCal Formazin Turbidity Standard, < 0.1 NTU

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

26597-42 StablCal Formazin Turbidity Standard, < 0.1 NTU

UFI: AK0E-980S-J30M-50DY

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture

Water analysis

1.3. Details of the supplier of the safety data sheet

Company name: HACH LANGE GmbH
Street: Willstätterstr. 11
Place: D-40549 Düsseldorf
Telephone: +49 (0)211 5288-383
e-mail: SDS@hach.com
Internet: www.de.hach.com
Responsible Department: HACH LANGE Ltd.
5, Pacific Way
Salford Manchester M50 1DL - United Kingdom
Tel. +44 (0) 161 872 1487 * Fax +44 (0) 161 848 7324
e-Mail: info-uk@hach.com

HACH LANGE Ltd.
Unit 1, Chestnut Road Western Industrial Estate
IRL-Dublin 12
Tel. +353 (0)1 4602522
e-Mail: info-ie@hach.com

1.4. Emergency telephone number:

Poison Control Center Mainz: Tel: +49 (0) 6131 19240 - 24 hour emergency service -

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No. 1272/2008

Hazard categories:
Respiratory or skin sensitisation: Resp. Sens. 1
Respiratory or skin sensitisation: Skin Sens. 1
Hazard Statements:
May cause allergy or asthma symptoms or breathing difficulties if inhaled.
May cause an allergic skin reaction.

2.2. Label elements

Regulation (EC) No. 1272/2008

Hazard components for labelling

methenamine; hexamethylenetetramine

Signal word: Danger

Pictograms:



Hazard statements

H317	May cause an allergic skin reaction.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Precautionary statements

P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P272	Contaminated work clothing should not be allowed out of the workplace.
P280	Wear protective gloves/protective clothing/eye protection/face protection/hearing protection.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P304+P341	IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
P342+P311	If experiencing respiratory symptoms: Call a POISON CENTER/doctor.
P302+P352	IF ON SKIN: Wash with plenty of water.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.

Additional advice on labelling

The product is classified as dangerous in accordance with Regulation (EC) No. 1272/2008.

2.3. Other hazards

This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).

SECTION 3: Composition/information on ingredients

3.2. Mixtures

Hazardous components

CAS No	Chemical name			Quantity
	EC No	Index No	REACH No	
	CLP Classification			
7732-18-5	Water			>90 %
	231-791-2			
100-97-0	methenamine; hexamethylenetetramine			5-10 %
	202-905-8	612-101-00-2		
	Flam. Sol. 2, Resp. Sens. 1, Skin Sens. 1; H228 H334 H317			
50-00-0	formaldehyde ... %			<0,1 %
	200-001-8	605-001-00-5		
	Carc. 1B, Muta. 2, Acute Tox. 3, Acute Tox. 3, Acute Tox. 3, Skin Corr. 1B, Skin Sens. 1; H350 H341 H331 H311 H301 H314 H317			

Full text of H and EUH statements: see section 16.

Specific concentration limits and M-factors

CAS No	EC No	Chemical name	Quantity
	Specific concentration limits and M-factors		
50-00-0	200-001-8	formaldehyde ... %	<0,1 %
	Skin Corr. 1B; H314: >= 25 - 100 Skin Irrit. 2; H315: >= 5 - < 25 Eye Irrit. 2; H319: >= 5 - < 25 Skin Sens. 1; H317: >= 0,2 - 100 STOT SE 3; H335: >= 5 - 100		

SECTION 4: First aid measures

4.1. Description of first aid measures

General information

Take off all contaminated clothing immediately.

After inhalation

Move to fresh air.

After contact with skin

Wash off immediately with plenty of water.

After contact with eyes

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

After ingestion

Induce vomiting, but only if victim is fully conscious.

4.2. Most important symptoms and effects, both acute and delayed

sensitising effects

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. The product itself does not burn.

5.2. Special hazards arising from the substance or mixture

Fire may liberate hazardous vapours.

5.3. Advice for firefighters

In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment.

Additional information

Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use personal protective equipment.

6.2. Environmental precautions

Do not flush into surface water or sanitary sewer system.

6.3. Methods and material for containment and cleaning up

Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust).

6.4. Reference to other sections

13. Disposal considerations

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Advice on safe handling

Use only in well-ventilated areas.

Advice on protection against fire and explosion

See also section 5

7.2. Conditions for safe storage, including any incompatibilities

Requirements for storage rooms and vessels

Keep in a dry, cool place.

Hints on joint storage

None known.

7.3. Specific end use(s)

Reagent for analysis

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure limits (EH40)

CAS No	Substance	ppm	mg/m³	fibres/ml	Category	Origin
50-00-0	Formaldehyde	2	2.5		TWA (8 h)	WEL
		2	2.5		STEL (15 min)	WEL

Additional advice on limit values

None known.

8.2. Exposure controls

Appropriate engineering controls

Technical measures and appropriate working operations should be given priority over the use of personal protective equipment.

Protective and hygiene measures

The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Wash hands before breaks and after work.

Eye/face protection

Safety glasses with side-shields

Hand protection

Use barrier skin cream.
Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374. In full contact: Gloves material: Viton, Layer thickness: 0.70 mm, Breakthrough time: >480 min. In splash contact: Glove material: nitrile rubber, Layer thickness 0,20 mm, Breakthrough time: > 30 min

Skin protection

Remove and wash contaminated clothing before re-use.

Respiratory protection

Breathing apparatus only if aerosol or dust is formed. Recommended Filter type: ABEK-filter

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state:	liquid
Colour:	colourless
Odour:	odourless
pH-Value (at 20 °C):	7,5-8,5

Changes in the physical state

Melting point:	no data available
Initial boiling point and boiling range:	100 °C

Sublimation point:	not applicable
Softening point:	not applicable
Pour point:	not applicable
:	no data available
Flash point:	not applicable
Sustaining combustion:	No data available

Flammability

Solid:	not applicable
Gas:	not applicable

Explosive properties

not applicable

Lower explosion limits:	not applicable
Upper explosion limits:	not applicable
Ignition temperature:	no data available

Auto-ignition temperature

Solid:	not applicable
Gas:	not applicable
Decomposition temperature:	no data available

Oxidizing properties

not applicable

Vapour pressure:	no data available
Vapour pressure:	no data available
Density (at 20 °C):	1,04 g/cm³
Bulk density:	not applicable
Water solubility: (at 20 °C)	completely soluble

Solubility in other solvents

no data available

Partition coefficient:	no data available
Viscosity / dynamic:	no data available
Viscosity / kinematic:	no data available
Flow time:	no data available
Vapour density:	no data available
Evaporation rate:	no data available
Solvent separation test:	no data available
Solvent content:	no data available

9.2. Other information

Solid content:	not applicable

no data available

SECTION 10: Stability and reactivity

10.1. Reactivity

See also section 10.3

10.2. Chemical stability

Stable under recommended storage conditions.

10.3. Possibility of hazardous reactions

No dangerous reaction known under conditions of normal use.

10.4. Conditions to avoid

Extremes of temperature and direct sunlight.

10.5. Incompatible materials

No dangerous reaction known under conditions of normal use.
Oxidizing agents

10.6. Hazardous decomposition products

No decomposition if stored and applied as directed.

Further information

None known.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity

No data is available on the product itself.

CAS No	Chemical name				
	Exposure route	Dose	Species	Source	Method
100-97-0	methenamine; hexamethylenetetramine				
	oral	LD50 9200 mg/kg	Ratte		
50-00-0	formaldehyde ... %				
	oral	ATE 100 mg/kg			
	dermal	ATE 300 mg/kg			
	inhalation (4 h) vapour	LC50 250 mg/l	rat		
	inhalation aerosol	ATE 0,5 mg/l			

Irritation and corrosivity

No known effect.

Sensitising effects

May cause sensitisation by skin contact.
May cause sensitisation by inhalation. (List of references: Asthma in the workplace, I.Leonard Bernstein)

Carcinogenic/mutagenic/toxic effects for reproduction

Contains no ingredient listed as a carcinogen

STOT-single exposure

The substance or mixture is not classified as specific target organ toxicant, single exposure.

STOT-repeated exposure

The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Aspiration hazard

No aspiration toxicity classification

Specific effects in experiment on an animal

No data is available on the product itself.

Additional information on tests

no data available

Practical experience

Observations relevant to classification

no data available

Other observations

no data available

Further information

Other dangerous properties can not be excluded. Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1. Toxicity

No data is available on the product itself.

Do not flush into surface water or sanitary sewer system.

CAS No	Chemical name					
	Aquatic toxicity	Dose	[h] | [d]	Species	Source	Method
100-97-0	methenamine; hexamethylenetetramine					
	Acute fish toxicity	LC50 49800 mg/l	96 h	Fisch		

12.2. Persistence and degradability

No data is available on the product itself.

12.3. Bioaccumulative potential

No data is available on the product itself.

12.4. Mobility in soil

no data available

12.5. Results of PBT and vPvB assessment

no data available

12.6. Other adverse effects

No known effect.

Further information

no data available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal recommendations

In accordance with local and national regulations.

List of Wastes Code - residues/unused products

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

List of Wastes Code - used product

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

List of Wastes Code - contaminated packaging

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

Land transport (ADR/RID)

Other applicable information (land transport)

Not subject to transport regulations.

Inland waterways transport (ADN)

Other applicable information (inland waterways transport)

Not tested

Marine transport (IMDG)

Other applicable information (marine transport)

Not subject to transport regulations.

Air transport (ICAO-TI/IATA-DGR)

Other applicable information (air transport)

Not subject to transport regulations.

14.5. Environmental hazards

ENVIRONMENTALLY HAZARDOUS: No

14.6. Special precautions for user

no data available

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

not applicable

Other applicable information

no data available

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulatory information

Restrictions on use (REACH, annex XVII):

Entry 3, Entry 28

National regulatory information

Water hazard class (D): 1 - slightly hazardous to water

15.2. Chemical safety assessment

Chemical safety assessments for substances in this mixture were not carried out.

SECTION 16: Other information

Changes

Revision: 30.05.2022
Safety datasheet sections which have been updated: 2, 7, 11, 15
Revision: 10.04.2018
Safety datasheet sections which have been updated: 2, 3, 11, 16
Revision: 10.12.2015
Safety datasheet sections which have been updated: 2, 11
Revision: 24.11.2015
Safety datasheet sections which have been updated: 2, 3, 11
Revision: 26.05.2015

Safety datasheet sections which have been updated: 2, 4, 11

Classification for mixtures and used evaluation method according to Regulation (EC) No. 1272/2008 [CLP]

Classification	Classification procedure
Resp. Sens. 1; H334	Calculation method
Skin Sens. 1; H317	Calculation method

Relevant H and EUH statements (number and full text)

H228	Flammable solid.
H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.
H317	May cause an allergic skin reaction.
H331	Toxic if inhaled.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H341	Suspected of causing genetic defects.
H350	May cause cancer.

Further Information

The information is based on the present level of our knowledge. It does not, however, give assurance of product properties and establishes no contract legal rights.

(The data for the hazardous ingredients were taken respectively from the last version of the sub-contractor's safety data sheet.)

Safety Data Sheet

according to Regulation (EC) No 1907/2006

26601-42 StablCal Formazin Standard; 20 NTU

Revision date: 03.01.2019 Product code: 2660142

Creation date: 14.03.2007

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

26601-42 StablCal Formazin Standard; 20 NTU

UFI: NFJN-JYR1-911T-GUK1

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture

Water analysis

1.3. Details of the supplier of the safety data sheet

Company name:	HACH LANGE GmbH
Street:	Willstätterstr. 11
Place:	D-40549 Düsseldorf
Telephone:	+49 (0)211 5288-383
e-mail:	SDS@hach.com
Internet:	www.de.hach.com
Responsible Department:	HACH LANGE Ltd. 5, Pacific Way Salford Manchester M50 1DL - United Kingdom Tel. +44 (0) 161 872 1487 * Fax +44 (0) 161 848 7324 e-Mail: info-uk@hach.com HACH LANGE Ltd. Unit 1, Chestnut Road Western Industrial Estate IRL-Dublin 12 Tel. +353 (0)1 4602522 e-Mail: info-ie@hach.com

1.4. Emergency telephone number:

Poison Control Center Mainz: Tel: +49 (0) 6131 19240 - 24 hour emergency service -

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No. 1272/2008

Hazard categories:

Respiratory or skin sensitisation: Resp. Sens. 1

Respiratory or skin sensitisation: Skin Sens. 1

Hazard Statements:

May cause allergy or asthma symptoms or breathing difficulties if inhaled.

May cause an allergic skin reaction.

2.2. Label elements

Regulation (EC) No. 1272/2008

Hazard components for labelling

methenamine; hexamethylenetetramine

Signal word: Danger

Pictograms:



Hazard statements

H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H317	May cause an allergic skin reaction.

Precautionary statements

P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection/hearing protection.
P302+P352	IF ON SKIN: Wash with plenty of water.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P342+P311	If experiencing respiratory symptoms: Call a POISON CENTER/doctor.

Additional advice on labelling

The product is classified as dangerous in accordance with Regulation (EC) No. 1272/2008.

2.3. Other hazards

This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).

SECTION 3: Composition/information on ingredients

3.2. Mixtures

Hazardous components

CAS No	Chemical name			Quantity
	EC No	Index No	REACH No	
	CLP Classification			
7732-18-5	Water			> 90 %
	231-791-2			
100-97-0	methenamine; hexamethylenetetramine			1-5 %
	202-905-8	612-101-00-2		
	Flam. Sol. 2, Resp. Sens. 1, Skin Sens. 1; H228 H334 H317			
7757-82-6	Sodium sulfate			< 1 %
	231-820-9			

Full text of H and EUH statements: see section 16.

SECTION 4: First aid measures

4.1. Description of first aid measures

General information

Take off all contaminated clothing immediately.

After inhalation

Move to fresh air.

After contact with skin

Wash off immediately with plenty of water.

After contact with eyes

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
Show this safety data sheet to the doctor in attendance.

After ingestion

Clean mouth with water and drink afterwards plenty of water.
Call a physician immediately. Show this safety data sheet to the doctor in attendance.

4.2. Most important symptoms and effects, both acute and delayed

sensitising effects

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. The product itself does not burn.

5.2. Special hazards arising from the substance or mixture

Fire may liberate hazardous vapours.

5.3. Advice for firefighters

In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment.

Additional information

Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use personal protective equipment.

6.2. Environmental precautions

Do not flush into surface water or sanitary sewer system.

6.3. Methods and material for containment and cleaning up

Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust).

6.4. Reference to other sections

13. Disposal considerations

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Advice on safe handling

Use only in well-ventilated areas.
Avoid contact with skin and eyes.

Advice on protection against fire and explosion

See also section 5

7.2. Conditions for safe storage, including any incompatibilities

Requirements for storage rooms and vessels

Keep in a dry, cool place.

Hints on joint storage

None known.

7.3. Specific end use(s)

Reagent for analysis

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Additional advice on limit values

None known.

8.2. Exposure controls

Appropriate engineering controls

Technical measures and appropriate working operations should be given priority over the use of personal protective equipment.

Protective and hygiene measures

The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Wash hands before breaks and after work.

Eye/face protection

Safety glasses with side-shields

Hand protection

Use barrier skin cream.
Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374. In full contact: Gloves material: Viton, Layer thickness: 0.70 mm, Breakthrough time: >480 min. In splash contact: Glove material: nitrile rubber, Layer thickness 0,20 mm, Breakthrough time: > 30 min

Skin protection

Remove and wash contaminated clothing before re-use.

Respiratory protection

Provide adequate ventilation.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state:	suspension
Colour:	cloudy, milky
Odour:	odourless
pH-Value (at 20 °C):	8,26

Changes in the physical state

Melting point:	no data available
Initial boiling point and boiling range:	100 °C
Sublimation point:	not applicable
Softening point:	not applicable
Pour point:	not applicable
:	no data available
Flash point:	not applicable
Sustaining combustion:	No data available

Flammability

Solid:	not applicable
Gas:	not applicable

Explosive properties

not applicable

Lower explosion limits:	not applicable
Upper explosion limits:	not applicable

Ignition temperature:	no data available
Auto-ignition temperature	
Solid:	not applicable
Gas:	not applicable
Decomposition temperature:	no data available
Oxidizing properties	
not applicable	
Vapour pressure:	no data available
Vapour pressure:	no data available
Density (at 20 °C):	1,01 g/cm³
Bulk density:	not applicable
Water solubility: (at 20 °C)	miscible
Solubility in other solvents	
no data available	
Partition coefficient:	no data available
Viscosity / dynamic:	no data available
Viscosity / kinematic:	no data available
Flow time:	no data available
Vapour density:	no data available
Evaporation rate:	no data available
Solvent separation test:	no data available
Solvent content:	no data available

9.2. Other information

Solid content:	not applicable

no data available

SECTION 10: Stability and reactivity

10.1. Reactivity

See also section 10.3

10.2. Chemical stability

Stable under recommended storage conditions.

10.3. Possibility of hazardous reactions

No dangerous reaction known under conditions of normal use.

10.4. Conditions to avoid

Extremes of temperature and direct sunlight.

10.5. Incompatible materials

Oxidizing agents

10.6. Hazardous decomposition products

Ammonia, Carbon monoxide, nitrogen oxides (NOx)

Further information

Stable under recommended storage conditions.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity

No data is available on the product itself.

CAS No	Chemical name				
	Exposure route	Dose	Species	Source	Method
100-97-0	methenamine; hexamethylenetetramine				
	oral	LD50 9200 mg/kg	Ratte		
7757-82-6	Sodium sulfate				
	oral	LD50 5989 mg/kg	mouse		

Irritation and corrosivity

No known effect.

Sensitising effects

May cause sensitisation by skin contact.

May cause sensitisation by inhalation. (List of references: Asthma in the workplace, I.Leonard Bernstein)

Carcinogenic/mutagenic/toxic effects for reproduction

Contains no ingredient listed as a carcinogen

STOT-single exposure

The substance or mixture is not classified as specific target organ toxicant, single exposure.

STOT-repeated exposure

The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Aspiration hazard

No aspiration toxicity classification

Specific effects in experiment on an animal

No data is available on the product itself.

Additional information on tests

no data available

Practical experience

Observations relevant to classification

no data available

Other observations

no data available

Further information

Other dangerous properties can not be excluded. Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1. Toxicity

No data is available on the product itself.

Do not flush into surface water or sanitary sewer system.

CAS No	Chemical name					
	Aquatic toxicity	Dose	[h] | [d]	Species	Source	Method
100-97-0	methenamine; hexamethylenetetramine					
	Acute fish toxicity	LC50 49800 mg/l	96 h	Fisch		
7757-82-6	Sodium sulfate					
	Acute fish toxicity	LC50 120 mg/l	96 h	Gambusia affinis	Merck	
	Acute crustacea toxicity	EC50 2564 mg/l	48 h			

12.2. Persistence and degradability

No data is available on the product itself.

12.3. Bioaccumulative potential

No data is available on the product itself.

12.4. Mobility in soil

no data available

12.5. Results of PBT and vPvB assessment

no data available

12.6. Other adverse effects

No known effect.

Further information

no data available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal recommendations

In accordance with local and national regulations.

List of Wastes Code - residues/unused products

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

List of Wastes Code - used product

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

List of Wastes Code - contaminated packaging

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

Land transport (ADR/RID)

Other applicable information (land transport)

Not subject to transport regulations.

Inland waterways transport (ADN)

Other applicable information (inland waterways transport)

Not tested

Marine transport (IMDG)

Other applicable information (marine transport)

Not subject to transport regulations.

Air transport (ICAO-TI/IATA-DGR)

Other applicable information (air transport)

Not subject to transport regulations.

14.5. Environmental hazards

ENVIRONMENTALLY HAZARDOUS: No

14.6. Special precautions for user

no data available

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

not applicable

Other applicable information

no data available

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulatory information

Restrictions on use (REACH, annex XVII):

Entry 3

National regulatory information

Water hazard class (D): 1 - slightly hazardous to water

15.2. Chemical safety assessment

Chemical safety assessments for substances in this mixture were not carried out.

SECTION 16: Other information

Changes

Revision: 03.01.2019
Safety datasheet sections which have been updated: 15, 16
Revision: 22.06.2016
Safety datasheet sections which have been updated: 2, 3
Revision: 27.05.2015
Safety datasheet sections which have been updated: 2, 4, 11

Classification for mixtures and used evaluation method according to Regulation (EC) No. 1272/2008 [CLP]

Classification	Classification procedure
Resp. Sens. 1; H334	Calculation method
Skin Sens. 1; H317	Calculation method

Relevant H and EUH statements (number and full text)

H228 Flammable solid.
H317 May cause an allergic skin reaction.
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Further Information

The information is based on the present level of our knowledge. It does not, however, give assurance of product properties and establishes no contract legal rights.

(The data for the hazardous ingredients were taken respectively from the last version of the sub-contractor's safety data sheet.)

Safety Data Sheet

according to Regulation (EC) No 1907/2006

26602-42 StablCal Formazin Turbidity Standard; 100 NTU

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

26602-42 StablCal Formazin Turbidity Standard; 100 NTU

UFI: VXTP-DY7N-611F-SVMQ

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture

Water analysis

1.3. Details of the supplier of the safety data sheet

Company name: HACH LANGE GmbH
Street: Willstätterstr. 11
Place: D-40549 Düsseldorf
Telephone: +49 (0)211 5288-383
e-mail: SDS@hach.com
Internet: www.de.hach.com
Responsible Department: HACH LANGE Ltd.
5, Pacific Way
Salford Manchester M50 1DL - United Kingdom
Tel. +44 (0) 161 872 1487 * Fax +44 (0) 161 848 7324
e-Mail: info-uk@hach.com

HACH LANGE Ltd.
Unit 1, Chestnut Road Western Industrial Estate
IRL-Dublin 12
Tel. +353 (0)1 4602522
e-Mail: info-ie@hach.com

1.4. Emergency telephone number:

Poison Control Center Mainz: Tel: +49 (0) 6131 19240 - 24 hour emergency service -

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No. 1272/2008

Hazard categories:
Respiratory or skin sensitisation: Resp. Sens. 1
Respiratory or skin sensitisation: Skin Sens. 1
Hazard Statements:
May cause allergy or asthma symptoms or breathing difficulties if inhaled.
May cause an allergic skin reaction.

2.2. Label elements

Regulation (EC) No. 1272/2008

Hazard components for labelling

methenamine; hexamethylenetetramine

Signal word: Danger

Pictograms:



Hazard statements

H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H317	May cause an allergic skin reaction.

Precautionary statements

P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection/hearing protection.
P302+P352	IF ON SKIN: Wash with plenty of water.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P342+P311	If experiencing respiratory symptoms: Call a POISON CENTER/doctor.

Additional advice on labelling

The product is classified as dangerous in accordance with Regulation (EC) No. 1272/2008.

2.3. Other hazards

no data available

SECTION 3: Composition/information on ingredients

3.2. Mixtures

Hazardous components

CAS No	Chemical name			Quantity
	EC No	Index No	REACH No	
	CLP Classification			
7732-18-5	Water			> 90 %
	231-791-2			
100-97-0	methenamine; hexamethylenetetramine			1-5 %
	202-905-8	612-101-00-2		
	Flam. Sol. 2, Resp. Sens. 1, Skin Sens. 1; H228 H334 H317			
7757-82-6	Sodium sulfate			< 1 %
	231-820-9			

Full text of H and EUH statements: see section 16.

SECTION 4: First aid measures

4.1. Description of first aid measures

General information

Take off all contaminated clothing immediately.

After inhalation

Move to fresh air.

After contact with skin

Wash off immediately with plenty of water.

In the case of skin irritation or allergic reactions see a physician.

After contact with eyes

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

Show this safety data sheet to the doctor in attendance.

After ingestion

Clean mouth with water and drink afterwards plenty of water.
Call a physician immediately. Show this safety data sheet to the doctor in attendance.

4.2. Most important symptoms and effects, both acute and delayed

sensitising effects

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. The product itself does not burn.

5.2. Special hazards arising from the substance or mixture

Fire may liberate hazardous vapours.

5.3. Advice for firefighters

In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment.

Additional information

Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use personal protective equipment.

6.2. Environmental precautions

Do not flush into surface water or sanitary sewer system.

6.3. Methods and material for containment and cleaning up

Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust).

6.4. Reference to other sections

13. Disposal considerations

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Advice on safe handling

Use only in well-ventilated areas.
Avoid contact with skin and eyes.

Advice on protection against fire and explosion

See also section 5

7.2. Conditions for safe storage, including any incompatibilities

Requirements for storage rooms and vessels

Keep in a dry, cool place.

Hints on joint storage

None known.

Further information on storage conditions

Keep locked up or in an area accessible only to qualified or authorised persons.

7.3. Specific end use(s)

Reagent for analysis

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Additional advice on limit values

None known.

8.2. Exposure controls

Appropriate engineering controls

Technical measures and appropriate working operations should be given priority over the use of personal protective equipment.

Protective and hygiene measures

The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Wash hands before breaks and after work.

Eye/face protection

Safety glasses with side-shields

Hand protection

Use barrier skin cream.
Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374. In full contact: Gloves material: Viton, Layer thickness: 0.70 mm, Breakthrough time: >480 min. In splash contact: Glove material: nitrile rubber, Layer thickness 0,20 mm, Breakthrough time: > 30 min

Skin protection

Remove and wash contaminated clothing before re-use.

Respiratory protection

Provide adequate ventilation.
Breathing apparatus only if aerosol or dust is formed. Recommended Filter type: ABEK-filter

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state:	suspension
Colour:	cloudy, milky
Odour:	odourless
pH-Value (at 20 °C):	8,54

Changes in the physical state

Melting point:	not applicable
Initial boiling point and boiling range:	100 °C
Sublimation point:	not applicable
Softening point:	not applicable
Pour point:	not applicable
:	no data available
Flash point:	not applicable
Sustaining combustion:	No data available

Flammability

Solid:	not applicable
Gas:	not applicable

Explosive properties
not applicable

Lower explosion limits:	not applicable
Upper explosion limits:	not applicable
Ignition temperature:	not applicable

Auto-ignition temperature

Solid:	not applicable
Gas:	not applicable
Decomposition temperature:	not applicable

Oxidizing properties
not applicable

Vapour pressure:	no data available
Vapour pressure:	no data available
Density (at 20 °C):	1,01 g/cm³
Bulk density:	no data available
Water solubility: (at 20 °C)	miscible

Solubility in other solvents
no data available

Partition coefficient:	no data available
Viscosity / dynamic:	no data available
Viscosity / kinematic:	no data available
Flow time:	no data available
Vapour density:	no data available
Evaporation rate:	no data available
Solvent separation test:	no data available
Solvent content:	no data available

9.2. Other information

Solid content:	not applicable

no data available

SECTION 10: Stability and reactivity

10.1. Reactivity
No dangerous reaction known under conditions of normal use.

10.2. Chemical stability
Stable under recommended storage conditions.

10.3. Possibility of hazardous reactions
Hazardous polymerisation does not occur.

10.4. Conditions to avoid
Extremes of temperature and direct sunlight.

10.5. Incompatible materials
Oxidizing agents

10.6. Hazardous decomposition products
Ammonia, Carbon monoxide, nitrogen oxides (NOx)

Further information

Stable under recommended storage conditions.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity

No data is available on the product itself.

CAS No	Chemical name				
	Exposure route	Dose	Species	Source	Method
100-97-0	methenamine; hexamethylenetetramine				
	oral	LD50 9200 mg/kg	Ratte		
7757-82-6	Sodium sulfate				
	oral	LD50 5989 mg/kg	mouse		

Irritation and corrosivity

No known effect.

Sensitising effects

May cause sensitisation by skin contact.

May cause sensitisation by inhalation. (List of references: Asthma in the workplace, I.Leonard Bernstein)

Carcinogenic/mutagenic/toxic effects for reproduction

Contains no ingredient listed as a carcinogen

STOT-single exposure

The substance or mixture is not classified as specific target organ toxicant, single exposure.

STOT-repeated exposure

The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Aspiration hazard

No aspiration toxicity classification

Specific effects in experiment on an animal

No data is available on the product itself.

Additional information on tests

no data available

Practical experience

Observations relevant to classification

no data available

Other observations

no data available

Further information

Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1. Toxicity

No data is available on the product itself.

Do not flush into surface water or sanitary sewer system.

CAS No	Chemical name					
	Aquatic toxicity	Dose	[h] | [d]	Species	Source	Method
100-97-0	methenamine; hexamethylenetetramine					
	Acute fish toxicity	LC50 49800 mg/l	96 h	Fisch		
7757-82-6	Sodium sulfate					
	Acute fish toxicity	LC50 120 mg/l	96 h	Gambusia affinis	Merck	
	Acute crustacea toxicity	EC50 2564 mg/l	48 h			

12.2. Persistence and degradability

No data is available on the product itself.

12.3. Bioaccumulative potential

no data available

12.4. Mobility in soil

no data available

12.5. Results of PBT and vPvB assessment

no data available

12.6. Other adverse effects

Discharge into the environment must be avoided.

Further information

no data available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal recommendations

In accordance with local and national regulations.

List of Wastes Code - residues/unused products

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

List of Wastes Code - used product

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

List of Wastes Code - contaminated packaging

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

Land transport (ADR/RID)

Other applicable information (land transport)

Not subject to transport regulations.

Inland waterways transport (ADN)

Other applicable information (inland waterways transport)

Not tested

Marine transport (IMDG)

Other applicable information (marine transport)

Not subject to transport regulations.

Air transport (ICAO-TI/IATA-DGR)

Other applicable information (air transport)

Not subject to transport regulations.

14.5. Environmental hazards

ENVIRONMENTALLY HAZARDOUS: No

14.6. Special precautions for user

Use personal protective equipment.

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Not relevant

Other applicable information

no data available

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulatory information

Restrictions on use (REACH, annex XVII):

Entry 3

National regulatory information

Water hazard class (D): 1 - slightly hazardous to water

15.2. Chemical safety assessment

Chemical safety assessments for substances in this mixture were not carried out.

SECTION 16: Other information

Changes

Revision: 10.08.2020
Safety datasheet sections which have been updated: 15, 16
Revision: 22.06.2016
Safety datasheet sections which have been updated: 2, 3
Revision: 06.05.2015
Safety datasheet sections which have been updated: 2, 4, 11

Classification for mixtures and used evaluation method according to Regulation (EC) No. 1272/2008 [CLP]

Classification	Classification procedure
Resp. Sens. 1; H334	Calculation method
Skin Sens. 1; H317	Calculation method

Relevant H and EUH statements (number and full text)

H228 Flammable solid.
H317 May cause an allergic skin reaction.
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Further Information

The information is based on the present level of our knowledge. It does not, however, give assurance of product properties and establishes no contract legal rights.

(The data for the hazardous ingredients were taken respectively from the last version of the sub-contractor's safety data sheet.)

26605-42 StablCal® Standard, 800 NTU or FNU

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

26605-42 StablCal® Standard, 800 NTU or FNU

UFI: 5JGQ-UYVW-Q117-HTG6

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture

Water analysis

1.3. Details of the supplier of the safety data sheet

Company name: HACH LANGE GmbH
Street: Willstätterstr. 11
Place: D-40549 Düsseldorf
Telephone: +49 (0)211 5288-383
e-mail: SDS@hach.com
Internet: www.de.hach.com
Responsible Department: HACH LANGE Ltd.
5, Pacific Way
Salford Manchester M50 1DL - United Kingdom
Tel. +44 (0) 161 872 1487 * Fax +44 (0) 161 848 7324
e-Mail: info-uk@hach.com

HACH LANGE Ltd.
Unit 1, Chestnut Road Western Industrial Estate
IRL-Dublin 12
Tel. +353 (0)1 4602522
e-Mail: info-ie@hach.com

1.4. Emergency telephone number:

Poison Control Center Mainz: Tel: +49 (0) 6131 19240 - 24 hour emergency service -

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No. 1272/2008

Hazard categories:
Respiratory or skin sensitisation: Resp. Sens. 1
Respiratory or skin sensitisation: Skin Sens. 1
Hazard Statements:
May cause allergy or asthma symptoms or breathing difficulties if inhaled.
May cause an allergic skin reaction.

2.2. Label elements

Regulation (EC) No. 1272/2008

Hazard components for labelling

methenamine; hexamethylenetetramine

Signal word: Danger

Pictograms:



Hazard statements

H317	May cause an allergic skin reaction.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Precautionary statements

P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P272	Contaminated work clothing should not be allowed out of the workplace.
P280	Wear protective gloves/protective clothing/eye protection/face protection/hearing protection.
P302+P352	IF ON SKIN: Wash with plenty of water.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P342+P311	If experiencing respiratory symptoms: Call a POISON CENTER/doctor.
P362+P364	Take off contaminated clothing and wash it before reuse.
P501	Dispose of contents/container to Disposal.

Additional advice on labelling

The product is classified as dangerous in accordance with Regulation (EC) No. 1272/2008.

2.3. Other hazards

This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).

SECTION 3: Composition/information on ingredients

3.2. Mixtures

Hazardous components

CAS No	Chemical name			Quantity
	EC No	Index No	REACH No	
	CLP Classification			
7732-18-5	Water			>90 %
	231-791-2			
100-97-0	methenamine; hexamethylenetetramine			5-10 %
	202-905-8	612-101-00-2		
	Flam. Sol. 2, Resp. Sens. 1, Skin Sens. 1; H228 H334 H317			
7757-82-6	Sodium sulfate			<0,5 %
	231-820-9			
50-00-0	formaldehyde ... %			<0,1 %
	200-001-8	605-001-00-5		
	Carc. 1B, Muta. 2, Acute Tox. 3, Acute Tox. 3, Acute Tox. 3, Skin Corr. 1B, Skin Sens. 1; H350 H341 H331 H311 H301 H314 H317			

Full text of H and EUH statements: see section 16.

Specific concentration limits and M-factors

CAS No	EC No	Chemical name	Quantity
	Specific concentration limits and M-factors		
50-00-0	200-001-8	formaldehyde ... %	<0,1 %
	Skin Corr. 1B; H314: >= 25 - 100 Skin Irrit. 2; H315: >= 5 - < 25 Eye Irrit. 2; H319: >= 5 - < 25 Skin Sens. 1; H317: >= 0,2 - 100 STOT SE 3; H335: >= 5 - 100		

SECTION 4: First aid measures

4.1. Description of first aid measures

General information

Take off all contaminated clothing immediately.

After inhalation

Move to fresh air.

After contact with skin

Wash off immediately with plenty of water.

After contact with eyes

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

After ingestion

Induce vomiting, but only if victim is fully conscious.

4.2. Most important symptoms and effects, both acute and delayed

sensitising effects

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. The product itself does not burn.

5.2. Special hazards arising from the substance or mixture

Fire may liberate hazardous vapours.

5.3. Advice for firefighters

In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment.

Additional information

Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use personal protective equipment.

6.2. Environmental precautions

Do not flush into surface water or sanitary sewer system.

6.3. Methods and material for containment and cleaning up

Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust).

6.4. Reference to other sections

13. Disposal considerations

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Advice on safe handling

Use only in well-ventilated areas.

Advice on protection against fire and explosion

See also section 5

7.2. Conditions for safe storage, including any incompatibilities

Requirements for storage rooms and vessels

Keep in a dry, cool place.

Hints on joint storage

None known.

7.3. Specific end use(s)

Reagent for analysis

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure limits (EH40)

CAS No	Substance	ppm	mg/m³	fibres/ml	Category	Origin
50-00-0	Formaldehyde	2	2.5		TWA (8 h)	WEL
		2	2.5		STEL (15 min)	WEL

Additional advice on limit values

None known.

8.2. Exposure controls

Appropriate engineering controls

Technical measures and appropriate working operations should be given priority over the use of personal protective equipment.

Protective and hygiene measures

The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Wash hands before breaks and after work.

Eye/face protection

Safety glasses with side-shields

Hand protection

Use barrier skin cream.
Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374. In full contact: Gloves material: Viton, Layer thickness: 0.70 mm, Breakthrough time: >480 min. In splash contact: Glove material: nitrile rubber, Layer thickness 0,20 mm, Breakthrough time: > 30 min

Skin protection

Remove and wash contaminated clothing before re-use.

Respiratory protection

Breathing apparatus only if aerosol or dust is formed. Recommended Filter type: ABEK-filter

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state:	liquid
Colour:	colourless
Odour:	odourless
pH-Value (at 20 °C):	7,5-8,5

Changes in the physical state

Melting point:	no data available
Initial boiling point and boiling range:	100 °C

Sublimation point:	not applicable
Softening point:	not applicable
Pour point:	not applicable
:	no data available
Flash point:	not applicable
Sustaining combustion:	No data available

Flammability

Solid:	not applicable
Gas:	not applicable

Explosive properties

not applicable

Lower explosion limits:	not applicable
Upper explosion limits:	not applicable
Ignition temperature:	no data available

Auto-ignition temperature

Solid:	not applicable
Gas:	not applicable
Decomposition temperature:	no data available

Oxidizing properties

not applicable

Vapour pressure:	no data available
Vapour pressure:	no data available
Density (at 20 °C):	1,04 g/cm³
Bulk density:	not applicable
Water solubility: (at 20 °C)	completely soluble

Solubility in other solvents

no data available

Partition coefficient:	no data available
Viscosity / dynamic:	no data available
Viscosity / kinematic:	no data available
Flow time:	no data available
Vapour density:	no data available
Evaporation rate:	no data available
Solvent separation test:	no data available
Solvent content:	no data available

9.2. Other information

Solid content:	not applicable

no data available

SECTION 10: Stability and reactivity

10.1. Reactivity

See also section 10.3

10.2. Chemical stability

Stable under recommended storage conditions.

10.3. Possibility of hazardous reactions

No dangerous reaction known under conditions of normal use.

10.4. Conditions to avoid

Extremes of temperature and direct sunlight.

10.5. Incompatible materials

No dangerous reaction known under conditions of normal use.
Oxidizing agents

10.6. Hazardous decomposition products

No decomposition if stored and applied as directed.

Further information

None known.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity

No data is available on the product itself.

CAS No	Chemical name				
	Exposure route	Dose	Species	Source	Method
100-97-0	methenamine; hexamethylenetetramine				
	oral	LD50 9200 mg/kg	Ratte		
7757-82-6	Sodium sulfate				
	oral	LD50 5989 mg/kg	mouse		
50-00-0	formaldehyde ... %				
	oral	ATE 100 mg/kg			
	dermal	ATE 300 mg/kg			
	inhalation (4 h) vapour	LC50 250 mg/l	rat		
	inhalation aerosol	ATE 0,5 mg/l			

Irritation and corrosivity

No known effect.

Sensitising effects

May cause sensitisation by skin contact.
May cause sensitisation by inhalation. (List of references: Asthma in the workplace, I.Leonard Bernstein)

Carcinogenic/mutagenic/toxic effects for reproduction

Contains no ingredient listed as a carcinogen

STOT-single exposure

The substance or mixture is not classified as specific target organ toxicant, single exposure.

STOT-repeated exposure

The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Aspiration hazard

No aspiration toxicity classification

Specific effects in experiment on an animal

No data is available on the product itself.

Additional information on tests

no data available

Practical experience

Observations relevant to classification

no data available

Other observations

no data available

Further information

Other dangerous properties can not be excluded. Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1. Toxicity

No data is available on the product itself.

Do not flush into surface water or sanitary sewer system.

CAS No	Chemical name					
	Aquatic toxicity	Dose	[h] | [d]	Species	Source	Method
100-97-0	methenamine; hexamethylenetetramine					
	Acute fish toxicity	LC50 49800 mg/l	96 h	Fisch		
7757-82-6	Sodium sulfate					
	Acute fish toxicity	LC50 120 mg/l	96 h	Gambusia affinis	Merck	
	Acute crustacea toxicity	EC50 2564 mg/l	48 h			

12.2. Persistence and degradability

No data is available on the product itself.

12.3. Bioaccumulative potential

No data is available on the product itself.

12.4. Mobility in soil

no data available

12.5. Results of PBT and vPvB assessment

no data available

12.6. Other adverse effects

No known effect.

Further information

no data available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal recommendations

In accordance with local and national regulations.

List of Wastes Code - residues/unused products

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

List of Wastes Code - used product

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

List of Wastes Code - contaminated packaging

160506 WASTES NOT OTHERWISE SPECIFIED IN THE LIST; gases in pressure containers and discarded chemicals; laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals; hazardous waste

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

Land transport (ADR/RID)

Other applicable information (land transport)

Not subject to transport regulations.

Inland waterways transport (ADN)

Other applicable information (inland waterways transport)

Not tested

Marine transport (IMDG)

Other applicable information (marine transport)

Not subject to transport regulations.

Air transport (ICAO-TI/IATA-DGR)

Other applicable information (air transport)

Not subject to transport regulations.

14.5. Environmental hazards

ENVIRONMENTALLY HAZARDOUS: No

14.6. Special precautions for user

no data available

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

not applicable

Other applicable information

no data available

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulatory information

Restrictions on use (REACH, annex XVII):

Entry 3, Entry 28

National regulatory information

Water hazard class (D): 1 - slightly hazardous to water

15.2. Chemical safety assessment

Chemical safety assessments for substances in this mixture were not carried out.

SECTION 16: Other information

Changes

Revision: 15.08.2018
Safety datasheet sections which have been updated: 2, 3, 15
Revision: 22.09.2015
Safety datasheet sections which have been updated: 2, 3
Revision: 18.06.2015
Safety datasheet sections which have been updated: 2, 4, 11

Classification for mixtures and used evaluation method according to Regulation (EC) No. 1272/2008 [CLP]

Classification	Classification procedure
Resp. Sens. 1; H334	Calculation method
Skin Sens. 1; H317	Calculation method

Relevant H and EUH statements (number and full text)

H228	Flammable solid.
H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.
H317	May cause an allergic skin reaction.
H331	Toxic if inhaled.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H341	Suspected of causing genetic defects.
H350	May cause cancer.

Further Information

The information is based on the present level of our knowledge. It does not, however, give assurance of product properties and establishes no contract legal rights.

(The data for the hazardous ingredients were taken respectively from the last version of the sub-contractor's safety data sheet.)

SAFETY DATA SHEET

1. IDENTIFICATION

Product identifier
Product Name STABLCAL® FORMAZIN STANDARD 100 NTU

Other means of identification
Product Code(s) 2684901

Safety data sheet number M03412

Recommended use of the chemical and restrictions on use
Recommended Use Laboratory Use. Standard solution.
Uses advised against None.
Restrictions on use None.

Details of the supplier of the safety data sheet

Manufacturer Address
Hach Company P.O.Box 389 Loveland, CO 80539 USA +1(970) 669-3050

Emergency telephone number
+1(303) 623-5716 - 24 Hour Service +1(515)232-2533 - 8am - 4pm CST

2. HAZARDS IDENTIFICATION

Classification

Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Respiratory sensitization	Category 1
Skin sensitization	Category 1

Hazards not otherwise classified (HNOC)
Not applicable

Label elements

Signal word - Danger



Hazard statements

H317 - May cause an allergic skin reaction
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

Precautionary statements
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P285 - In case of inadequate ventilation wear respiratory protection
P304 + P341 - IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
P501 - Dispose of contents/ container to an approved waste disposal plant
P272 - Contaminated work clothing should not be allowed out of the workplace
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
P363 - Wash contaminated clothing before reuse

Other Hazards Known
Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance
Not applicable

Mixture

Chemical Family Mixture.

Percent ranges are used where confidential product information is applicable.

Chemical name	CAS No.	Percent Range	HMRIC #
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	5 - 10%	-
Sodium sulfate	7757-82-6	<1%	-
Formaldehyde	50-00-0	<0.1%	-
Ammonium sulfate	7783-20-2	<0.1%	-

4. FIRST AID MEASURES

Description of first aid measures

General advice Show this safety data sheet to the doctor in attendance.

Inhalation May cause allergic respiratory reaction. If breathing has stopped, give artificial respiration. Get medical attention immediately. Remove to fresh air. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Get immediate medical advice/attention.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.

Skin contact Wash with soap and water. May cause an allergic skin reaction. In the case of skin irritation or allergic reactions see a physician.

Ingestion May produce an allergic reaction. Do NOT induce vomiting. Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.

Self-protection of the first aider Ensure that medical personnel are aware of the material(s) involved, take precautions to

protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation.

Most important symptoms and effects, both acute and delayed

Symptoms May cause allergy or asthma symptoms or breathing difficulties if inhaled. Coughing and/ or wheezing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Note to physicians May cause sensitization in susceptible persons. Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical Product is or contains a sensitizer. May cause sensitization by inhalation and skin contact. May cause sensitization by skin contact.

Hazardous combustion products This material will not burn.

Special protective equipment for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear.

6. ACCIDENTAL RELEASE MEASURES

U.S. Notice Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.

Personal precautions, protective equipment and emergency procedures

Personal precautions Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.

Other Information Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental precautions Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Pick up and transfer to properly labeled containers.

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Reference to other sections See section 8 for more information. See section 13 for more information.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Provide extract ventilation to points where emissions occur. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Remove contaminated clothing and shoes. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.

Flammability class Not applicable

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Formaldehyde CAS#: 50-00-0	STEL: 0.3 ppm TWA: 0.1 ppm	TWA: 0.75 ppm (vacated) TWA: 3 ppm (vacated) STEL: 10 ppm (vacated) Ceiling: 5 ppm STEL: 2 ppm	IDLH: 20 ppm Ceiling: 0.1 ppm 15 min TWA: 0.016 ppm

Appropriate engineering controls

Engineering Controls Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.

Hand Protection Wear suitable gloves.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing.

General Hygiene Considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing and gloves, including the inside, before re-use.

Environmental exposure controls Local authorities should be advised if significant spillages cannot be contained. Do not allow into any sewer, on the ground or into any body of water.

Thermal hazards None under normal processing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid		
Appearance	Turbid solution aqueous solution	**Color**	white
Odor	Odorless	**Odor threshold**	No data available

Property	Values	Remarks • Method
Molecular weight	No data available	
pH	No data available	
Melting point/freezing point	~ 0 °C / 32 °F	Estimation based on theoretical calculation
Boiling point / boiling range	~ 100 °C / 212 °F	Estimation based on theoretical calculation
Evaporation rate	1 (water = 1) Estimation based on theoretical calculation	
Vapor pressure	17.477 mm Hg / 2.33 kPa at 20 °C / 68 °F	Estimation based on theoretical calculation
Vapor density (air = 1)	0.62 (air = 1)	
Specific gravity (water = 1 / air = 1)	1.02	
Partition Coefficient (n-octanol/water)	Not applicable	
Soil Organic Carbon-Water Partition Coefficient	Not applicable	
Autoignition temperature	No data available	
Decomposition temperature	No data available	
Dynamic viscosity	No data available	
Kinematic viscosity	No data available	

Solubility(ies)

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Solubility in other solvents

Chemical Name	Solubility classification	Solubility	Solubility Temperature
None reported	No information available	No data available	No information available

Other Information

Metal Corrosivity

Steel Corrosion Rate	No data available
Aluminum Corrosion Rate	No data available

Volatile Organic Compounds (VOC) Content

No information available See ingredients information below

Chemical name	CAS No.	Volatile organic compounds (VOC) content	CAA (Clean Air Act)
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	Not applicable	X
Sodium sulfate	7757-82-6	No data available	-
Formaldehyde	50-00-0	No data available	X
Ammonium sulfate	7783-20-2	No data available	-

Explosive properties

Upper explosion limit No data available
Lower explosion limit No data available

Flammable properties

Flash point Not applicable

Flammability Limit in Air
Upper flammability limit No data available
Lower flammability limit No data available

Oxidizing properties No data available.

Bulk density No data available

Particle Size No information available

Particle Size Distribution No information available

10. STABILITY AND REACTIVITY

Reactivity
Not applicable.

Chemical stability
Stability Stable under normal conditions.

Explosion data
Sensitivity to Mechanical Impact None
Sensitivity to Static Discharge None.

Possibility of Hazardous Reactions
Possibility of Hazardous Reactions None under normal processing.

Hazardous polymerization
None under normal processing.

Conditions to avoid
Conditions to avoid None known based on information supplied.

Incompatible materials
Incompatible materials Strong oxidizing agents, strong acids, and strong bases.

Hazardous Decomposition Products
Ammonia. Carbon monoxide. Formaldehyde. Nitrogen oxides. Sodium oxides. Sulfur oxides.

11. TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure
Product Information

Inhalation	May cause sensitization in susceptible persons.
Eye contact	No known effect based on information supplied.
Skin contact	Repeated or prolonged skin contact may cause allergic reactions with susceptible persons. May cause sensitization by skin contact.
Ingestion	May cause additional affects as listed under "Inhalation".
Symptoms	Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain, or flushing. Coughing and/ or wheezing. Itching. Rashes. Hives.
Aggravated Medical Conditions	Respiratory disorders. Skin disorders. Allergies.
Toxicologically synergistic products	None known.
Toxicokinetics, metabolism and distribution	See ingredients information below.

Chemical name	Toxicokinetics, metabolism and distribution
Formaldehyde (<0.1%) CAS#: 50-00-0	Readily Absorbed via the respiratory and gastrointestinal routes. Absorbed formaldehyde can be oxidized to formate and carbon dioxide. Half-life of formaldehyde is 1 min in rat plasma.

Product Acute Toxicity Data

Oral Exposure Route	No data available
Dermal Exposure Route	No data available
Inhalation (Dust/Mist) Exposure Route	No data available
Inhalation (Vapor) Exposure Route	No data available
Inhalation (Gas) Exposure Route	No data available

Unknown Acute Toxicity
3.731E-05% of the mixture consists of ingredient(s) of unknown toxicity.

Acute Toxicity Estimations (ATE)

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	No information available
ATEmix (dermal)	No information available
ATEmix (inhalation-dust/mist)	No information available
ATEmix (inhalation-vapor)	No information available
ATEmix (inhalation-gas)	No information available

Ingredient Acute Toxicity Data
Oral Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%)	Rat LD_{50}	100 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of

CAS#: 50-00-0					the German Social Accident Insurance)
Ammonium sulfate (<0.1%) CAS#: 7783-20-2	Rat LD_{50}	2840 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Dermal Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rabbit LD_{50}	270 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Inhalation (Dust/Mist) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LC_{50}	0.578 mg/L	4 hours	None reported	LOLI

Inhalation (Vapor) Exposure Route If available, see data below
Inhalation (Gas) Exposure Route If available, see data below

Product Specific Target Organ Toxicity Single Exposure Data

Oral Exposure Route No data available
Dermal Exposure Route No data available
Inhalation (Dust/Mist) Exposure Route No data available
Inhalation (Vapor) Exposure Route No data available
Inhalation (Gas) Exposure Route No data available

Ingredient Specific Target Organ Toxicity Single Exposure Data

Oral Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human LD_{Lo}	70 mg/kg	None reported	**Gastrointestinal** **Kidney, Ureter, or Bladder** **Liver** Other changes Ulcerated stomach Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)
Ammonium sulfate (<0.1%) CAS#: 7783-20-2	Man TD_{Lo}	1500 mg/kg	None reported	**Gastrointestinal** Gas	RTECS (Registry of Toxic Effects of Chemical Substances)
Chemical name	**Endpoint type**	**Reported dose**	**Exposure time**	**Toxicological effects**	**Key literature references and sources for data**
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TD_{Lo}	643 mg/kg	None reported	**Gastrointestinal** **Lungs, Thorax, or Respiration** Nausea or vomiting Respiratory obstruction Ulcerated stomach	RTECS (Registry of Toxic Effects of Chemical Substances)
Ammonium sulfate (<0.1%) CAS#: 7783-20-2	Domestic mammal - Not specified LD_{Lo}	3500 mg/kg	None reported	**Lungs, Thorax, or Respiration** Respiratory stimulation	RTECS (Registry of Toxic Effects of Chemical Substances)

Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below
Inhalation (Vapor) Exposure Route If available, see data below
Inhalation (Gas) Exposure Route If available, see data below

Aspiration toxicity
No data available

Product Skin Corrosion/Irritation Data
No data available.

Ingredient Skin Corrosion/Irritation Data
If available, see data below

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Organization for Economic Co-operation and Development (OECD) - Test 404: Acute Dermal Corrosion/Irritation	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Standard Draize Test	Human	0.150 mg	72 hours	Corrosive to skin	RTECS (Registry of Toxic Effects of Chemical Substances)
Ammonium sulfate (<0.1%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	800 mg	20 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)

Product Serious Eye Damage/Eye Irritation Data
No data available.

Ingredient Eye Damage/Eye Irritation Data
No data available

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Organization for Economic Co-operation and Development (OECD) - Test 405: Acute Eye Corrosion/Irritation	Rabbit	100 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	90 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Rinse Test	Human	1 ppm	6 minutes	Corrosive to eyes	RTECS (Registry of Toxic Effects of Chemical Substances)
Ammonium sulfate (<0.1%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	0.050 mL	None reported	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)

Sensitization Information

Product Sensitization Data
Skin Sensitization Exposure Route No data available.
Respiratory Sensitization Exposure Route No data available.

Ingredient Sensitization Data

Skin Sensitization Exposure Route If available, see data below.

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	OECD Test No. 406: Skin Sensitization	Guinea pig	Confirmed to be a skin sensitizer	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	OECD Test No. 406: Skin Sensitization	Guinea pig	Not confirmed to be a skin sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	Patch test	Human	Confirmed to be a skin sensitizer	ERMA (New Zealands Environmental Risk Management Authority)

Respiratory Sensitization Exposure Route If available, see data below.

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Based on human experience	Human	Confirmed to be a respiratory sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	IgE Specific Immune Response Test	Guinea pig	Confirmed to be a respiratory sensitizer	CICAD (Concise International Chemical Assessment Documents)

Chronic Toxicity Information

Product Specific Target Organ Toxicity Repeat Dose Data

Oral Exposure Route No data available.
Dermal Exposure Route No data available.
Inhalation (Dust/Mist) Exposure Route No data available.
Inhalation (Vapor) Exposure Route No data available.
Inhalation (Gas) Exposure Route No data available.

Ingredient Specific Target Organ Toxicity Repeat Exposure Data

Oral Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Rat NOAEL	80 mg/kg	None reported	None reported	Vendor SDS

Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Rat TC_{Lo}	350 mg/m^3	21 days	**Kidney, Ureter, or Bladder** Urine volume decreased or anuria **Nutritional and Gross Metabolic** Weight loss or decreased weight gain **Biochemical** Enzyme inhibition, induction, or change in blood or tissue levels	RTECS (Registry of Toxic Effects of Chemical Substances)

				(true cholinesterase)	

Inhalation (Vapor) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TC_{Lo}	0.017 mg/L	0.5 days	**Eye** **Lungs, Thorax, or Respiration** Lacrimation Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TC_{Lo}	2 mg/L	40 minutes	**Lungs, Thorax, or Respiration** Other changes Respiratory depression	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Gas) Exposure Route If available, see data below

Product Carcinogenicity Data

Oral Exposure Route No data available
Dermal Exposure Route No data available
Inhalation (Dust/Mist) Exposure Route No data available
Inhalation (Vapor) Exposure Route No data available
Inhalation (Gas) Exposure Route No data available

Ingredient Carcinogenicity Data

Chemical name	CAS No.	ACGIH	IARC	NTP	OSHA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	-	-	-	-
Sodium sulfate	7757-82-6	-	-	-	-
Formaldehyde	50-00-0	A1	Group 1	Known	X
Ammonium sulfate	7783-20-2	-	-	-	-

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)	A2 - Suspected Human Carcinogen
IARC (International Agency for Research on Cancer)	Group 1 - Carcinogenic to Humans
NTP (National Toxicology Program)	Known - Known Carcinogen
OSHA (Occupational Safety and Health Administration of the US Department of Labor)	X - Present

Oral Exposure Route If available, see data below
Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below
Inhalation (Vapor) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat	15 mg/L	78 weeks	**Olfaction** Tumors	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Gas) Exposure Route If available, see data below

Product Germ Cell Mutagenicity *invitro* Data
No data available.

Ingredient Germ Cell Mutagenicity *invitro* Data
If available, see data below

Chemical name	Test	Cell Strain	Reported dose	Exposure time	Results	Key literature references and sources for data

1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Cytogenetic analysis	Human HeLa Cell	1 mmol/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)
Chemical name	**Test**	**Cell Strain**	**Reported dose**	**Exposure time**	**Results**	**Key literature references and sources for data**
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Morphological transformation	Hamster kidney	10 mg/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Product Germ Cell Mutagenicity *invivo* **Data**

Oral Exposure Route No data available
Dermal Exposure Route No data available
Inhalation (Dust/Mist) Exposure Route No data available
Inhalation (Vapor) Exposure Route No data available
Inhalation (Gas) Exposure Route No data available

Ingredient Germ Cell Mutagenicity *invivo* **Data**

Oral Exposure Route If available, see data below

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Dominant lethal test	Mouse	25000 mg/kg	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below
Inhalation (Vapor) Exposure Route If available, see data below

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Micronucleus test	Human	.000985 mg/L	8.5 years	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)
Chemical name	**Test**	**Species**	**Reported dose**	**Exposure time**	**Results**	**Key literature references and sources for data**
Formaldehyde (<0.1%) CAS#: 50-00-0	Micronucleus test	Human	2 mg/L	15 minutes	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Gas) Exposure Route If available, see data below

Product Reproductive Toxicity Data

Oral Exposure Route No data available
Dermal Exposure Route No data available
Inhalation (Dust/Mist) Exposure Route No data available
Inhalation (Vapor) Exposure Route No data available
Inhalation (Gas) Exposure Route No data available

Ingredient Reproductive Toxicity Data

Oral Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	Mouse TD_{Lo}	14000 mg/kg	4 days	**Effects on Newborn** Other neonatal measures or effects	RTECS (Registry of Toxic Effects of Chemical Substances)

Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below
Inhalation (Vapor) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat TC_{Lo}	40 mg/L	14 days	**Effects on Embryo or Fetus** Fetotoxicity (except death e.g. stunted fetus)	RTECS (Registry of Toxic Effects of Chemical Substances)

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat TC_{Lo}	.001 mg/L	24 weeks	**Effects on Embryo or Fetus** Cytological changes (including somatic cell genetic material)	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Gas) Exposure Route If available, see data below

12. ECOLOGICAL INFORMATION

Ecotoxicity

Product Ecological Data

Aquatic toxicity

Fish No data available
Crustacea No data available
Algae No data available

Ingredient Ecological Data

Aquatic toxicity

Fish If available, see ingredient data below

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	96 hours	None reported	LC_{50}	56 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	96 hours	*Morone saxatilis*	LC_{50}	6.7 mg/L	PEEN (Pan European Ecological Network)
Ammonium sulfate (<0.1%) CAS#: 7783-20-2	96 hours	*Oncorhynchus mykiss*	LC_{50}	36.7 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Crustacea If available, see ingredient data below

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	48 Hours	*Daphnia magna*	EC_{50}	3150 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	48 Hours	*Daphnia pulex*	EC_{50}	5.8 mg/L	PEEN (Pan European Ecological Network)
Ammonium sulfate	48 Hours	None reported	LC_{50}	14 mg/L	GESTIS (Information System on

(<0.1%) CAS#: 7783-20-2					Hazardous Substances of the German Social Accident Insurance)

Algae If available, see ingredient data below

Other Information

Persistence and degradability

Product Biodegradability Data
No data available.

Ingredient Biodegradability Data

Chemical name	Test method	Biodegradation	Exposure time	Results
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	None reported	70%	28 days	Readily biodegradable

Bioaccumulation

Product Bioaccumulation Data
No data available.

Partition Coefficient (n-octanol/water) Not applicable

Ingredient Bioaccumulation Data

Chemical name	Test method	Exposure time	Species	Bioconcentration factor (BCF)	Results
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	None reported	None reported	None reported	None reported	Not determined
Formaldehyde (<0.1%) CAS#: 50-00-0	Estimation through BCFBAF v3.01 part of the Estimation Programs Interface (EPI) Suite™	None reported	None reported	BCF = 3.16228	Does not have the potential to bioaccumulate

Mobility

Soil Organic Carbon-Water Partition Coefficient Not applicable

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Other adverse effects
Contains a substance with an endocrine-disrupting potential.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

US EPA Waste Number Not applicable, U122

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Formaldehyde 50-00-0	U122	Included in waste streams: K009, K010, K038, K040, K156, K157	-	U122

14. TRANSPORT INFORMATION

U.S. DOT Not regulated

TDG Not regulated

IATA Not regulated

IMDG Not regulated

Note: No special precautions necessary.

Additional information
There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods.
If the item is not in a reagent set or kit, the classification given above applies.
If the item is part of a reagent set or kit the classification would change to the following:
UN3316 Chemical Kit, Hazard Class 9, Packing Group II or III.
If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

National Inventories

TSCA	Complies
DSL/NDSL	Complies

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

International Inventories

EINECS/ELINCS	Complies
ENCS	Does not comply
IECSC	Does not comply
KECL	Complies
PICCS	Does not comply
TCSI	Does not comply
AICS	Does not comply
NZIoC	Complies

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
TCSI - Taiwan Chemical Substances Inventory
AICS - Australian Inventory of Chemical Substances
NZIoC - New Zealand Inventory of Chemicals

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
Formaldehyde (CAS #: 50-00-0)	0.1
Ammonium sulfate (CAS #: 7783-20-2)	1.0

SARA 311/312 Hazard Categories

Acute health hazard	Yes
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Formaldehyde 50-00-0	100 lb	-	-	X

CERCLA

Chemical name	Hazardous Substances RQs	CERCLA/SARA RQ	Reportable Quantity (RQ)
Formaldehyde 50-00-0	100 lb	100 lb	RQ 100 lb final RQ RQ 45.4 kg final RQ

U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues

Chemical name	U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues
Formaldehyde (<0.1%) CAS#: 50-00-0	Release - Toxic (solution)

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Formaldehyde (CAS #: 50-00-0)	Carcinogen

WARNING: This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer.
For more information, go to http://www.P65Warnings.ca.gov

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	X	-	-
Sodium sulfate 7757-82-6	-	X	X
Formaldehyde 50-00-0	X	X	X
Ammonium sulfate 7783-20-2	-	X	X

U.S. EPA Label Information

Chemical name	FIFRA	FDA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	180.0910	-
Sodium sulfate	-	21 CFR 186.1797
Ammonium sulfate	180.0910	21 CFR 184.1143

16. OTHER INFORMATION, INCLUDING DATE OF PREPARATION OF THE LAST REVISION

Special Comments
None

Additional information

Global Automotive Declarable Substance List (GADSL)

Chemical name	Global Automotive Declarable Substance List Classifications	Global Automotive Declarable Substance List Thersholds
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	Declarable Substance (FI)	0.1 %
Formaldehyde 50-00-0	Declarable Substance (FI) Prohibited Substance (LR) Declarable Substance (LR)	0.0 % 0.1 %

NFPA and HMIS Classifications

NFPA	**Health hazards** - 2	**Flammability** - 0	**Instability** - 0	**Physical and Chemical Properties** -
HMIS	**Health hazards** - 2	**Flammability** - 0	**Physical Hazards** - 0	**Personal protection** - X - See section 8 for more information

Key or legend to abbreviations and acronyms used in the safety data sheet

NIOSH IDLH — *Immediately Dangerous to Life or Health*
ACGIH — ACGIH (American Conference of Governmental Industrial Hygienists)

NDF	*no data*

Legend - Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
MAC	Maximum Allowable Concentration	Ceiling	Ceiling Limit Value
X	Listed	Vacated	These values have no official status. The only binding levels of contaminants are those listed in the final OSHA PEL. These lists are for reference purposes only. Please note that some reference state regulations of these "liberated" exposure limits in their state regulations.
SKN*	Skin designation	SKN+	Skin sensitization
RSP+	Respiratory sensitization	**	Hazard Designation
C	Carcinogen	R	Reproductive toxicant
M	mutagen		

Prepared By	Hach Product Compliance Department
Issue Date	16-Aug-2018
Revision Date	17-Aug-2018
Revision Note	None

Disclaimer

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

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End of Safety Data Sheet

SAFETY DATA SHEET

1. IDENTIFICATION

Product identifier
Product Name STABLCAL® FORMAZIN STANDARD 800 NTU

Other means of identification
Product Code(s) 2660501

Safety data sheet number M03413

Recommended use of the chemical and restrictions on use
Recommended Use Laboratory Use. Standard solution.
Uses advised against None.
Restrictions on use None.

Details of the supplier of the safety data sheet

Manufacturer Address
Hach Company P.O.Box 389 Loveland, CO 80539 USA +1(970) 669-3050

Emergency telephone number
+1(303) 623-5716 - 24 Hour Service +1(515)232-2533 - 8am - 4pm CST

2. HAZARDS IDENTIFICATION

Classification

Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Respiratory sensitization	Category 1
Skin sensitization	Category 1

Hazards not otherwise classified (HNOC)
Not applicable

Label elements

Signal word - Danger



Hazard statements

H317 - May cause an allergic skin reaction
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

Precautionary statements
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P285 - In case of inadequate ventilation wear respiratory protection
P304 + P341 - IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
P501 - Dispose of contents/ container to an approved waste disposal plant
P272 - Contaminated work clothing should not be allowed out of the workplace
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
P363 - Wash contaminated clothing before reuse

Other Hazards Known
Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance
Not applicable

Mixture

Chemical Family Mixture.

Percent ranges are used where confidential product information is applicable.

Chemical name	CAS No.	Percent Range	HMRIC #
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	5 - 10%	-
Sodium sulfate	7757-82-6	<1%	-
Ammonium sulfate	7783-20-2	<1%	-
Formaldehyde	50-00-0	<0.1%	-

4. FIRST AID MEASURES

Description of first aid measures

General advice Show this safety data sheet to the doctor in attendance.

Inhalation May cause allergic respiratory reaction. If breathing has stopped, give artificial respiration. Get medical attention immediately. Remove to fresh air. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Get immediate medical advice/attention.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.

Skin contact Wash with soap and water. May cause an allergic skin reaction. In the case of skin irritation or allergic reactions see a physician.

Ingestion May produce an allergic reaction. Do NOT induce vomiting. Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.

Self-protection of the first aider Ensure that medical personnel are aware of the material(s) involved, take precautions to

protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation.

Most important symptoms and effects, both acute and delayed

Symptoms May cause allergy or asthma symptoms or breathing difficulties if inhaled. Coughing and/ or wheezing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Note to physicians May cause sensitization in susceptible persons. Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical Product is or contains a sensitizer. May cause sensitization by inhalation and skin contact. May cause sensitization by skin contact.

Hazardous combustion products This material will not burn.

Special protective equipment for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear.

6. ACCIDENTAL RELEASE MEASURES

U.S. Notice Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.

Personal precautions, protective equipment and emergency procedures

Personal precautions Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.

Other Information Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental precautions Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Pick up and transfer to properly labeled containers.

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Reference to other sections See section 8 for more information. See section 13 for more information.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Provide extract ventilation to points where emissions occur. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Remove contaminated clothing and shoes. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.

Flammability class Not applicable

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Formaldehyde CAS#: 50-00-0	STEL: 0.3 ppm TWA: 0.1 ppm	TWA: 0.75 ppm (vacated) TWA: 3 ppm (vacated) STEL: 10 ppm (vacated) Ceiling: 5 ppm STEL: 2 ppm	IDLH: 20 ppm Ceiling: 0.1 ppm 15 min TWA: 0.016 ppm

Appropriate engineering controls

Engineering Controls Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.

Hand Protection Wear suitable gloves.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing.

General Hygiene Considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing and gloves, including the inside, before re-use.

Environmental exposure controls Local authorities should be advised if significant spillages cannot be contained. Do not allow into any sewer, on the ground or into any body of water.

Thermal hazards None under normal processing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid		
Appearance	Turbid solution aqueous solution	**Color**	white
Odor	Odorless	**Odor threshold**	No data available

Property	Values	Remarks • Method
Molecular weight	No data available	
pH	No data available	
Melting point/freezing point	~ 0 °C / 32 °F	Estimation based on theoretical calculation
Boiling point / boiling range	~ 100 °C / 212 °F	Estimation based on theoretical calculation
Evaporation rate	1 (water = 1)	Estimation based on theoretical calculation
Vapor pressure	17.477 mm Hg / 2.33 kPa at 20 °C / 68 °F	Estimation based on theoretical calculation
Vapor density (air = 1)	0.62 (air = 1)	
Specific gravity (water = 1 / air = 1)	1.02	
Partition Coefficient (n-octanol/water)	Not applicable	
Soil Organic Carbon-Water Partition Coefficient	Not applicable	
Autoignition temperature	No data available	
Decomposition temperature	No data available	
Dynamic viscosity	No data available	
Kinematic viscosity	No data available	

Solubility(ies)

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Solubility in other solvents

Chemical Name	Solubility classification	Solubility	Solubility Temperature
None reported	No information available	No data available	No information available

Other Information

Metal Corrosivity

Steel Corrosion Rate	No data available
Aluminum Corrosion Rate	No data available

Volatile Organic Compounds (VOC) Content
No information available See ingredients information below

Chemical name	CAS No.	Volatile organic compounds (VOC) content	CAA (Clean Air Act)
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	Not applicable	X
Sodium sulfate	7757-82-6	No data available	-
Ammonium sulfate	7783-20-2	No data available	-
Formaldehyde	50-00-0	No data available	X

Explosive properties

Upper explosion limit No data available
Lower explosion limit No data available

Flammable properties

Flash point No data available

Flammability Limit in Air
Upper flammability limit No data available
Lower flammability limit No data available

Oxidizing properties No data available.

Bulk density No data available

Particle Size No information available

Particle Size Distribution No information available

10. STABILITY AND REACTIVITY

Reactivity
Not applicable.

Chemical stability
Stability Stable under normal conditions.

Explosion data
Sensitivity to Mechanical Impact None
Sensitivity to Static Discharge None.

Possibility of Hazardous Reactions
Possibility of Hazardous Reactions None under normal processing.

Hazardous polymerization
None under normal processing.

Conditions to avoid
Conditions to avoid None known based on information supplied.

Incompatible materials
Incompatible materials Strong oxidizing agents, strong acids, and strong bases.

Hazardous Decomposition Products

Ammonia. Carbon monoxide. Formaldehyde. Nitrogen oxides. Sodium oxides. Sulfur oxides.

11. TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure
Product Information

Inhalation	May cause sensitization in susceptible persons.
Eye contact	No known effect based on information supplied.
Skin contact	Repeated or prolonged skin contact may cause allergic reactions with susceptible persons. May cause sensitization by skin contact.
Ingestion	May cause additional affects as listed under "Inhalation".
Symptoms	Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain, or flushing. Coughing and/ or wheezing. Itching. Rashes. Hives.
Aggravated Medical Conditions	Respiratory disorders. Skin disorders. Allergies.
Toxicologically synergistic products	None known.
Toxicokinetics, metabolism and distribution	See ingredients information below.

Chemical name	Toxicokinetics, metabolism and distribution
Formaldehyde (<0.1%) CAS#: 50-00-0	Readily Absorbed via the respiratory and gastrointestinal routes. Absorbed formaldehyde can be oxidized to formate and carbon dioxide. Half-life of formaldehyde is 1 min in rat plasma.

Product Acute Toxicity Data

Oral Exposure Route	No data available
Dermal Exposure Route	No data available
Inhalation (Dust/Mist) Exposure Route	No data available
Inhalation (Vapor) Exposure Route	No data available
Inhalation (Gas) Exposure Route	No data available

Unknown Acute Toxicity
0.00030371% of the mixture consists of ingredient(s) of unknown toxicity.

Acute Toxicity Estimations (ATE)

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	No information available
ATEmix (dermal)	No information available
ATEmix (inhalation-dust/mist)	No information available
ATEmix (inhalation-vapor)	No information available
ATEmix (inhalation-gas)	No information available

Ingredient Acute Toxicity Data
Oral Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Ammonium sulfate	Rat LD_{50}	2840 mg/kg	None	None reported	GESTIS (Information System

(<1%) CAS#: 7783-20-2			reported		on Hazardous Substances of the German Social Accident Insurance)
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LD_{50}	100 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Dermal Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rabbit LD_{50}	270 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Inhalation (Dust/Mist) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LC_{50}	0.578 mg/L	4 hours	None reported	LOLI

Inhalation (Vapor) Exposure Route If available, see data below
Inhalation (Gas) Exposure Route If available, see data below

Product Specific Target Organ Toxicity Single Exposure Data

Oral Exposure Route No data available
Dermal Exposure Route No data available
Inhalation (Dust/Mist) Exposure Route No data available
Inhalation (Vapor) Exposure Route No data available
Inhalation (Gas) Exposure Route No data available

Ingredient Specific Target Organ Toxicity Single Exposure Data

Oral Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Ammonium sulfate (<1%) CAS#: 7783-20-2	Man TD_{Lo}	1500 mg/kg	None reported	**Gastrointestinal** Gas	RTECS (Registry of Toxic Effects of Chemical Substances)
Formaldehyde (<0.1%) CAS#: 50-00-0	Human LD_{Lo}	70 mg/kg	None reported	**Gastrointestinal** **Kidney, Ureter, or Bladder** **Liver** Other changes Ulcerated stomach Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)
Chemical name	**Endpoint type**	**Reported dose**	**Exposure time**	**Toxicological effects**	**Key literature references and sources for data**
Ammonium sulfate (<1%) CAS#: 7783-20-2	Domestic mammal - Not specified LD_{Lo}	3500 mg/kg	None reported	**Lungs, Thorax, or Respiration** Respiratory stimulation	RTECS (Registry of Toxic Effects of Chemical Substances)
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TD_{Lo}	643 mg/kg	None reported	**Gastrointestinal** **Lungs, Thorax, or Respiration** Nausea or vomiting Respiratory obstruction Ulcerated stomach	RTECS (Registry of Toxic Effects of Chemical Substances)

Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below
Inhalation (Vapor) Exposure Route If available, see data below
Inhalation (Gas) Exposure Route If available, see data below

Aspiration toxicity
No data available

Product Skin Corrosion/Irritation Data
No data available.

Ingredient Skin Corrosion/Irritation Data
If available, see data below

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Organization for Economic Co-operation and Development (OECD) - Test 404: Acute Dermal Corrosion/Irritation	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Ammonium sulfate (<1%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	800 mg	20 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Standard Draize Test	Human	0.150 mg	72 hours	Corrosive to skin	RTECS (Registry of Toxic Effects of Chemical Substances)

Product Serious Eye Damage/Eye Irritation Data
No data available.

Ingredient Eye Damage/Eye Irritation Data
If available, see data below

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Organization for Economic Co-operation and Development (OECD) - Test 405: Acute Eye Corrosion/Irritation	Rabbit	100 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	90 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Ammonium sulfate (<1%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	0.050 mL	None reported	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Rinse Test	Human	1 ppm	6 minutes	Corrosive to eyes	RTECS (Registry of Toxic Effects of Chemical Substances)

Sensitization Information

Product Sensitization Data
Skin Sensitization Exposure Route No data available.
Respiratory Sensitization Exposure Route No data available.

Ingredient Sensitization Data

Skin Sensitization Exposure Route If available, see data below.

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	OECD Test No. 406: Skin Sensitization	Guinea pig	Confirmed to be a skin sensitizer	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	OECD Test No. 406: Skin Sensitization	Guinea pig	Not confirmed to be a skin sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	Patch test	Human	Confirmed to be a skin sensitizer	ERMA (New Zealands Environmental Risk Management Authority)

Respiratory Sensitization Exposure Route If available, see data below.

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Based on human experience	Human	Confirmed to be a respiratory sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	IgE Specific Immune Response Test	Guinea pig	Confirmed to be a respiratory sensitizer	CICAD (Concise International Chemical Assessment Documents)

Chronic Toxicity Information

Product Specific Target Organ Toxicity Repeat Dose Data

Oral Exposure Route No data available.
Dermal Exposure Route No data available.
Inhalation (Dust/Mist) Exposure Route No data available.
Inhalation (Vapor) Exposure Route No data available.
Inhalation (Gas) Exposure Route No data available.

Ingredient Specific Target Organ Toxicity Repeat Exposure Data

Oral Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Rat NOAEL	80 mg/kg	None reported	None reported	Vendor SDS

Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Rat TC_{Lo}	350 mg/m^3	21 days	**Kidney, Ureter, or Bladder** Urine volume decreased or anuria **Nutritional and Gross Metabolic** Weight loss or decreased weight gain **Biochemical** Enzyme inhibition, induction, or	RTECS (Registry of Toxic Effects of Chemical Substances)

				change in blood or tissue levels (true cholinesterase)	

Inhalation (Vapor) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TC_{Lo}	0.017 mg/L	0.5 days	**Eye** **Lungs, Thorax, or Respiration** Lacrimation Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)
Chemical name	**Endpoint type**	**Reported dose**	**Exposure time**	**Toxicological effects**	**Key literature references and sources for data**
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TC_{Lo}	2 mg/L	40 minutes	**Lungs, Thorax, or Respiration** Other changes Respiratory depression	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Gas) Exposure Route If available, see data below

Product Carcinogenicity Data

Oral Exposure Route No data available
Dermal Exposure Route No data available
Inhalation (Dust/Mist) Exposure Route No data available
Inhalation (Vapor) Exposure Route No data available
Inhalation (Gas) Exposure Route No data available

Ingredient Carcinogenicity Data

Chemical name	CAS No.	ACGIH	IARC	NTP	OSHA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	-	-	-	-
Sodium sulfate	7757-82-6	-	-	-	-
Ammonium sulfate	7783-20-2	-	-	-	-
Formaldehyde	50-00-0	A1	Group 1	Known	X

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)	A2 - Suspected Human Carcinogen A1 - Known Human Carcinogen
IARC (International Agency for Research on Cancer)	Group 1 - Carcinogenic to Humans
NTP (National Toxicology Program)	Known - Known Carcinogen
OSHA (Occupational Safety and Health Administration of the US Department of Labor)	X - Present

Oral Exposure Route If available, see data below
Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below
Inhalation (Vapor) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat	15 mg/L	78 weeks	**Olfaction** Tumors	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Gas) Exposure Route If available, see data below

Product Germ Cell Mutagenicity *invitro* **Data**
No data available.

Ingredient Germ Cell Mutagenicity *invitro* **Data**
If available, see data below

Chemical name	Test	Cell Strain	Reported	Exposure	Results	Key literature

			dose	time		references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Cytogenetic analysis	Human HeLa Cell	1 mmol/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)
Chemical name	**Test**	**Cell Strain**	**Reported dose**	**Exposure time**	**Results**	**Key literature references and sources for data**
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Morphological transformation	Hamster kidney	10 mg/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Product Germ Cell Mutagenicity *invivo* **Data**

Oral Exposure Route No data available
Dermal Exposure Route No data available
Inhalation (Dust/Mist) Exposure Route No data available
Inhalation (Vapor) Exposure Route No data available
Inhalation (Gas) Exposure Route No data available

Ingredient Germ Cell Mutagenicity *invivo* **Data**

Oral Exposure Route If available, see data below

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	Dominant lethal test	Mouse	25000 mg/kg	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below
Inhalation (Vapor) Exposure Route If available, see data below

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Micronucleus test	Human	.000985 mg/L	8.5 years	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)
Chemical name	**Test**	**Species**	**Reported dose**	**Exposure time**	**Results**	**Key literature references and sources for data**
Formaldehyde (<0.1%) CAS#: 50-00-0	Micronucleus test	Human	2 mg/L	15 minutes	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Gas) Exposure Route If available, see data below

Product Reproductive Toxicity Data

Oral Exposure Route No data available
Dermal Exposure Route No data available
Inhalation (Dust/Mist) Exposure Route No data available
Inhalation (Vapor) Exposure Route No data available
Inhalation (Gas) Exposure Route No data available

Ingredient Reproductive Toxicity Data

Oral Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	Mouse TD_{Lo}	14000 mg/kg	4 days	**Effects on Newborn** Other neonatal measures or effects	RTECS (Registry of Toxic Effects of Chemical Substances)

Dermal Exposure Route If available, see data below
Inhalation (Dust/Mist) Exposure Route If available, see data below
Inhalation (Vapor) Exposure Route If available, see data below

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat TC_{Lo}	40 mg/L	14 days	**Effects on Embryo or Fetus** Fetotoxicity (except death e.g. stunted fetus)	RTECS (Registry of Toxic Effects of Chemical Substances)
Chemical name	**Endpoint type**	**Reported dose**	**Exposure time**	**Toxicological effects**	**Key literature references and sources for data**
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat TC_{Lo}	.001 mg/L	24 weeks	**Effects on Embryo or Fetus** Cytological changes (including somatic cell genetic material)	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Gas) Exposure Route If available, see data below

12. ECOLOGICAL INFORMATION

Ecotoxicity

Product Ecological Data

Aquatic toxicity

Fish No data available
Crustacea No data available
Algae No data available

Ingredient Ecological Data

Aquatic toxicity

Fish If available, see ingredient data below

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	96 hours	None reported	LC_{50}	56 mg/L	IUCLID (The International Uniform Chemical Information Database)
Ammonium sulfate (<1%) CAS#: 7783-20-2	96 hours	*Oncorhynchus mykiss*	LC_{50}	36.7 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)
Formaldehyde (<0.1%) CAS#: 50-00-0	96 hours	*Morone saxatilis*	LC_{50}	6.7 mg/L	PEEN (Pan European Ecological Network)

Crustacea If available, see ingredient data below

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	48 Hours	*Daphnia magna*	EC_{50}	3150 mg/L	IUCLID (The International Uniform Chemical Information Database)
Ammonium sulfate (<1%)	48 Hours	None reported	LC_{50}	14 mg/L	GESTIS (Information System on Hazardous Substances of the

CAS#: 7783-20-2					German Social Accident Insurance)
Formaldehyde (<0.1%) CAS#: 50-00-0	48 Hours	*Daphnia pulex*	EC_{50}	5.8 mg/L	PEEN (Pan European Ecological Network)

Algae If available, see ingredient data below

Other Information

Persistence and degradability

Product Biodegradability Data
No data available.

Ingredient Biodegradability Data

Chemical name	Test method	Biodegradation	Exposure time	Results
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	None reported	70%	28 days	Readily biodegradable

Bioaccumulation

Product Bioaccumulation Data
No data available.

Partition Coefficient (n-octanol/water) Not applicable

Ingredient Bioaccumulation Data

Chemical name	Test method	Exposure time	Species	Bioconcentration factor (BCF)	Results
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (5 - 10%) CAS#: 100-97-0	None reported	None reported	None reported	None reported	Not determined
Formaldehyde (<0.1%) CAS#: 50-00-0	Estimation through BCFBAF v3.01 part of the Estimation Programs Interface (EPI) Suite™	None reported	None reported	BCF = 3.16228	Does not have the potential to bioaccumulate

Mobility

Soil Organic Carbon-Water Partition Coefficient Not applicable

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Other adverse effects
Contains a substance with an endocrine-disrupting potential.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

US EPA Waste Number U122

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Formaldehyde 50-00-0	U122	Included in waste streams: K009, K010, K038, K040, K156, K157	-	U122

14. TRANSPORT INFORMATION

U.S. DOT Not regulated
Special Provisions

TDG Not regulated

IATA Not regulated

IMDG Not regulated

Note: No special precautions necessary.

Additional information
There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is not in a reagent set or kit, the classification given above applies.
If the item is part of a reagent set or kit the classification would change to the following:
UN3316 Chemical Kit, Hazard Class 9, Packing Group II or III.
If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

National Inventories

TSCA	Complies
DSL/NDSL	Complies

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

International Inventories

EINECS/ELINCS	Complies
ENCS	Does not comply
IECSC	Does not comply
KECL	Complies
PICCS	Does not comply
TCSI	Does not comply
AICS	Does not comply
NZIoC	Complies

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
TCSI - Taiwan Chemical Substances Inventory
AICS - Australian Inventory of Chemical Substances
NZIoC - New Zealand Inventory of Chemicals

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
Ammonium sulfate (CAS #: 7783-20-2)	1.0
Formaldehyde (CAS #: 50-00-0)	0.1

SARA 311/312 Hazard Categories

Acute health hazard	Yes
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Formaldehyde 50-00-0	100 lb	-	-	X

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

Chemical name	Hazardous Substances RQs	CERCLA/SARA RQ	Reportable Quantity (RQ)
Formaldehyde 50-00-0	100 lb	100 lb	RQ 100 lb final RQ RQ 45.4 kg final RQ

U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues

Chemical name	U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues
Formaldehyde (<0.1%) CAS#: 50-00-0	Release - Toxic (solution)

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Formaldehyde (CAS #: 50-00-0)	Carcinogen

WARNING: This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer.
For more information, go to http://www.P65Warnings.ca.gov

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	X	-	-
Sodium sulfate 7757-82-6	-	X	X
Ammonium sulfate 7783-20-2	-	X	X
Formaldehyde 50-00-0	X	X	X

U.S. EPA Label Information

Chemical name	FIFRA	FDA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	180.0910	-
Sodium sulfate	-	21 CFR 186.1797
Ammonium sulfate	180.0910	21 CFR 184.1143

16. OTHER INFORMATION, INCLUDING DATE OF PREPARATION OF THE LAST REVISION

Special Comments
None

Additional information

Global Automotive Declarable Substance List (GADSL)

Chemical name	Global Automotive Declarable Substance List Classifications	Global Automotive Declarable Substance List Thersholds
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	Declarable Substance (FI)	0.1 %
Formaldehyde 50-00-0	Declarable Substance (FI) Prohibited Substance (LR) Declarable Substance (LR)	0.0 % 0.1 %

NFPA and HMIS Classifications

NFPA	**Health hazards** - 2	**Flammability** - 0	**Instability** - 0	**Physical and Chemical Properties** -
HMIS	**Health hazards** - 2	**Flammability** - 0	**Physical Hazards** - 0	**Personal protection** - X - See section 8 for more information

Key or legend to abbreviations and acronyms used in the safety data sheet

NIOSH IDLH	*Immediately Dangerous to Life or Health*
ACGIH	ACGIH (American Conference of Governmental Industrial Hygienists)
NDF	*no data*

Legend - Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
MAC	Maximum Allowable Concentration	Ceiling	Ceiling Limit Value
X	Listed	Vacated	These values have no official status. The only binding levels of contaminants are those listed in the final OSHA PEL. These lists are for reference purposes only. Please note that some reference state regulations of these "liberated" exposure limits in their state regulations.
SKN*	Skin designation	SKN+	Skin sensitization
RSP+	Respiratory sensitization	**	Hazard Designation
C	Carcinogen	R	Reproductive toxicant
M	mutagen		

Prepared By	Hach Product Compliance Department
Issue Date	16-Aug-2018
Revision Date	17-Aug-2018
Revision Note	None

Disclaimer

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

HACH COMPANY©2018

End of Safety Data Sheet

SAFETY DATA SHEET

Creation Date 23-Jun-2009 **Revision Date** 26-Dec-2021 **Revision Number** 9

1. Identification

Product Name **Sulfuric acid**

Cat No. : **AC424520000; AC424520025; AC424520026; AC424520100; AC424525000; AC424525001, AC424528000**

CAS No 7664-93-9
Synonyms No information available

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/Irritation	Category 1
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements

Causes severe skin burns and eye damage
May cause respiratory irritation



Precautionary Statements
Prevention
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Response
Immediately call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Sulfuric acid	7664-93-9	>95

4. First-aid measures

General Advice
Immediate medical attention is required. Remove and isolate contaminated clothing and shoes.

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation
Remove to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.

Ingestion	Rinse mouth. Drink 1 or 2 glasses of water. Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Call a physician or poison control center immediately.
Most important symptoms and effects	Causes burns by all exposure routes. . Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.
Unsuitable Extinguishing Media	DO NOT USE WATER
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Corrosive material. Reacts violently with water. Reaction with water may generate much heat which will increase the concentration of fumes in the air. Contact with metals may evolve flammable hydrogen gas. Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.

Hazardous Combustion Products
Hydrogen. Sulfur oxides.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	2	W

6. Accidental release measures

Personal Precautions	Use personal protective equipment as required. Wear self-contained breathing apparatus and protective suit. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Avoid contact with skin, eyes or clothing.
Environmental Precautions	Avoid release to the environment. See Section 12 for additional Ecological Information.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. After cleaning, flush away traces with water.

7. Handling and storage

Handling	Handle product only in closed system or provide appropriate exhaust ventilation. Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Do not breathe (dust, vapor, mist, gas). Do not ingest. If swallowed then seek immediate medical assistance.
Storage.	Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area.

Incompatible Materials. Strong oxidizing agents. Combustible material. Bases. Organic materials. Reducing Agent. Finely powdered metals. Peroxides.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Sulfuric acid	TWA: 0.2 mg/m³	(Vacated) TWA: 1 mg/m³ TWA: 1 mg/m³	IDLH: 15 mg/m³ TWA: 1 mg/m³	TWA: 0.2 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures Handle in a place equipped with local exhaust ventilation. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Odorless
Odor Threshold	No information available
pH	1 1N aq.sol
Melting Point/Range	10 °C / 50 °F
Boiling Point/Range	290 °C / 554 °F
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	1 mmHg @ 146 °C
Vapor Density	No information available
Specific Gravity	1.840
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	340 °C
Viscosity	21mPa.s @ 25 °C
Molecular Formula	H2 O4 S
Molecular Weight	98.07

10. Stability and reactivity

Reactive Hazard Yes

Stability Water reactive. Hygroscopic.

Conditions to Avoid Incompatible products. Excess heat. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Combustible material, Bases, Organic materials, Reducing Agent, Finely powdered metals, Peroxides

Hazardous Decomposition Products Hydrogen, Sulfur oxides

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions Contact with metals may evolve flammable hydrogen gas. Reacts violently with water.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sulfuric acid	2140 mg/kg (Rat)	Not listed	LC50 = 0.375 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes severe burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Sulfuric acid	7664-93-9	Group 1	Known	A2	X	A2

IARC (International Agency for Research on Cancer)

ACGIH: (American Conference of Governmental Industrial Hygienists)

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. Large amounts will affect pH and harm aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Sulfuric acid	-	LC50: > 500 mg/L, 96h static (Brachydanio rerio)	-	EC50: 29 mg/L/24h

Persistence and Degradability Miscible with water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

TDG

UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

IATA

UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

IMDG/IMO

UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Sulfuric acid	7664-93-9	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Sulfuric acid	7664-93-9	X	-	231-639-5	X	X	X	X	X	KE-32570

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313

Component	CAS No	Weight %	SARA 313 - Threshold Values %
Sulfuric acid	7664-93-9	>95	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Sulfuric acid	X	1000 lb	-	-

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Sulfuric acid	1000 lb	1000 lb

California Proposition 65 This product contains the following Proposition 65 chemicals.

Component	CAS No	California Prop. 65	Prop 65 NSRL	Category
Sulfuric acid	7664-93-9	Carcinogen	-	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Sulfuric acid	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Component	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Sulfuric acid	-	Use restricted. See item 75. (see link for restriction details)	-

https://echa.europa.eu/substances-restricted-under-reach

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Sulfuric acid	7664-93-9	Listed	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Sulfuric acid	7664-93-9	Not applicable	Not applicable	Not applicable	Annex I - Y34

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 23-Jun-2009
Revision Date 26-Dec-2021
Print Date 26-Dec-2021
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

1. Identification

Product identifier **UNLEADED GASOLINE**

Other means of identification

SDS number 002-GHS

Synonyms Regular/Premium/Midgrade - Unleaded Gasoline * RFG - Reformated Unleaded Gasoline * Conventional Unleaded Gasoline * Premium Conventional Gasoline * Oxygenated Unleaded Gasoline * Non-Oxygenated Unleaded Gasoline * CARB (California Air Resource Board) Unleaded Gasoline * PBOB - Premium Blendstock for Oxygenate Blending * RBOB - Reformulated Blendstock for Oxygenate Blending * Premium RBOB * CBOB - Conventional Blendstock for Oxygenate Blending * Petrol * Motor Fuel

Recommended use Motor fuels. Blendstock for motor fuels.

Recommended restrictions No other uses are advised.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer/Supplier Valero Marketing & Supply Company and Affiliates
One Valero Way
San Antonio, TX 78269-6000

General Assistance 210-345-4593

E-Mail CorpHSE@valero.com

Contact Person Industrial Hygienist

Emergency Telephone 24 Hour Emergency 866-565-5220
1-800-424-9300 (CHEMTREC USA)

2. Hazard(s) identification

Physical hazards	Flammable liquids	Category 1
Health hazards	Skin corrosion/irritation	Category 2
	Germ cell mutagenicity	Category 1B
	Carcinogenicity	Category 1B
	Reproductive toxicity	Category 2
	Specific target organ toxicity, single exposure	Category 3 narcotic effects
	Aspiration hazard	Category 1
Environmental hazards	Hazardous to the aquatic environment, long-term hazard	Category 2

OSHA defined hazards Not classified.

Label elements



Signal word Danger

Hazard statement Extremely flammable liquid and vapor. May be fatal if swallowed and enters airways. Causes skin irritation. May cause drowsiness or dizziness. May cause genetic defects. May cause cancer. Suspected of damaging fertility or the unborn child. Toxic to aquatic life with long lasting effects.

Precautionary statement

Prevention Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Avoid breathing mist/vapors. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection.

Response	If swallowed: Immediately call a poison center/doctor. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If exposed or concerned: Get medical advice/attention. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash it before reuse. In case of fire: Use water fog, alcohol resistant foam, dry chemical powder, carbon dioxide for extinction. Collect spillage.
Storage	Keep cool. Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national regulations.
Hazard(s) not otherwise classified (HNOC)	Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Gasoline	86290-81-5	80 - 100

Hazardous Components of Complex Mixtures

Chemical name	CAS number	%
Octane (All isomers)	111-65-9	0 - 70
Toluene	108-88-3	0 - 30
Hexane (Other Isomers)	96-14-0	5 - 25
Xylene (o, m, p isomers)	1330-20-7	0 - 25
Butane (normal, iso and butylene)	106-97-8	0 - 15
Ethanol	64-17-5	≤ 10
1,2,4-Trimethylbenzene	95-63-6	0 - 6
Pentane (mixed isomers)	109-66-0	1 - 5
n-Heptane	142-82-5	1 - 5
Ethylbenzene	100-41-4	0 - 5
Cumene	98-82-8	≤ 5
Benzene	71-43-2	< 5
n-Hexane	110-54-3	0 - 3
Cyclohexane	110-82-7	0 - 3

Composition comments Note: Components of hazardous substances/mixtures are listed for disclosure purposes. Ranges may represent maximum regulatory limits or apply to multiple product grades (see Synonyms - Section 1). Typical and actual concentrations of individual components may be substantially less than the maximum values shown or zero, depending on the product grade or specifications.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a poison center or doctor/physician if they feel unwell.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Get medical attention if irritation develops and persists.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Most important symptoms/effects, acute and delayed	Aspiration may cause pulmonary edema and pneumonitis. May cause drowsiness and dizziness. Headache. Nausea, vomiting. Direct contact with eyes may cause temporary irritation. Skin irritation. May cause redness and pain.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Thermal burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim under observation. Symptoms may be delayed.

General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Alcohol resistant foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	Vapors may form explosive mixtures with air. Vapors may travel considerable distance to a source of ignition and flash back. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	Extremely flammable liquid and vapor.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Wear appropriate protective equipment and clothing during clean-up. Avoid breathing mist/vapors. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. Take precautionary measures against static discharge. Use only non-sparking tools. The product is immiscible with water and will spread on the water surface. This material is classified as a water pollutant under the Clean Water Act and should be prevented from contaminating soil or from entering sewage and drainage systems which lead to waterways. Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Following product recovery, flush area with water. Retain and dispose of contaminated wash water. Small Spills: Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. Put material in suitable, covered, labeled containers. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Before entering storage tanks and commencing any operation in a confined area, check the atmosphere for oxygen content and flammability. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. When using do not smoke. Explosion-proof general and local exhaust ventilation. Take precautionary measures against static discharges. All equipment used when handling the product must be grounded. Use non-sparking tools and explosion-proof equipment. Avoid breathing mist/vapors. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Pregnant or breastfeeding women must not handle this product. Should be handled in closed systems, if possible. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Avoid release to the environment. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Keep away from heat, sparks and open flame. Prevent electrostatic charge build-up by using common bonding and grounding techniques. Store in a cool, dry place out of direct sunlight. Store in tightly closed container. Store in a well-ventilated place. Keep in an area equipped with sprinklers. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Hazardous Components of Complex Mixtures	Type	Value
Benzene (CAS 71-43-2)	STEL	5 ppm
	TWA	1 ppm

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Hazardous Components of Complex Mixtures	Type	Value
Ethanol (CAS 64-17-5)	PEL	1900 mg/m3
		1000 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	PEL	435 mg/m3
		100 ppm
n-Hexane (CAS 110-54-3)	PEL	1800 mg/m3
		500 ppm
Cyclohexane (CAS 110-82-7)	PEL	1050 mg/m3
		300 ppm
Cumene (CAS 98-82-8)	PEL	245 mg/m3
		50 ppm
Ethylbenzene (CAS 100-41-4)	PEL	435 mg/m3
		100 ppm
n-Heptane (CAS 142-82-5)	PEL	2000 mg/m3
		500 ppm
Pentane (mixed isomers) (CAS 109-66-0)	PEL	2950 mg/m3
		1000 ppm
Octane (All isomers) (CAS 111-65-9)	PEL	2350 mg/m3
		500 ppm

US. OSHA Table Z-2 (29 CFR 1910.1000)

Hazardous Components of Complex Mixtures	Type	Value
Toluene (CAS 108-88-3)	Ceiling	300 ppm
	TWA	200 ppm
Benzene (CAS 71-43-2)	Ceiling	25 ppm
	TWA	10 ppm

US. ACGIH Threshold Limit Values

Material	Type	Value
UNLEADED GASOLINE	STEL	500 ppm
	TWA	300 ppm
Components	**Type**	**Value**
Gasoline (CAS 86290-81-5)	STEL	500 ppm
	TWA	300 ppm
Hazardous Components of Complex Mixtures	**Type**	**Value**
Ethanol (CAS 64-17-5)	STEL	1000 ppm

US. ACGIH Threshold Limit Values

Hazardous Components of Complex Mixtures	Type	Value
Butane (normal, iso and butylene) (CAS 106-97-8)	STEL	1000 ppm
Hexane (Other Isomers) (CAS 96-14-0)	STEL	1000 ppm
	TWA	500 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm
n-Hexane (CAS 110-54-3)	TWA	50 ppm
Cyclohexane (CAS 110-82-7)	TWA	100 ppm
Toluene (CAS 108-88-3)	TWA	20 ppm
Benzene (CAS 71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
Cumene (CAS 98-82-8)	TWA	50 ppm
Ethylbenzene (CAS 100-41-4)	TWA	20 ppm
n-Heptane (CAS 142-82-5)	STEL	500 ppm
	TWA	400 ppm
Pentane (mixed isomers) (CAS 109-66-0)	TWA	1000 ppm
1,2,4-Trimethylbenzene (CAS 95-63-6)	TWA	25 ppm
Octane (All isomers) (CAS 111-65-9)	TWA	300 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Hazardous Components of Complex Mixtures	Type	Value
Ethanol (CAS 64-17-5)	TWA	1900 mg/m3
		1000 ppm
Butane (normal, iso and butylene) (CAS 106-97-8)	TWA	1900 mg/m3
		800 ppm
Hexane (Other Isomers) (CAS 96-14-0)	Ceiling	1800 mg/m3
		510 ppm
	TWA	350 mg/m3
		100 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	STEL	655 mg/m3
		150 ppm
	TWA	435 mg/m3
		100 ppm
n-Hexane (CAS 110-54-3)	TWA	180 mg/m3
		50 ppm
Cyclohexane (CAS 110-82-7)	TWA	1050 mg/m3
		300 ppm
Toluene (CAS 108-88-3)	STEL	560 mg/m3
		150 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Hazardous Components of Complex Mixtures	Type	Value
	TWA	375 mg/m3
		100 ppm
Benzene (CAS 71-43-2)	STEL	1 ppm
	TWA	0.1 ppm
Cumene (CAS 98-82-8)	TWA	245 mg/m3
		50 ppm
Ethylbenzene (CAS 100-41-4)	STEL	545 mg/m3
		125 ppm
	TWA	435 mg/m3
		100 ppm
n-Heptane (CAS 142-82-5)	Ceiling	1800 mg/m3
		440 ppm
	TWA	350 mg/m3
		85 ppm
Pentane (mixed isomers) (CAS 109-66-0)	Ceiling	1800 mg/m3
		610 ppm
	TWA	350 mg/m3
		120 ppm
1,2,4-Trimethylbenzene (CAS 95-63-6)	TWA	125 mg/m3
		25 ppm
Octane (All isomers) (CAS 111-65-9)	Ceiling	1800 mg/m3
		385 ppm
	TWA	350 mg/m3
		75 ppm

Biological limit values

ACGIH

Hazardous Components of Complex Mixtures	Value	Determinant	Specimen	Sampling Time
Benzene (CAS 71-43-2)	500 µg/g	t,t-Muconic acid	Creatinine in urine	*

ACGIH Biological Exposure Indices

Hazardous Components of Complex Mixtures	Value	Determinant	Specimen	Sampling Time
Xylene (o, m, p isomers) (CAS 1330-20-7)	1.5 g/g	Methylhippuric acids	Creatinine in urine	*
n-Hexane (CAS 110-54-3)	0.5 mg/l	2,5-Hexanedione, without hydrolysis	Urine	*
Toluene (CAS 108-88-3)	0.3 mg/g	o-Cresol, with hydrolysis	Creatinine in urine	*
	0.03 mg/l	Toluene	Urine	*
	0.02 mg/l	Toluene	Blood	*
Benzene (CAS 71-43-2)	25 µg/g	S-Phenylmercapturic acid	Creatinine in urine	*

ACGIH Biological Exposure Indices

Hazardous Components of Complex Mixtures	Value	Determinant	Specimen	Sampling Time
Ethylbenzene (CAS 100-41-4)	0.15 g/g	Sum of mandelic acid and phenylglyoxylic acid	Creatinine in urine	*

* - For sampling details, please see the source document.

Exposure guidelines

US - California OELs: Skin designation

Benzene (CAS 71-43-2)	Can be absorbed through the skin.
Cumene (CAS 98-82-8)	Can be absorbed through the skin.
n-Hexane (CAS 110-54-3)	Can be absorbed through the skin.
Toluene (CAS 108-88-3)	Can be absorbed through the skin.

US - Minnesota Haz Subs: Skin designation applies

Cumene (CAS 98-82-8)	Skin designation applies.
Toluene (CAS 108-88-3)	Skin designation applies.

US - Tennessee OELs: Skin designation

Cumene (CAS 98-82-8)	Can be absorbed through the skin.

US ACGIH Threshold Limit Values: Skin designation

Benzene (CAS 71-43-2)	Danger of cutaneous absorption
n-Hexane (CAS 110-54-3)	Danger of cutaneous absorption

US. NIOSH: Pocket Guide to Chemical Hazards

Cumene (CAS 98-82-8)	Can be absorbed through the skin.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Cumene (CAS 98-82-8)	Can be absorbed through the skin.

Appropriate engineering controls Explosion-proof general and local exhaust ventilation. Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Provide eyewash station and safety shower.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Wear protective gloves. Viton® or nitrile rubber gloves are possible options. Verify chemical resistant charts before using. Be aware that the liquid may penetrate the gloves. Frequent change is advisable. Suitable gloves can be recommended by the glove supplier.

Skin protection

Other Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.

Respiratory protection When conditions indicate, use chemical respirator with organic vapor cartridge and full facepiece or other appropriate methods.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Observe any medical surveillance requirements. When using do not smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Liquid.

Color Clear to straw yellow.

Odor Characteristic Gasoline Odor (Strong).

Odor threshold Not available.

pH Not available.

Melting point/freezing point	< -76 °F (< -60 °C)
Initial boiling point and boiling range	80.1 - 440.1 °F (26.7 - 226.7 °C) (20% Evaporated Point: ≥100 °F)
Flash point	-40.0 °F (-40.0 °C) (closed cup)
Evaporation rate	10 - 11 BuAc
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	1.3 %
Flammability limit - upper (%)	7.1 %
Vapor pressure	60.8 - 101.3 kPa (20°C)
Vapor density	3 - 4 (Air=1)
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Very slightly soluble.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	> 500 °F (> 260 °C)
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Explosive properties	Not explosive.
Flash point class	Flammable IB
Oxidizing properties	Not oxidizing.
VOC	100 %

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources. Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Prolonged inhalation may be harmful.
Skin contact	Causes skin irritation.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Droplets of the product aspirated into the lungs through ingestion or vomiting may cause a serious chemical pneumonia.
Symptoms related to the physical, chemical and toxicological characteristics	Aspiration may cause pulmonary edema and pneumonitis. May cause drowsiness and dizziness. Headache. Nausea, vomiting. Skin irritation. May cause redness and pain.

Information on toxicological effects

Acute toxicity	May be fatal if swallowed and enters airways. Hydrogen sulfide, a highly toxic gas, may be present. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.

Components	Species	Test Results
Gasoline (CAS 86290-81-5)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg, 24 Hours
Inhalation		
Vapor		
LC50	Rat	> 5610 mg/m3, 4 Hours
Oral		
LD50	Rat	> 5000 mg/kg

Hazardous Components of Complex Mixtures	Species	Test Results
Ethanol (CAS 64-17-5)		
Acute		
Dermal		
LD50	Rat	> 2000 mg/kg
Inhalation		
Vapor		
LC50	Mouse	39 g/m3, 4 Hours
Oral		
LD50	Rat	7000 - 11000 mg/kg
Butane (normal, iso and butylene) (CAS 106-97-8)		
Acute		
Inhalation		
LC50	Rat	658 mg/l, 4 Hours
Xylene (o, m, p isomers) (CAS 1330-20-7)		
Acute		
Oral		
LD50	Rat	3523 mg/kg
Cyclohexane (CAS 110-82-7)		
Acute		
Oral		
LD50	Rat	12710 mg/kg
n-Hexane (CAS 110-54-3)		
Acute		
Oral		
LD50	Rat	28710 mg/kg
Toluene (CAS 108-88-3)		
Acute		
Dermal		
LD50	Rabbit	12200 mg/kg
Inhalation		
Vapor		
LC50	Rat	28.1 mg/l, 4 Hours
Benzene (CAS 71-43-2)		
Acute		
Oral		
LD50	Rat	930 mg/kg

Hazardous Components of Complex Mixtures	Species	Test Results
Ethylbenzene (CAS 100-41-4)		
Acute		
Dermal		
LD50	Rabbit	15400 mg/kg
Inhalation		
LC50	Rat	17.4 mg/l, 4 hours
Oral		
LD50	Rat	3500 - 4700 mg/kg
n-Heptane (CAS 142-82-5)		
Acute		
Inhalation		
Vapor		
LC50	Rat	> 29.29 mg/l, 4 Hours
Oral		
LD50	Rat	15000 mg/kg
Pentane (mixed isomers) (CAS 109-66-0)		
Other		
NOAEL	Rat	> 1000 mg/kg/day
Acute		
Dermal		
LD50	Rabbit	3000 mg/kg/day
Inhalation		
LC50	Rat	18 mg/l, 4 Hours
Oral		
LD50	Rat	> 2000 mg/kg/day
Chronic		
Other		
NOAEL	Rat	20 mg/l
1,2,4-Trimethylbenzene (CAS 95-63-6)		
Acute		
Oral		
LD50	Rat	2720 - 3960 mg/kg

Skin corrosion/irritation Causes skin irritation.

Serious eye damage/eye irritation Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity May cause genetic defects.

Carcinogenicity May cause cancer.

IARC Monographs. Overall Evaluation of Carcinogenicity

Benzene (CAS 71-43-2)	1 Carcinogenic to humans.
Cumene (CAS 98-82-8)	2B Possibly carcinogenic to humans.
Ethylbenzene (CAS 100-41-4)	2B Possibly carcinogenic to humans.
Gasoline (CAS 86290-81-5)	2B Possibly carcinogenic to humans.
Toluene (CAS 108-88-3)	3 Not classifiable as to carcinogenicity to humans.
Xylene (o, m, p isomers) (CAS 1330-20-7)	3 Not classifiable as to carcinogenicity to humans.

NTP Report on Carcinogens

Benzene (CAS 71-43-2)	Known To Be Human Carcinogen.
Cumene (CAS 98-82-8)	Reasonably Anticipated to be a Human Carcinogen.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Benzene (CAS 71-43-2) Cancer

Reproductive toxicity Suspected of damaging fertility or the unborn child.

Specific target organ toxicity - single exposure May cause drowsiness and dizziness.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard May be fatal if swallowed and enters airways.

Chronic effects Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.

Further information May be absorbed through the skin.

12. Ecological information

Ecotoxicity Toxic to aquatic life with long lasting effects.

Components		Species	Test Results
Gasoline (CAS 86290-81-5)			
Aquatic			
Algae	EC50	Pseudokirchneriella subcapitata	3.1 mg/l, 72 Hours
Crustacea	EC50	Daphnia magna	4.5 mg/l, 48 Hours
Fish	LC50	Oncorhynchus mykiss	10 mg/l, 96 Hours
		Pimephales promelas	8.2 mg/l, 96 Hours
Hazardous Components of Complex Mixtures		**Species**	**Test Results**
Ethanol (CAS 64-17-5)			
Aquatic			
Acute			
Crustacea	LC50	Ceriodaphnia dubia	5012 mg/l, 48 hours
		Daphnia magna	454 mg/l, 11 days
Fish	LC50	Pimephales promelas	13480 mg/l, 96 hours
Chronic			
Crustacea	NOEC	Ceriodaphnia dubia	9.6 mg/l, 10 days
Xylene (o, m, p isomers) (CAS 1330-20-7)			
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	2.6 mg/l, 96 hours
Cyclohexane (CAS 110-82-7)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	0.9 mg/l, 48 hours
Acute			
Fish	LC50	Fathead minnow (Pimephales promelas)	3.961 - 5.181 mg/l, 96 hours
n-Hexane (CAS 110-54-3)			
Aquatic			
Acute			
Fish	LC50	Fathead minnow (Pimephales promelas)	2.101 - 2.981 mg/l, 96 hours
Toluene (CAS 108-88-3)			
Aquatic			
Acute			
Crustacea	EC50	Daphnia magna	11.5 mg/l, 48 hours
Fish	LC50	Oncorhynchus kisutch	5.5 mg/l, 96 hours
Chronic			
Crustacea	NOEC	Ceriodaphnia dubia	0.74 mg/l, 7 days
Fish	NOEC	Oncorhynchus kisutch	1.4 mg/l, 40 days

Hazardous Components of Complex Mixtures		Species	Test Results
Ethylbenzene (CAS 100-41-4)			
Aquatic			
Acute			
Crustacea	EC50	Water flea (Daphnia magna)	1.81 - 2.38 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	4.2 mg/l, 96 hours
Chronic			
Crustacea	EC50	Ceriodaphnia dubia	3.6 mg/l, 7 days
Pentane (mixed isomers) (CAS 109-66-0)			
Acute			
	EC50	Selenastrum capricornutum (new Pseudokirchneriella subcapita	7.51 mg/l, 72 Hours
Aquatic			
Acute			
Crustacea	EC50	Daphnia magna	2.7 mg/l, 48 Hours
Fish	LC50	Oncorhynchus mykiss	4.26 mg/l, 96 Hours
1,2,4-Trimethylbenzene (CAS 95-63-6)			
Aquatic			
Acute			
Fish	LC50	Fathead minnow (Pimephales promelas)	7.72 mg/l, 96 hours
Octane (All isomers) (CAS 111-65-9)			
Aquatic			
Crustacea	LC50	Daphnia magna	0.38 mg/l, 48 hours

Persistence and degradability Expected to be inherently biodegradable.

Bioaccumulative potential The product is not bioaccumulating.

Mobility in soil No data available.

Other adverse effects Oil spills are generally hazardous to the environment. The product contains volatile organic compounds which have a photochemical ozone creation potential.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Incinerate the material under controlled conditions in an approved incinerator. Do not incinerate sealed containers. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code D001: Waste Flammable material with a flash point <140 F
D018: Waste Benzene
The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

US RCRA Hazardous Waste U List: Reference

Benzene (CAS 71-43-2)	U019
Cumene (CAS 98-82-8)	U055
Cyclohexane (CAS 110-82-7)	U056
Toluene (CAS 108-88-3)	U220
Xylene (o, m, p isomers) (CAS 1330-20-7)	U239

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN1203
UN proper shipping name	Gasoline
Transport hazard class(es)	
Class	3
Subsidiary risk	-
Label(s)	3
Packing group	II
Environmental hazards	
Marine pollutant	Yes
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	144, 177, B1, B33, IB2, T4, TP1
Packaging exceptions	150
Packaging non bulk	202
Packaging bulk	242

IATA

UN number	UN1203
UN proper shipping name	GASOLINE
Transport hazard class(es)	
Class	3
Subsidiary risk	-
Packing group	II
Environmental hazards	Yes
ERG Code	3H
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN1203
UN proper shipping name	GASOLINE
Transport hazard class(es)	
Class	3
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	Yes
EmS	F-E, S-E
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable. However, this product is a liquid and if transported in bulk covered under MARPOL 73/78, Annex I.
General information	Shipping descriptions in this section are offered as examples only. Classification for transport must accurately reflect the material hazards as designated under a variety of regulations and is solely the responsibility of the person offering the material for transport into commerce.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Benzene (CAS 71-43-2)	Listed.
Butane (normal, iso and butylene) (CAS 106-97-8)	Listed.
Cumene (CAS 98-82-8)	Listed.
Cyclohexane (CAS 110-82-7)	Listed.
Ethylbenzene (CAS 100-41-4)	Listed.
Gasoline (CAS 86290-81-5)	Listed.
Hexane (Other Isomers) (CAS 96-14-0)	Listed.
n-Heptane (CAS 142-82-5)	Listed.
n-Hexane (CAS 110-54-3)	Listed.
Octane (All isomers) (CAS 111-65-9)	Listed.

Pentane (mixed isomers) (CAS 109-66-0) Listed.
Toluene (CAS 108-88-3) Listed.
Xylene (o, m, p isomers) (CAS 1330-20-7) Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Benzene (CAS 71-43-2)
Cancer
Central nervous system
Blood
Aspiration
Skin
Eye
respiratory tract irritation
Flammability

Toxic Substances Control Act (TSCA) All components of the mixture on the TSCA 8(b) inventory are designated "active".

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

Classified hazard categories
Flammable (gases, aerosols, liquids, or solids)
Skin corrosion or irritation
Germ cell mutagenicity
Carcinogenicity
Reproductive toxicity
Specific target organ toxicity (single or repeated exposure)
Aspiration hazard
Hazard not otherwise classified (HNOC)

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
1,2,4-Trimethylbenzene	95-63-6	0 - 6
Benzene	71-43-2	< 5
Cumene	98-82-8	≤ 5
Cyclohexane	110-82-7	0 - 3
Ethylbenzene	100-41-4	0 - 5
n-Hexane	110-54-3	0 - 3
Toluene	108-88-3	0 - 30
Xylene (o, m, p isomers)	1330-20-7	0 - 25

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Benzene (CAS 71-43-2)
Cumene (CAS 98-82-8)
Ethylbenzene (CAS 100-41-4)
n-Hexane (CAS 110-54-3)
Toluene (CAS 108-88-3)
Xylene (o, m, p isomers) (CAS 1330-20-7)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Butane (normal, iso and butylene) (CAS 106-97-8)
Pentane (mixed isomers) (CAS 109-66-0)

Safe Drinking Water Act (SDWA) Not regulated.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2) and Chemical Code Number

Toluene (CAS 108-88-3) 6594

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

Toluene (CAS 108-88-3) 35 %WV

DEA Exempt Chemical Mixtures Code Number

Toluene (CAS 108-88-3) 594

FEMA Priority Substances Respiratory Health and Safety in the Flavor Manufacturing Workplace

Ethanol (CAS 64-17-5)	Low priority

US state regulations

US. Massachusetts RTK - Substance List

1,2,4-Trimethylbenzene (CAS 95-63-6)
Benzene (CAS 71-43-2)
Butane (normal, iso and butylene) (CAS 106-97-8)
Cumene (CAS 98-82-8)
Cyclohexane (CAS 110-82-7)
Ethanol (CAS 64-17-5)
Ethylbenzene (CAS 100-41-4)
Hexane (Other Isomers) (CAS 96-14-0)
n-Heptane (CAS 142-82-5)
n-Hexane (CAS 110-54-3)
Octane (All isomers) (CAS 111-65-9)
Pentane (mixed isomers) (CAS 109-66-0)
Toluene (CAS 108-88-3)
Xylene (o, m, p isomers) (CAS 1330-20-7)

US. New Jersey Worker and Community Right-to-Know Act

1,2,4-Trimethylbenzene (CAS 95-63-6)
Benzene (CAS 71-43-2)
Butane (normal, iso and butylene) (CAS 106-97-8)
Cumene (CAS 98-82-8)
Cyclohexane (CAS 110-82-7)
Ethanol (CAS 64-17-5)
Ethylbenzene (CAS 100-41-4)
n-Heptane (CAS 142-82-5)
n-Hexane (CAS 110-54-3)
Octane (All isomers) (CAS 111-65-9)
Pentane (mixed isomers) (CAS 109-66-0)
Toluene (CAS 108-88-3)
Xylene (o, m, p isomers) (CAS 1330-20-7)

US. Pennsylvania Worker and Community Right-to-Know Law

1,2,4-Trimethylbenzene (CAS 95-63-6)
Benzene (CAS 71-43-2)
Butane (normal, iso and butylene) (CAS 106-97-8)
Cumene (CAS 98-82-8)
Cyclohexane (CAS 110-82-7)
Ethanol (CAS 64-17-5)
Ethylbenzene (CAS 100-41-4)
Gasoline (CAS 86290-81-5)
Hexane (Other Isomers) (CAS 96-14-0)
n-Heptane (CAS 142-82-5)
n-Hexane (CAS 110-54-3)
Octane (All isomers) (CAS 111-65-9)
Pentane (mixed isomers) (CAS 109-66-0)
Toluene (CAS 108-88-3)
Xylene (o, m, p isomers) (CAS 1330-20-7)

US. Rhode Island RTK

1,2,4-Trimethylbenzene (CAS 95-63-6)
Benzene (CAS 71-43-2)
Butane (normal, iso and butylene) (CAS 106-97-8)
Cumene (CAS 98-82-8)
Cyclohexane (CAS 110-82-7)
Ethanol (CAS 64-17-5)
Ethylbenzene (CAS 100-41-4)
n-Heptane (CAS 142-82-5)
n-Hexane (CAS 110-54-3)
Octane (All isomers) (CAS 111-65-9)
Pentane (mixed isomers) (CAS 109-66-0)
Toluene (CAS 108-88-3)
Xylene (o, m, p isomers) (CAS 1330-20-7)

California Proposition 65

WARNING: This product can expose you to chemicals including Benzene, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

California Proposition 65 - CRT: Listed date/Carcinogenic substance

Benzene (CAS 71-43-2)	Listed: February 27, 1987
Cumene (CAS 98-82-8)	Listed: April 6, 2010
Ethylbenzene (CAS 100-41-4)	Listed: June 11, 2004

California Proposition 65 - CRT: Listed date/Developmental toxin

Benzene (CAS 71-43-2)	Listed: December 26, 1997
Toluene (CAS 108-88-3)	Listed: January 1, 1991

California Proposition 65 - CRT: Listed date/Male reproductive toxin

Benzene (CAS 71-43-2)	Listed: December 26, 1997
n-Hexane (CAS 110-54-3)	Listed: December 15, 2017

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

1,2,4-Trimethylbenzene (CAS 95-63-6)
Benzene (CAS 71-43-2)
Butane (normal, iso and butylene) (CAS 106-97-8)
Cumene (CAS 98-82-8)
Cyclohexane (CAS 110-82-7)
Ethylbenzene (CAS 100-41-4)
Gasoline (CAS 86290-81-5)
n-Heptane (CAS 142-82-5)
n-Hexane (CAS 110-54-3)
Octane (All isomers) (CAS 111-65-9)
Pentane (mixed isomers) (CAS 109-66-0)
Toluene (CAS 108-88-3)
Xylene (o, m, p isomers) (CAS 1330-20-7)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 13-May-2013
Revision date 30-June-2020
Version # 06
NFPA ratings



References	CONCAWE
Disclaimer	The information in this Safety Data Sheet (SDS) was obtained from sources believed to be reliable and accurate, and is not represented as being absolutely complete. The end user of this product has the responsibility for evaluating the adequacy of the data for the intended application and conditions of use; for determining the safety, toxicity, regulatory requirements, and suitability of the product under these conditions; and for obtaining additional or clarifying data where uncertainty exists. The data serves as general guidance only, and is to be used in combination with professional judgement of persons experienced in a specific application, use or process; and additional data may be required. Valero Marketing & Supply Co., (Valero) provides this data without any warranty, expressed or implied regarding its correctness or accuracy; and does not assume any liability arising out of product handling, storage, use or disposal by others.

ATTACHMENT C

Heat Illness Prevention Program

HEAT ILLNESS
PREVENTION PROGRAM

CORPORATE HEALTH AND SAFETY DIRECTOR	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**10/2019**
REVISION DATE	:	**03/2023**
REVISION NUMBER	:	**2**

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1. PURPOSE

Roux Associates, Inc. and its affiliated **companies**, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has established this heat illness prevention program to assist in preventing workplace accidents, injuries, and illnesses associated with temperature extremes. Roux is committed to taking every precaution to protect employees who might be exposed to heat stress, including establishing safe work practices, heat illness prevention controls, and emergency preparedness, which will be detailed in this plan.

2. SCOPE AND APPLICABILITY

Roux's Heat Illness Prevention Program applies to all employees who may be exposed to heat stress in the field.

3. ROLES AND RESPONSIBILITIES

The Heat Illness Prevention Program Administrator for Roux is the Corporate Health and Safety Director (CHSD), Brian Hobbs, CIH, CSP. The daily administration of the program is delegated to the Operations Manager (OM) and Office Health and Safety Manager (OHSM). The CHSD has the authority, responsibility, and overall accountability for the comprehensive implementation of this program.

All managers and supervisors shall implement and maintain the heat illness prevention program in work areas where there is a potential for heat stress.

Management Responsibilities

Management (i.e., Project Managers, Project Principals, OM) must provide the following to promote compliance and foster a good safety culture:

- Comply with applicable standards.
- Inform employees of the provisions of the heat illness prevention program and ensure understanding.
- Provide sufficient water, shade, rest areas, and other heat illness controls for employees.
- Assist with establishing work practices to minimize heat stress risks, such as acclimatization, required rest periods, employee monitoring, and strategic scheduling.
- Encourage employees to report hazardous conditions or heat illness symptoms.
- Provide training to any employee who could possibly be exposed to the risk of heat illness.

Employee Responsibilities

Employees are expected to actively participate in the organization's heat illness prevention program, which includes the following responsibilities:

- Receive appropriate training with regards to heat stress.
- Understand core concepts of heat illness prevention and follow guidelines to mitigate risks.
- Recognize the signs and symptoms of heat illness and immediately report them.
- Cooperate with workplace inspections and incident investigations.

Effective Communication

All Roux employees shall be accountable for ensuring there is effective communication with both the field team and their subcontractors. Communication between Roux employees project leads (e.g., Project Principal, Project Managers) and subcontractors (if applicable) will be established and maintained, so that employees can quickly contact should there be a change in condition or someone at the Site exhibits signs/symptoms of heat stress. These

types of incidents would follow Roux's Incident Investigation and Reporting Management Program 2.12 and Roux's Injury Illness Prevention Program 2.22.

4. HAZARD IDENTIFICATION AND ASSESSMENT

Prior to scheduled field work, the project team shall ensure a hazard assessment is conducted as it relates to heat stress. This will include a determination of how much heat and exertion employees are likely to be exposed to based on the work activity.

Factors that can increase heat stress can include the following:

- Temperatures at the work site;
- Humidity;
- A lack of air movement or exchange;
- The amount of time employees spend working in the heat;
- The time of day work takes place;
- Sources of radiant heat (e.g., sunlight, fire, or hot furnace);
- Work activities that produce heat (e.g., welding);
- Physical contact with warm or hot objects or liquids;
- The clothing and PPE employees are required to wear; and/or
- Physically strenuous work.

Results of the hazard analysis should be used to determine appropriate controls for mitigating heat stress, whenever possible, for planning acclimatization and for developing work schedules that rotate workers to limit employee exposure. Typically, the Site Supervisor (SS) or Site Health and Safety Officer (SHSO) shall conduct worksite observations to assure all employees follow heat illness prevention procedures and that hazards are sufficiently controlled. However, all employees should be continuously evaluating work site conditions and be able to recognize heat stressors in order to prevent heat illnesses.

5. TRAINING

All Roux employees shall be trained on the topics listed below prior to beginning work, which may potentially expose workers to heat stress.

Training Topics

- The environmental, behavioral, and personal risk factors for heat illness, such as radiant heat sources, exertion, clothing and PPE, and use of alcohol or drugs.
- Types of heat illnesses, common symptoms, and appropriate emergency response for each.
- The knowledge that mild symptoms may quickly become more severe or life-threatening.
- The importance of immediately reporting any signs or symptoms of heat illness to the supervisor.
- The employer's responsibility to provide shade, water, access to first aid, and cool-down rests during work and the employee's freedom to exercise their rights under this standard without fear of retaliation.
- The employer's heat stress plan and its procedures:
  - Procedures for employees who are newly assigned to work in high heat areas.

  - The organization's acclimatization methods, as applicable.
  - Heat wave procedures.
  - Heat illness and emergency response, including contact information.
- The importance of frequent consumption of water and the taking of rest breaks.
- How heat illness prevention applies to employees' specific tasks.

Increasing Training Effectiveness:

- The SS/SHSO will hold daily tailgates with the field team to go over daily work tasks and basic safety information including Job Safety Analysis (JSA) review as well as incorporate elements such as current weather and effects on the work activities for the day.
- If a heat wave or high heat is anticipated, OHSMs and/or OMs will provide communications to Roux employees prior to their shifts and remind them of any special high heat procedures.

6. DRINKING WATER

Employees shall be given access to potable drinking water. Access to water will be provided as near as possible to where employees are working, and there shall be enough locations so employees will have sufficient water. Water should be fresh and pure, free of taste or smell that would discourage employees from drinking, comfortably cool, and obtained from an approved source.

The recommendation is that during warm or hot weather, employees drink four 8-ounce glasses of water, or a total of one quart per hour, throughout the entire work shift. Easy access to sufficient potable drinking water throughout the work shift encourages employees to drink.

During a heat wave, water shall be replenished more often to keep available and cool. Water containers (and all spouts and levers) must be kept clean. If able, provide single use drinking cups with appropriate waste receptacle. Accessible sanitation facilities shall also be maintained at work Sites as appropriate.

SS/SHSO are responsible for the following:

- Drink sufficient water before, during, and after work shifts to maintain hydration.
- Encourage frequent drinking of small amounts of water throughout the shift. In high heat environments, remind field staff and subcontractors that drinking extra water may be necessary.
- Discourage the choosing of drinks with caffeine or sugar that may possibly dehydrate employees instead of water. Also, discourage the drinking of alcohol.
- Monitor the water supply.
- If employees become dehydrated and are unable to alleviate symptoms with the steps below, get them immediate medical attention.

Field Staff/Subcontractors are responsible for the following:

- Drink sufficient water before, during, and after work shifts to maintain hydration. Drink up to 4 cups of water per hour, especially during hot weather.
- Be aware that in high heat situations, you may need to drink more water.
- Monitor yourself and others for signs of dehydration. If you feel dehydrated:
  - Follow Roux's Incident Notification Flowchart;

- Rest in the shaded resting area; and
- Drink water in small amounts, but frequently.

7. ACCESS TO SHADE

Access to shaded areas will be provided to Roux staff, as needed. Employees are encouraged to use these areas when they feel overheated. Roux's SS/SHSO shall oversee the proper implementation of shaded areas and will communicate these locations on a daily basis with the Field Team.

Depending on the Site, shaded areas can include the following:

- Pop-up Tents
- Canopies
- Umbrellas
- Structures mechanically ventilated or open to air movement
  - Garage
- Conex mounted RV canopies
- Full and thick tree canopies that block direct sunlight
- Buildings
- Enclosed areas only if they provide cooling comparable to shade in open air
  - Vehicles with air conditioning

Shaded Area Requirements

Shade shall be strong enough to cool employees down and other shadows should not be visible in the shade. Shade will be provided by Roux when the air temperature exceeds 80°F. If the temperature is less than 80°F, shade will be available and provided upon request. The SS/SHSO will monitor conditions to determine when the air will exceed (and is exceeding) 80°F. For most Sites, air will be monitored hourly and shade will be setup immediately if 80°F is exceeded.

Shade shall be located as close as practical to areas where employees are working and is easily accessible. These areas will be considered safe and free from other hazards. Shaded areas should be large enough to accommodate all employees who are on a break, resting, or recovering without crowding. Should natural vegetation be used for shade, the SS/SHSO will evaluate shade for effectiveness.

Field Staff Responsibilities

Field Staff should take ordinary rest breaks in the shaded areas and monitor themselves for signs of heat stress, and go to the shaded area when they need to cool down. Any issues or problems with shaded areas should be reported to the SS/SHSO for the Site.

If shaded areas are used for a preventative cool-down, the SS/SHSO will ensure the affected employees will remain in the shade until they begin to feel better. The SS/SHSO will continue to monitor the employees and ask them if they are experiencing symptoms of a heat illness. Employees shall not be sent back to work before symptoms have ended and at a minimum at least 10 minutes of rest.

8. MONITORING AND SCHEDULING

Monitoring

The SS/SHSO and Field Team will continue to monitor themselves and others for signs of heat illness. The SS/SHSO will monitor when the air temperature exceeds 80°F. Throughout the summer, weather and temperature will be monitored at least two weeks ahead, and the work schedule will be planned to accommodate the expected weather.

Scheduling

Scheduling accommodations may include:

- Working during cooler hours of the day
- Working at night
- Stopping work early
- Rescheduling work activities
- Increasing frequency of breaks

In general, strenuous work activities shall be rescheduled to the coolest parts of the day.

Special precautions are required for temperatures above 80°F, 95°F, and heat waves. These precautions are provided in sections below.

9. ACCLIMATIZATION AND NEW EMPLOYEE PROCEDURES

Roux requires employees to be acclimatized in order for them to better tolerate heat in the workplace. Acclimatization is the physical process of adapting to a different thermal environment, allowing a better toleration of heat. Acclimatization procedures require gradual exposure that gives the employee time to adjust to each level of exposure. Acclimatization is essential for new employees, but is necessary for all employees when the temperature significantly changes. Heat stress is much more likely if these procedures are not followed.

The SS/SHSO is responsible for observing new employees during their first 14 days of employment in high heat areas.

Re-acclimatization is necessary if employees are absent from high heat environments for a week or more or the temperature increases significantly.

10. HEAT WAVE AND EXTREME HEAT PROCEDURES

Heat Wave Procedures

A heat wave is defined as consistent temperatures over 80°F or if the temperature is 10° higher than the average daily temperatures in the preceding 5 days.

SS/SHSO and Project Management (e.g., PP, PM) shall closely observe and monitor employees during a heat wave. The Field Teams should institute a ratio of one SS to 20 or fewer employees, a mandatory buddy system, or a consistent practice for supervisors to check on employees. Pre-shift meetings to review high heat procedures with employees will be carried out to emphasize work rest schedules, drinking water, shade, etc.

Extreme Heat Procedures

When work site temperatures equal or exceed 95°F, the employer will enact extreme heat procedures:

- Employees will be closely observed by the SS/SHSO for signs of heat illness. New employees will be supervised for acclimatization.
- Effective communication and monitoring will be assured through the use of periodic check ins with the SS/SHSO via phone. Communications between employees and Project Management (e.g., PP/PM) will be established and maintained. Mandatory 10-minute break periods are required for every two hours worked. SS/SHSO must enforce this rule.
- Pre-shift safety tailgate meetings will occur to review procedures and to remind employees to drink water and take cool-down rests if needed. SS/SHSO shall remind employees to rest and drink water. Employees should drink more water than usual.

11. EMERGENCY RESPONSE PROCEDURES

Roux is dedicated to providing prompt appropriate care for all employees who report or show symptoms of heat illness. If an employee shows signs of heat illness, they will be monitored and shall not be left alone or sent home without being offered first aid or emergency medical services. If on-Site personnel require any medical treatment, the following steps will be taken:

1. Notify Roux's Project and Corporate Management Team for any work-related injury and/or illness occurrence, and communicate with the contracted Occupational Health Care Management Provider, AllOne Health (AOH), immediately following the notifications provided above.
2. Based on discussions with the Project Team, Corporate Management, and the AOH evaluation, if medical attention beyond onsite First Aid is warranted, transport the injured / ill person (IP) to the Urgent Care Center, or notify the Fire Department or Ambulance Emergency service and request an ambulance or transport the victim to the hospital, and continue communications with Corporate Management Team. An Urgent Care/Hospital Route map with locations and directions are provided within Site Specific Health and Safety Plans.
3. First aid medical support will be provided by onsite personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).
4. The SHSO and Project Manager will perform a Loss Investigation (LI) and the Project Team will complete the final Loss Report.

12. HEAT-RELATED ILLNESSES

Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (PPE) in hot weather environments. For these reasons, the company will provide potable drinking water and access to shade or other areas of relief (i.e., air-conditioned vehicles, work trailers). Supervisors, prior to supervising personnel in the field as well as all personnel involved with the field work of a project, are trained in this HASP that includes preventing heat-related illnesses and the below procedures in response to heat-related symptoms and illness. Since much of our work is dependent upon environmental factors beyond our control, we must closely monitor air temperature and humidity and be aware of avoiding radiant heat sources and providing as much air circulation as possible wherever we work. Physical factors that need to be evaluated as part of our Job Safety Analysis (JSA) reviews include the level of physical activity and duration of work and the type (i.e., color, weight breathability) of the clothing we select. In addition, personal factors such as age, weight, fitness, drug/alcohol use, and prior history of heat-related illness need to be considered.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body, resulting in painful muscle cramps. The signs and symptoms of heat stress are as follows:

- Severe muscle cramps, usually in the legs and abdomen;
- Exhaustion, often to the point of collapse; and
- Dizziness or periods of faintness.

First aid treatment includes, but is not limited to, shade, rest, and fluid replacement. Typically, the individual should recover within one-half hour while being monitored constantly. If the individual has not improved substantially within 30 minutes and the body temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat Exhaustion

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin to rid the body of excess heat through transference. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;
- Cold and clammy skin with heavy perspiration;
- Skin appears pale;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment include, but is not limited to, cooling the victim, elevating the feet, and replacing fluids. If the individual is not substantially improved within 30 minutes and the body temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat Stroke

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a MEDICAL EMERGENCY requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- Dry, hot red skin;
- Body temperature approaching or above 105 degrees F;
- Confusion, altered mental state, slurred speech;
- Seizures;
- Large (dilated) pupils; and
- Loss of consciousness – the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility. Heat stress is a significant hazard if any type of protective equipment (semi-permeable or impermeable) that prevents evaporative cooling is worn in hot weather environments.

13. OTHER HEAT CONTROLS

Clothing and PPE

Employees should choose clothing that is reflective, light-colored, lightweight, loose-fitting and breathable. Clothing should cover the exposed parts of the body. In direct sun, hard hats with a brim or bill may be helpful. Should specialized cooling garments be applicable, please consult with your OM/OHSM/CHSD.

Managing Employee Risk Factors

It is recommended that employees are aware of how their health can affect their risk of heat stress. The following increases ones risk for a heat related illness:

- A poor level of physical fitness
- Obesity
- Chronic or acute illnesses
- Conditions such as diabetes, heart disease, or high blood pressure
- Certain medications, such as diuretics
- Age (60+)

Employees should:

- Maintain their health outside of work
- Be aware of the effects of medications
- Drink adequate amounts of water
- Eat light, cool meals during work shifts and save heavy meals until after the shift is over
- Do not skip meals: food helps replace electrolytes when sweating
- Take breaks as needed
- Do not consume alcohol prior to working in a hot environment

ATTACHMENT D

Personal Protective Equipment (PPE) Management Program

PERSONAL PROTECTIVE EQUIPMENT
MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY DIRECTOR	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVIEW DATE	:	**03/2023**
REVISION NUMBER	:	**4**

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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C., and Remedial Engineering (collectively, "Roux") has instituted the following program to establish guidelines for the selection of personal protective equipment (PPE) for use by Roux personnel performing field activities in hazardous environments. PPE is not meant to be a substitute for engineering, work practice, and/or administrative controls, but PPE should be used in conjunction with these controls to protect employees in the workplace. Clothing, body coverings, and other accessories designed to prevent worker exposure to workplace hazards are all types of PPE. To ensure adequate PPE employee-owned PPE is evaluated on a case-by-case basis to insure its adequacy, maintenance and sanitation.

2. SCOPE AND APPLICABILITY

These guidelines apply to all PPE selection decisions to be made in implementing the Roux program. The foundations for this program are the numerous Occupational Health and Safety Administration (OSHA) standards related to PPE cited in 29 CFR 1910 Subpart I, 29 CFR 1926 Subpart E, and the hazardous environment work employee protection requirements under the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 and 1926.65. To ensure hazard assessments are documented, the levels of protection, types of protection, and tasks requiring protection are covered in site-specific Health and Safety Plans (HASPs) and Job Safety Analyses (JSAs).

3. PROCEDURES

Due to the varied nature of site activities and the different potential hazards associated with different sites, several aspects must be considered when selecting PPE. The following text describes PPE selection logic and provides guidelines and requirements for the appropriate selection and use of PPE.

3.1 Introduction

To harm the body, chemicals must first gain entrance. The intact skin and respiratory tract are usually the first body tissues that are exposed to chemical contaminants. These tissues provide barriers to some chemicals but in many cases, are damaged themselves or are highly permeable by certain chemical compounds. PPE therefore is used to minimize or eliminate chemical compounds from coming into contact with these first barrier tissues.

The proper selection of equipment is important in preventing exposures. The Project Manager (PM) or health and safety personnel making the selection will have to take several factors into consideration. The level of protection, type, and kind of equipment selected depends on the hazardous conditions. In some cases, additional selection factors include cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors must be made before work can be safely carried out.

3.1.1 Training

Training shall be provided to all field-based employees in the proper use and care of PPE. Training shall include, but is not limited to, the initial 40-hour HAZWOPER training, annual 8-hour HAZWOPER refresher training, and site-specific PPE training. The training program includes when PPE is necessary; what types of PPE are necessary; how to don, doff, adjust and wear PPE; the limitations of PPE; the proper care, maintenance, useful life and disposal of PPE. In addition, retraining shall be conducted when workplace changes require a change in PPE when an employee demonstrates a lack of knowledge or improper use of PPE is identified. Training certifications are provided to employees that include the date of training and certification subject.

3.2 Types of PPE

The type and selection of PPE must meet certain general criteria and requirements as required under OSHA 29 CFR 1910.132 (General Industry) and 1926.95 (Construction). In addition to these general requirements, specific requirements and specifications exist for some types of PPE that form the basis of the protective clothing scheme. All manufacturer's recommendations for PPE care and use shall be followed. All PPE shall be maintained in a sanitary and reliable condition. Additionally, proper fit and/or size shall be evaluated to ensure adequate protection for all employees. Should PPE become defective, it shall be immediately removed from service and discarded.

The following is a list of the common types of specific PPE and the specific requirements for the PPE type, where applicable:

1. Hard Hats - Regulated by 29 CFR 1910.135 and 1926.100; and, specified in ANSI Z89.1.
2. Face Shields and Safety Glasses - Regulated by 29 CFR 1910.133 and 1926.102; and, specified in ANSI Z87.1.
3. Respiratory Protection - Regulated by 29 CFR 1910.134 and 1926.103.
4. Hand Protection - Not specifically regulated.
5. Foot Protection - Regulated by 29 CFR 1910.136 and 1926.96; and, specified in ANSI Z41.1.
6. Protective Clothing (e.g., fully encapsulated suits, aprons) - Not specifically regulated.

3.3 Protective Clothing Selection Criteria

3.3.1 Chemicals Present

The most important factor in selecting PPE is the determination of what chemicals the employee may be exposed to. On field investigations, the number of chemicals may range from a few to several hundred. The exact chemicals or group of chemicals present at the site (certain groups tend to require similar protection) can be determined by collecting and analyzing samples of the air, soil, water, or other site media. When data are lacking, research into the hazardous materials used or stored at the site can be used to infer potential chemical exposures on the site.

The most appropriate clothing shall be selected once the known, or suspected chemicals have been identified and taken into consideration based on the type of work to be performed.

Protective garments are made of several different substances for protection against specific chemicals. There is no universal protective material. All will decompose, be permeated by, or otherwise fail to protect under given circumstances. Fortunately, most manufacturers make guides to the use of their products (i.e., Dupont's Tyvek™ Permeation Guide). These guides are usually for gloves and coveralls and typically provide information regarding chemical degradation rates (failure of the material to maintain structural integrity when in contact with the chemical), and may provide information on the permeation rate (whether or not the material allows the chemical to pass through). When permeation tables are available, they shall be used in conjunction with degradation tables to determine the most appropriate protective material for the specific chemical hazard(s).

During most site work, chemicals are usually in mixed combinations, and the protective materials are not in continuous contact with pure chemicals for long periods of time; therefore, the selected material may be adequate for the particular chemical of most concern and type of work being performed, yet not the "best" protecting material for all site chemicals and activities. Selection shall depend upon the most hazardous

chemicals based on their hazards and concentrations. Sometimes layering (i.e., using several different layers of protective materials) affords the best protection.

3.3.2 Concentration of the Chemical(s)

One of the major criteria for selecting protective material is the concentration of the chemical(s) in air, liquid, and/or solid state. Airborne and liquid chemical concentrations should be compared to the OSHA standards and/or American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines to determine the level of skin or other absorptive surface (e.g., eyes) protection needed. While these standards are not designed specifically for skin exposed directly to the liquid, they may provide skin designations indicative of chemicals known to have significant skin or dermal absorption effects. For example, airborne levels of PCBs on-site may be low because it is not very volatile, so the inhalation hazard may be minimal; however, PCB-containing liquid coming in direct contact with the skin may cause overexposure. Thus, PCBs have been assigned a skin designation in both the OSHA and ACGIH exposure limit tables.

3.3.3 Physical State

The characteristics of a chemical may range from nontoxic to extremely toxic, depending on its physical state. Inorganic lead in soil would not be considered toxic to site personnel, unless it became airborne, since it is generally not absorbed through the intact skin. However, organic lead in a liquid could be readily absorbed through the skin. Soil is frequently contaminated with hazardous materials. Concentrations will vary from a few parts per million to nearly one hundred percent by volume. The degree of hazard is dependent on the type of soil and concentration of the chemical. Generally speaking, "dry" soils that have not become airborne do not pose a hazard to site personnel if they take minimal precautions, such as wearing some type of lightweight gloves.

3.3.4 Length of Exposure

The length of time a material is exposed to a chemical increases the probability of a breakthrough. Determinations of actual breakthrough times for short-term exposures indicate that several different materials can be used that would be considered inadequate under long-term exposures. It should be kept in mind that during manufacturer’s permeation testing, a pure (100% composition) liquid is usually placed in direct contact with the material producing a worst-case situation.

3.3.5 Abrasion

When selecting protective clothing, the job the employee is engaged in must be taken into consideration. Persons moving drums or performing other manual tasks may require added protection for their hands, lower chest and thighs. The use of leather gloves and a heavy apron over other normal protective clothing will help prevent damage to the normal PPE, and thus reduce worker exposures.

3.3.6 Dexterity

Although protection from skin and inhalation hazards is the primary concern when selecting PPE, the ability to perform the assigned task must be maintained. For example, personnel cannot be expected to perform work that requires fine dexterity if they must wear a thick glove. Therefore, the PPE selection process must consider the task being performed and provide PPE alternatives or techniques that allow dexterity to be maintained while still protecting the worker (e.g., wearing tight latex gloves over more bulky hand protection to increase dexterity).

3.3.7 Ability to Decontaminate

If disposable clothing cannot be used, the ability to decontaminate the materials selected must be taken into consideration. Once a chemical makes contact with the material, the PPE must be cleaned before it can be reused. If the chemical has completely permeated the material, the clothing cannot be adequately decontaminated, and the material should be discarded.

3.3.8 Climactic Conditions

The human body works best with few restraints from clothing. Protective clothing adds a body burden by increasing weight, restricting movement, and preventing the body's natural cooling process. In severe situations, a modified work program must be used.

Some materials act differently when they are very hot and very cold. For example, PVC becomes almost brittle in very cold temperatures. If there are any questions about the stability of the protective materials under different conditions, the manufacturer should be contacted prior to using PPE in the field.

3.3.9 Work Load

Like climactic conditions, the type of work activity may affect work duration and the ability of personnel to perform certain tasks. Similarly, the amount of protective materials a person wears will affect their ability to perform certain tasks. For example, a person in a total encapsulating suit, even at 72°F, cannot work for more than a short period of time without requiring a break.

The work schedule should be adjusted to maintain the health of the employees. Modified work practices may include allowing more time for individual job tasks and implementing work/rest cycles per NIOSH and ACGIH thermal stress recommendations. Special consideration should be given to the selection of clothing that both protects the worker and adds the least burden when personnel are required to perform strenuous tasks. Excessive bodily stress frequently represents the most significant hazard encountered during field work.

3.4 Types of Protective Materials

1. Cellulose or Paper: suitable for nuisance dusts and coarse fibers.
2. Natural and Synthetic Fibers
    a. Tyvek™: suitable small sized hazardous particles, including lead, asbestos, and mold.
    b. Tychem™: suitable for a variety of hazards from light liquid splashes to heavy exposures of industrial chemicals and agents.
    c. Nomex™: suitable for flame-resistance, radiation resistance, acids, alkalis, fluorocarbon refrigerants (CFCs), and non-polar solvents.
3. Elastomers
    a. Polyethylene: suitable for polar substances and solvents.
    b. Saran™ : suitable for flame-resistance, acids, alkalis, oils, and organic solvents.
    c. Polyvinyl Chloride (PVC): suitable for alcohols, oils, inorganic acids, alkalis, and salts.
    d. Neoprene: suitable for polar/non-polar substances, petroleum mixtures, and ≤ 200 F heat resistance.
    e. Butyl Rubber: suitable for polar substances and solvents.
    f. Viton: suitable for non-polar substances, petroleum mixtures, and ≤ 200 F heat resistance.

g. Nitrile: suitable for polar/non-polar substances and petroleum mixtures.

3.5 Protection Levels

3.5.1 Level A Protection

Level A protection (a fully encapsulated suit) is used when skin hazards exist or when there is no known data that positively rule out skin and other absorption hazards. Per the Roux Respiratory Protection Management Program, Roux employees are not authorized to enter an IDLH atmosphere; therefore, the program does not allow the use of supplied-air respirators (SARs) or self-contained breathing apparatus (SCBA). At no time will Level A work be performed without the consent of the CHSD and OM.

The following conditions suggest a need for Level A protection:

- Confined facilities where probability of skin contact is high;
- Sites containing known skin hazards;
- Sites with no established history to rule out skin and other absorption hazards;
- Atmosphere immediately dangerous to life and health (IDLH) through the skin absorption route;
- Site exhibiting signs of acute mammalian toxicity (e.g., dead animals, illnesses associated with past entry into site by humans);
- Sites at which sealed drums of unknown materials must be opened;
- Total atmospheric readings on the Photoionization Detector (PID), Flame Ionization Detector (FID), and similar instruments indicate 500 to 1,000 ppm of unidentified substances; and
- Extremely hazardous substances (e.g., cyanide compounds, concentrated pesticides, Department of Transportation Poison "A" materials, suspected carcinogens and infectious substances) are known or suspected to be present and skin contact is possible.

The following items constitute Level A protection:

- Open circuit, pressure-demand self-contained breathing apparatus (SCBA);
- Totally encapsulated suit;
- Gloves, inner (surgical type);
- Gloves, outer;
- Chemical protective;
- Boots, chemical protective, steel toe and shank;
- Radiation detector (if applicable); and
- Communications.

3.5.2 Level B Protection

Level B protection is utilized when the highest level of respiratory protection is needed but hazardous material exposure to the few unprotected areas of the body is unlikely.

The following conditions suggest a need for Level B protection:

- The type and atmospheric concentration of toxic substances have been identified and they require the highest level of respiratory protection;

- IDLH atmospheres where the substance or concentration in the air does not present a severe skin hazard;
- The type and concentrations of toxic substances do not meet the selection criteria permitting the use of air-purifying respirators; and
- It is highly unlikely that the work being done will generate high concentrations of vapors, gases or particulates, or splashes of materials that will affect the skin of personnel.

Personal protective equipment for Level B includes:

- Open circuit, pressure-demand SCBA;
- Chemical protective clothing:
- Overalls and long-sleeve jacket; or
- Coveralls;
- Gloves, inner (surgical type); gloves, outer, chemical protective;
- Boots, chemical protective, steel toe, and shank; and
- Communications optional.

3.5.3 Level C Protection

Level C protection is utilized when both skin and respiratory hazards are well defined, and the criteria for using negative pressure respirators have been fulfilled (i.e., known contaminants and contaminant concentrations, acceptable oxygen levels, approved filter/cartridge available, known cartridge service life, etc.). Level C protection may require an emergency escape respirator during specific initial entry and site reconnaissance situations or when applicable after that.

Personal protective equipment for Level C typically includes:

- full facepiece air-purifying respirator;
- emergency escape respirator (optional);
- chemical protective clothing:
  - overalls and long-sleeved jacket; or
  - coveralls;
- gloves, inner (surgical type);
- gloves, outer, chemical protective; and
- boots, chemical protective, steel toe, and shank.

3.5.4 Level D Protection

Level D is the basic work uniform. Personal protective equipment for Level D includes:

- Coveralls;
- Safety boots/shoes;
- Eye protection;
- Hand protection;

- Reflective traffic safety vest (mandatory for traffic areas or railyards);
- Hard hat (with face shield is optional); and
- Emergency escape respirator is optional.

3.5.5 Level E Protection

Level E protection is used when radioactivity above 10 millirems per hour (mrems/hr) is detected at the site. Personal protective equipment for Level E includes:

- Coveralls;
- Air purifying respirator (i.e., P100 or equivalent);
- Time limits on exposure;
- Appropriate dermal protection for the type of radiation present, and
- Radiation dosimetry and ambient monitoring.

3.5.6 Additional Considerations

Fieldwork will contain a variety of situations due to chemicals in various concentrations and combinations. These situations may be partially ameliorated by following the work practices listed below:

1. Foot protection is needed on every site. If the ground to be worked on is contaminated with liquid, and it is necessary to walk in the chemicals, some sort of protective shoe coverings or "booties" can be worn over the boots. Shoe coverings should be designed with soles to help prevent slips. Using disposable shoe coverings when contacting liquid contamination can cut down on overall decontamination requirements. If non-liquids are to be encountered, a Tyvek™ bootie could be used. The advantage of booties is questionable if the ground contains any sharp objects. Boots should be worn with either cotton or wool socks to help absorb perspiration.
2. If the site situation requires the use of hard hats, chin straps should be used if a person will be stooping over where his/her hat may fall off. Respirator straps should not be placed over the hard hats, as this will affect the fit of the respirator.

   Some types of protective materials conduct heat and cold readily. In cold conditions, natural material clothing should be worn under protective clothing. Protective clothing should be removed prior to allowing a person "to get warm." Applying heat, such as with a space heater, to the outside of the protective clothing may drive contaminant permeation. In hot weather, under clothing will absorb sweat. It is recommended that workers use all cotton undergarments.
3. Body protection should be worn and taped to prevent anything from running into the top of the boot. Gloves should be worn and taped to prevent substances from entering the top of the glove. Duct tape is preferred, but masking tape can be used. When aprons are used, they should be taped across the back for added protection. However, this should be done in such a way that the person has mobility.
4. Atmospheric conditions such as precipitation, temperature, wind direction, humidity, wind velocity, and pressure determine the behavior of contaminants in air or the potential for volatile materials to become airborne. These parameters should be considered in determining the need for and the level of protection.
5. A program must be established for periodic air monitoring during site operations. Without an air monitoring program, any changes to air quality would go undetected and might jeopardize on-site personnel. Monitoring can be done with various types of air pumps and filtering devices followed by laboratory analysis of the filtration media, personnel dosimeters, and periodic walk-throughs by personnel carrying real-time direct-reading survey instruments.

6. For operations in the exclusion zone, different levels of protection may be selected, and various types of chemical-resistant clothing may be worn. This selection should be based on the job function, reason for being in the area, and the potential for skin contact with, or inhalation of, the chemicals present.
7. Escape masks must be readily available when levels of respiratory protection do not include a SCBA and the possibility of an IDLH atmosphere exists. The use and placement of escape masks should be made on a case-by-case basis. Escape masks should be strategically located at the site in areas that have higher possibilities of vapors, gases or particulates.

ATTACHMENT E

Subsurface Utility Clearance Management Program

SUBSURFACE UTILITY CLEARANCE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY DIRECTOR	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVIEW DATE	:	**03/2023**
REVISION NUMBER	:	**3**

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APPENDICES

Appendix A – Roux Subsurface Utility Clearance Checklist

Appendix B – Utility Verification/Site Walkthrough Record

Appendix C – Private Utility Technology Applications and Considerations

1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C., and Remedial Engineering (collectively, "Roux") has instituted the following program for completing proper utility mark-outs and for conducting subsurface clearance activities. This establishes a method to ensure, to the greatest extent possible, that utilities have been identified and contact and/or damage to underground utilities and other subsurface structures will be avoided. For the purpose of this program, a structure is defined as any underground feature that may present a potential source(s) of energy, such as, but not limited to, utility vaults, bunkers, piping, electrical boxes, wires, conduits, culverts, utility lines, underground tanks, and ducts.

2. SCOPE AND APPLICABILITY

The Subsurface Utility Clearance Management Program applies to all Roux employees, its contractors, and subcontractors. Employees are expected to follow this program for all intrusive work involving Roux or other personnel (e.g., contractors/subcontractors) working for Roux unless the client's requirements are more stringent. Intrusive work activities can include, but are not limited to, digging or scraping the ground surface, including, but not limited to, excavation; test pitting or trenching; soil vapor sampling or the installation of soil borings, soil vapor monitoring points and wells, or monitoring wells; and drilling within concrete slabs on grade.

Deviation from the program, regardless of the specific work activity or location, must be pre-approved based on the client's site knowledge, experience, site conditions, and additional documentation on the site. Any exceptions shall be documented through Roux Subsurface Variance Form located within the Roux Health & Safety Application or through OKTA. Approval is required by the Project Principal (PP) and the Operations Manager (OM) in consultation with the Office Health and Safety Manager (OHSM) or Corporate Health and Safety Director (CHSD) prior to mobilization. Depending on the work location, more stringent federal, state, local, or client requirements may apply. It is the responsibility of the Project Team to identify such requirements prior to mobilization.

3. PROCEDURES

3.1 Before Intrusive Activities/Job Planning Process

Obtain, review, and field verify relevant historical site data that may include: as-builts/site plans; easement/right-of-way information; historical aerial photos/development plans; local/state permitting records; previous site investigation/boring logs; and/or interviews with site representative/client.

If there is the potential for unexploded ordinances or munitions, consultation with your OM and CHSD is required prior to site operations.

During the project kick-off meeting for intrusive activities, the Project Manager (PM) will review the Roux Subsurface Utility Clearance Checklist and Utility Verification (Appendix A) / Site Walkthrough Record (Appendix B) and the below bullet points with the project field team:

- Review the work scope to be performed with the site owner/tenant to determine if it may impact any utilities;
- Determine the need for utility owner companies to be contacted or to have their representatives on site;

- Where mark-outs terminate at the property boundary, consider the use of private utility locating / GPR / geophysical-type services. Use of private utility locating firms, however, does not eliminate the legal requirement for the subcontractor (e.g., driller, excavation firm) to submit a request for Public Utility Mark-outs. Also, the information provided by the service may be inaccurate and unable to locate subsurface utilities and structures in urban areas, landfills, urban fill areas and below reinforced slabs, etc. They should not be relied upon as the only means of performing utility clearance;
    - A mark-out is defined as the process of contracting with a competent and qualified company to confirm the presence or absence of underground utilities and structures. This process will clearly mark-out and delineate utilities that are identified so that intrusive work activities can be performed without causing disturbance or damage to the subsurface utilities and structures. After utility mark-outs are completed the soft Digging must completed prior to intrusive work.
- Documented description of the dig site, which is included in the project's Health and Safety Plan (HASP), and one call report will be maintained in the field and distributed amongst Roux personnel, its contractors, and subcontractors; and
- Documentation of the actual placement of mark outs in the field shall be collected using dated pictures, videos and/or sketches with distance from markings to fixed objects. All documentation shall be maintained within the project file.

3.2 Utility Mark Out

- Ensure the Mark-out / Stake-out Request Information Sheet (or one-call report) is complete and accurate for the site, including address and cross streets, and review for missing utilities.
    - Note: utility mark-out organizations do not have contracts with all utilities and it is often necessary to contact certain utilities separately, such as the local water and sewer authorities.
- Have written confirmation prior to mobilizing to the site that the Project Team or Roux personnel performing the intrusive activity has correctly completed the mark-out notification process, including requesting mark-outs, waiting for mark-outs to be applied to ground surfaces at the site, and receiving written confirmation of findings (via fax or email) from utility operators for all known or suspected utilities in the proposed area of intrusive activity, and provided utility owner written confirmation to Roux personnel for review and project files documentation.
- Do not begin any intrusive activity until all utility mark-outs have been completed (i.e., Did all utilities mark-out the site?) and any unresolved mark-out issues are finalized. Perform a site walk to review the existing utilities and determine if the utility locators have located said utilities.

  (Note: The Tolerance Zone is defined as three feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks, and other non-cylindrical utilities) of a utility and three feet from the outside edge of any subsurface structure.)
- For non-subscribing utility owners or if public one-call service is not available, perform due diligence and request further information regarding utility type, construction details, location and burial depth directly from public service providers/utility owners. Request utility mark-out by each public service provider/utility owner as applicable. Confirm contact and response by each public utility owner on the Subsurface Utility Clearance Checklist.
- If utilizing a Private Markout, ensure the contractor has a plan regarding what types of technology will be used based on Table 1 in Appendix C: Private Utility Technology Applications and Considerations. If possible, it is recommended that multiple technologies are used to sweep each location/work area. Use tracer wire to locate the utility (when tracer wires are present). Record the results of the private utility mark-out on the Utility Verification/Site Walkthrough Record form.

3.3 Site Visit/Utility Walkthrough

Before mobilization with the subcontractor or during the pre-work safety tailgate with the subcontractor, perform a site walkthrough after utility mark-outs have been completed to determine whether additional potential hazards are present and look for visible signs of utilities that may be present. Outlined below are considerations regarding a site walk before intrusive activities.

- Identify overhead utilities that may impede equipment mobilization or work zones to ensure adequate clearance distance, as specified within the site-specific Health and Safety Plan (HASP).

The presence of any of the following may indicate potential subsurface structures:

- Locations of buildings, equipment, and features like area lights, signs, sprinkler systems, phones, drains, natural gas meters, manholes, etc.;
- Warning tape, which is often a sign of underground services;
- Material like pea gravel, sand, or other non-native materials can indicate the presence of tanks or lines or any deviations from the established native soil or backfill conditions;
- Red concrete, which is often used for electrical duct banks;
- Evidence of damaged utilities, such as piping materials, insulation, or odors present in the work area; and
- Other utilities including fire hydrants, electrical transformers, pipeline markers, valve covers, steam lines, and valve box covers, clean-outs, etc.

By observing the path between the main service line and the connection point, it may be possible to determine the likely routing of on-site utilities. However, this method should not be relied upon solely, and proper risk mitigation strategies should be in place before proceeding with any ground disturbance activities.

For sites with potential underground storage tanks present (UST) the following guidance applies:

- Identify if the product piping is either rigid or flexible.
- Conduct a visual examination of the tank field, observation wells, dispensers, vent stacks, and UST fill points to determine their location.
- Locate and become familiar with the emergency shutoff button/switch, if present.
- Determine the orientation, arrangement, and location of the tanks, as well as their size and capacity, through the examination of visible features at grade, such as fill ports and extractor covers, and by consulting any available as-built drawings.

3.4 Guidance on Preferred Methods of Clearing the Subsurface

At least one of the methods listed below should be carried out during pre-clearing activities. The Project Team is responsible for evaluating risks associated with the Scope of Work to determine which method is selected.

The following approaches shall be considered and implemented based on the Scope of Work.

- Soft Digging
    - This is the preferred method of utility clearance when clearing higher-risk utilities. Soil should be cleared through the use of a vacuum truck/equivalent, an accompanying air knife (preferred), or a water lance to break up and loosen the soil for removal with the vacuum.

- Hand Digging
  - Soil should be broken up and removed using a shovel or other appropriate hand tools without excessive force. Limit the use of dig bars or other tools that, if used incorrectly, can significantly damage utilities.
- Hand Augering
  - The hand auger must be turned slowly without excessive force. Rounded edge augers are preferred. Hand augers should not be used in pea stone/pea gravel where utilities may be present and could potentially be damaged by the hand auger. The abrupt absence of soil recovery in a hand auger could indicate utilities as pea gravel or sand may have spilled out of the auger (exception: native soil conditions that typically result in poor hand auger recoveries).

3.4.1 Guidance for Tools and Equipment

Personnel performing pre-clearance activities shall keep tools and equipment in safe working order and be properly inspected before use. If tools or equipment are broken, they will be tagged and removed from service. The following specify additional guidelines regarding tools and equipment:

- Hand digging tools must have a non-conductive handle, such as fiberglass, wood, or composite, or fully insulated handles and potential contact surfaces.
- Blades on shovels and post-hole diggers should have rounded or blunt edges.
- Pick axes or pointed spades should not be used for physical clearance.
- Crow bars, pinch bars, or pry bars should not be used to break hardened soil or backfill, except when authorized by the SS lead to loosen materials like bricks or larger stones.
- Electric-powered equipment must have ground fault protection.
- Should there be refusal or difficulty with advancing hand tools, the contractor shall stop work and notify the Roux SS/SHSO immediately.

3.5 During Intrusive Activities

Remove any surface coverings (i.e., pavement, brush, debris, etc.) to ensure workers have clear visibility of the work area and subsurface conditions. Avoid mechanical jack hammering over known lines unless they are de-energized, locked-out/tagged-out and potential repairs are planned or if the utility has been completely disconnected prior.

Install Pre-Clearance exploratory test holes using one of the techniques, as outlined in Section 3.4, for the first 5-ft below land surface (BLS) at each location before conducting intrusive mechanized activities.

- The size of the pre-clearance exploratory test hole should be, at a minimum, twice the diameter of any downhole tool or boring device. Note: Pre-Clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for PM and PP to evaluate alternative approaches for the project. Alternative approaches will need to be pre-approved by the OM.
- For direct push applications (CPT, Geoprobe®, etc.) the borehole clearance diameter shall be at least 125% of the diameter of the largest tool being pushed through the subsurface (e.g., tip, rod, sampler, etc.), to the minimum required depth.
- For excavations, all utilities need to be marked and then exposed by hand following the protocols in this program. Pre-clearing for excavations may be performed by the “moat” technique (i.e., soft Digging around the perimeter). In these cases, dig in small lifts (<12” for first 5 feet) using a dedicated spotter.)

- For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of pre-clearance test holes specified in Section 3.4 to expose the utility. Once structures have been verified, a minimum clearance of three feet must be maintained between the utility and any powered equipment. If considered a high risk utility, additional requirements may be necessary and required by the Operator of the utility. Consultation with the OM and CHSD may be appropriate.

The PM, field team lead or personnel performing oversight is to:

- Ensure the mark-out remains valid. (In certain states, there are limits regarding the duration of time after the mark-out was applied to the ground surface work can be started or interrupted.) Additionally, the mark-outs must be maintained, documented, and in many cases, refreshed periodically to be considered valid. This will be accomplished through calls to the one call center.
- Ensure intrusive activities are only performed within the safe boundaries of the mark-out as detailed in the One-Call Report.
- Halt all work if intrusive activities have resulted in the discovery of an unmarked utility. Roux personnel shall notify the facility owner/operator and the one call center. All incidents such as this will be reported as per Roux Incident Investigation and Reporting Management Program.
- Halt all work if intrusive activities must take place outside of the safe boundaries of a mark-out and only proceed after new mark-outs are performed.
- Halt the intrusive activities and immediately consult with the PP if an unmarked utility is encountered.
- Completing any subsurface utility incident reports that are necessary.
- If a utility cannot be found as marked, Roux personnel shall notify the facility owner/operator directly or through the one-call center. Following notification, the excavation/mechanical intrusive work may continue unless otherwise specified in state law.
- Contractors/subcontractors must contact the one-call center to refresh the ticket when the excavation continues past the life of the ticket. State law dictates ticket life; however, at a maximum, ticket life shall not exceed 20 working days.

3.6 Stop Work Authority

Each Roux employee has Stop Work Authority that he or she will execute upon determination of any imminent safety hazard, emergency situation, or other potentially dangerous situation, such as hazardous weather conditions. This Stop Work Authority includes subsurface clearance issues such as the adequacy of a mark-out or identification during intrusive operations of an unexpected underground utility. Authorization to proceed with work will be issued by the PM/PP in consultation with the OHSM after such action is reviewed and resolved. The PM will initiate and execute all management notifications and contact emergency facilities and personnel when this action is appropriate.

Appendix A - Roux Subsurface Utility Clearance Checklist

Roux Subsurface Utility Clearance Checklist ***Date of Revision: 3/2023***

Work site set-up and work execution

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
Daily site safety meeting conducted, SPSAs performed, JSAs reviewed, appropriate work permits obtained (if applicable).				
HASP is available and reviewed by site workers / visitors.				
Subsurface Utility Clearance Procedure has been reviewed with all site workers.				
Mechanical intrusive work activities may not be performed at any location without authorization from the Roux Site Supervisor (SS). Clearance activities may not be performed at any location unless the SS is physically present.				
Work area secured; traffic control established as needed. Emergency shut-off switch located. Fire extinguishers / other safety equipment available as needed.				
Utility mark-outs (public / private) clear and visible. Provide Excavator's Stake-Out Reference Number / Request Date / Time.				
Tolerance zone work identified. Intrusive work activities cannot be performed in areas that are in direct conflict with any markings made by public or private locators.				
Unless the PP & OM authorizes it, all boreholes and test pit locations must be physically cleared before using mechanized equipment. Required minimum physical clearance depths and diameters are as follows: • Physically clear to a depth of 5 feet bls. • The size of the pre-clearance exploratory test hole must be, at a minimum, twice the diameter of any downhole tool or boring device. • For direct push applications (CPT, Geoprobe®, etc.) the borehole clearance diameter shall be at least 125% to the diameter of the largest tool being pushed through the subsurface (e.g., tip, rod, sampler, etc.).				
Work execution plan reviewed and adhered to (ground disturbance methods, clearance depths, any special utility protection requirements, or any other execution requirements; especially for Tolerance Zone work).				

Mechanical intrusive work is prohibited within 3-feet distance in all directions from subsurface structures that will be intentionally exposed during pre-clearance. Any removal of material within 3-feet of the subsurface structure may only proceed by hand using non-conductive tools/compressed air if authorized by state law and the owner/operator of the utility.				
All equipment onsite must maintain the appropriate horizontal distance from any point on the equipment to the nearest overhead electrical power line. Refer to site-specific HASP and local/utility company requirements.				
Verbal endorsement received from Roux PM and OM for any required field deviations to work execution plan.				

Key Reminders for Execution

The Subsurface Utility Clearance Protocol should be referenced to determine all requirements while executing subsurface work. The bullet points below are intended as general reminders only and should not be relied upon solely.

- The size of the pre-clearance exploratory test hole must be at a minimum twice the diameter of any downhole tool or boring device.
- For direct push applications (CPT, Geoprobe®, etc.) the borehole clearance diameter shall be at least 125% to the diameter of the largest tool being pushed through the subsurface (e.g., tip, rod, sampler, etc.), to the minimum required depth.
- The tolerance zone is defined as three feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks, and other non-cylindrical utilities) of a utility and three feet from the outside of any subsurface structure.
- For excavations, all utilities need to be marked and then exposed by hand, following the protocols in this program. Pre-clearing for excavations may be performed by the “moat” technique (i.e., soft digging around the perimeter). In these cases, dig in small lifts (<12” for first five feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes to expose the utility. Once structures have been verified, a minimum clearance of three feet must be maintained between the utility and any powered equipment.

Appendix B - Utility Verification/Site Walkthrough Record

Employee Name:_____

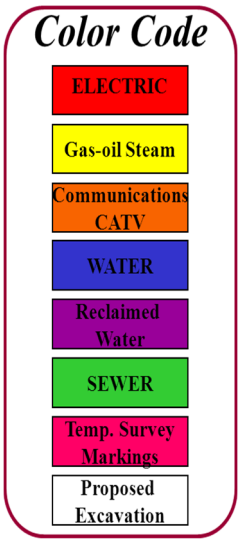
Date: _____

Instructions: For each utility suspected at the job site, indicate the location on the job site, approximate burial depth, and means of detecting the utility. Leave blank if that utility is not believed to be present.

Utility	Description of Utility Location Identified Onsite	Approx. Depth (bls)	Method / Instrumentation used to determine Utility Location	Utility Owner Response (Date/Time)	Mark Out Indicates (Clear / Conflict)
Electrical Lines					
Gas Lines					
Pipelines					
Steam Lines					
Water Lines					
Sanitary and Stormwater Sewer lines					
Pressured Air-Lines					
Tank Vent Lines					
Fiber Optic Lines					
Underground Storage Tanks					
Phone Lines/ Other					

* bls - below land surface

Site Sketch Showing Utilities:



Other Comments / Findings:

Completed by: _____

Signature: _____ Date: _____

Appendix C – Private Utility Technology Applications and Considerations

Technology ⇒ Utility/Object ⇓	Radio Frequency Electro-Magnetic Detector (connection to utility, or induction without connection)	Radio Frequency Electro-Magnetic Detector (passive sweep)	Ground Penetrating Radar (GPR)⊙	Acoustic Plastic Pipe Locator	Beacon, Sonde or Conductive Rodder Insertion	EM-61 (time domain electromagnetics) Ξ	
Power/Instrument Line (Energized/Signaled) □	✱ G	G	G	R	R	G	
Power Line (Non-energized) □	✱ G	R	G	R	R	G	
Sewer/Water Line (Metallic) □	✱ G	Y	G	Y	G	G	
Sewer/Water Line (Non-metallic)	R	R	G	G	✱ G	R	
Instrument / Telecomm Lines (Non-energized)	✱ G	R	G	R	R	Y Only if metallic	
Hydrocarbon Transmission Line (Pipeline)◆ □	✱ G	R	G	R	R	G	
Metallic/Non-Metallic Line (with Tracer Wire)	✱ G	Y	G	Y	Y	G metallic	Y non-metallic
Metallic/Non-Metallic Line (without Tracer Wire)	G metallic	R non-metallic	R	✱ G	Y	Y	G metallic	R non-metallic
Metal or Fiberglass UST	R	R	✱ G	R	R	G metallic	R non-metallic

Additional Considerations

Technology ⇒ Variable ⇓	Radio Frequency Electro-Magnetic Detector	Ground Penetrating Radar (GPR)⊙	Acoustic Pipe Locator	Beacon, Sonde, or Conductive Rodder Insertion	EM-61 Ξ
Moist Soil	G	Y	G	G	G
Dry Soil	Y	G	Y	G	G
Clay	Y	R	G	G	G
Concrete w/Rebar	R	Y	G	G	R
Long Horizontal Profile	G	G	G	G	G
Short Horizontal but Deep Vertical Profile	Y	G	R	R	G
Access to Line✚	G	N/A	G	G	G
No Access to Line✚	G (induction or passive) R (direct connect)	G	R	R	G G
Ferrous Metal	G	G	G	G	G
Non-ferrous Metal	Y	G	G	G	G
Adjacent or crossing conductive utility(ies)	Y	N/A	N/A	N/A	Y

Each site will be unique. Do not use this table as the sole criteria for technology selection. Use it as a starting point to assess available, applicable technology(s).

✱ Indicates best technology for given object. Site structures, rebar in concrete, shallow groundwater tables, perched storm water, etc. can significantly affect performance and reliability of any electro/magnetic method. Other utilities which cross or are adjacent to the target line can cause the EM signal to bleed or jump to the other utility line.

□ Metallic lines that have power running through them or can be connected to a tracer signal generator.

◆ Natural gas pipeline locating technicians must be trained/certified (in the U.S. requires DOT and Office of Pipeline Safety standards, other regions may have similar certification or requirements).

⊙ Most sensitive to interpretation. The skill, training and experience of operator are critical.

Ξ Emerging technology with limited availability.

✚ Access: induce unique electronic signature, apply acoustical impulse or insert conductive rodder/beacon/sonde.

Green Generally, an applicable technology **Yellow** May or may not be applicable **Red** Not generally applicable

ATTACHMENT F

Heavy Equipment Exclusion Zone Management Program

HEAVY EQUIPMENT EXCLUSION ZONE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY DIRECTOR	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVIEWED DATE	:	**03/2023**
REVISION NUMBER	:	**2**

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1. PURPOSE

The Exclusion Zone Management Program aims to establish the minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). The intent is to have no personnel or equipment entering the Exclusion Zone while the equipment is in operation or moving to ensure that Roux and Subcontractor employees are unnecessarily exposed to the hazards of the equipment.

2. SCOPE AND APPLICABILITY

This Management Program applies to all Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C., and Remedial Engineering (collectively, "Roux") employees and their subcontractors performing fieldwork and are potentially exposed to heavy equipment. Heavy equipment includes, but is not necessarily limited to, excavation equipment, drill rigs, vacuum trucks, forklifts, lull telehandlers, man lifts, bobcats, delivery trucks, etc.

3. PROCEDURES

As specified in the following sections of this program, Exclusion Zones must be established and maintained during activities involving the movement/operation of heavy equipment. The Exclusion Zone requirements apply to all personnel on the site but are primarily focused on personnel required to work near the equipment. The exclusion zone is in effect when heavy equipment is moving or engaged (e.g., movement of an arm or bucket of an excavator, rotation of an auger, lifting of a load with a forklift, raising/lowering of a man lift, etc.).

1. The Exclusion Zone must meet the following minimum requirements:
   - A minimum distance of 10 feet from all heavy equipment and loads being moved by the equipment;
   - Greater than the swing/reach radius of any moving part on the heavy equipment (i.e., for large equipment, this may mean an exclusion zone distance larger than 20 feet);
   - Greater than the fall zone of equipment and their contents; and
   - Greater than the tip-over distance of the heavy equipment.

   The size of the Exclusion Zone will need to be determined on a task-specific basis considering the size of the heavy equipment in use and the task being performed. Prior to all heavy equipment operations, the Exclusion Zone(s) distance must be specifically identified in the Job Planning Process and incorporated in the pre-job tailgate meeting with the subcontractor(s), including any updates to our Job Safety Analysis (JSA).
2. The spotter (or another authorized individual) should be responsible for enforcing the Exclusion Zone and not conducting any other task. The spotter should be positioned immediately outside of the Exclusion Zone within a clear line of sight of the equipment operator. The spotter must signal the operator to stop work if anyone or anything has the potential to enter or compromise the Exclusion Zone. The operator should stop work if the spotter is not within their line of sight. If a spotter must be within the Exclusion Zone, they must be in a designated area outside the swing/tip radius, fall zone, line of fire of lifted loads, etc. If multiple pieces of equipment are being used, one spotter may be adequate so long as there is a clear line of sight and the spotter can control the zone(s). Radios would be required since hand signals would not be adequate if two pieces of equipment were running.

3. If an individual must enter the Exclusion Zone, the designated Spotter must signal the Equipment Operator to stop the equipment. Once the equipment is no longer moving (e.g., movement of an arm of an excavator is STOPPED, lifting of a load with a forklift STOPPED, raising/lowering of a man lift is STOPPED, etc.), the operator must bring the boom/arm to the ground ensuring a "Zero Energy State" and DISENGAGE THE CONTROLS and STOP and SIGNAL BY "SHOWING HIS HANDS." This signal will indicate that it is safe for the person to enter the limits of the Exclusion Zone to perform the required activity. The equipment must remain completely stopped/disengaged until all personnel exited the Exclusion Zone's boundaries and the designated Spotter has signaled by "SHOWING HIS HANDS" to the Equipment Operator that it is safe to resume operations.
4. When entering the limits of the Exclusion Zone, personnel must, at a minimum:
    - Establish eye contact with the operator and approach the heavy equipment in a manner that is in direct line of sight to the Equipment Operator;
    - Never walk under any suspended loads or raised booms/arms of the heavy equipment; and
    - Identify a travel path free of Slip/Trip/Fall hazards.
5. The Exclusion Zone should be delineated using cones with orange snow fences or solid poles between the cones, barrels, tape, or other measures. For work in rights-of-way, rigid barriers, such as Jersey barriers or temporary chain link fences, should be used. For certain types of widespread or moving/mobile equipment operations, such delineation may not be practicable around equipment or individual work areas. In such instances, it is expected that the entire operation will be within a larger secure work area or that additional means will be utilized to ensure the security of the work zone.

All subcontractors who provide heavy equipment operations to field projects must implement a program that meets or exceeds the expectations described above as well as any additional requirements that may be required on a client or site-specific basis. Logistics involving heavy equipment should be understood and discussed prior to the field event during the job planning phase.

3.1 Exceptions

It is recognized that certain heavy equipment activities may require personnel to work within the limits of the Exclusion Zone as specified in this program. Such activities may include certain excavation clearance tasks, drill crew activities, or construction tasks. However, any such activity must be pre-planned, emphasizing limiting the amount and potential exposure of any activity required within the zone. The critical safety steps to mitigate the hazards associated with working within the Exclusion Zone must be defined in the JSA and potentially other project-specific plans (i.e., critical lift plans, etc.), and approved by the Roux Project Principal (PP), Office Health and Safety Manager (OHSM) and client representative, if required, prior to implementation.

4. TRAINING

Many Roux projects have different requirements that are client-specific or site-specific in nature. However, all Roux employees are provided initial training, as well as annually thereafter, on our Heavy Equipment Exclusion zone policy.

5. STOP WORK AUTHORITY

All Roux employees and their subcontractors have stop-work authority. Upon initial hire, all Roux employees are provided initial safety orientation, including stop work authority. All Roux employees and subcontractors are encouraged to stop work whenever any task or operation presents unreasonable risk or employees are

unsure how to carry out work safely. This includes upon observing any questionable safety-related behavior or condition, they are to stop work immediately and discuss the behavior or condition with the individual(s) involved. Upon stopping work, the following actions will be taken:

- Notify the affected parties to include the Project Manager (PM) and Site Health and Safety Officer (SHSO);
- Work to correct the situation or not proceed until the situation is corrected by the PM or SHSO;
- Resume work only when told to proceed by either the PM or SHSO;
- The SHSO will document the Stop-Work intervention in the field logbook;
- Stop-Work interventions will be reported to the PP for review to ensure the interventions are closed; and
- The PP will share learnings from the interventions, as appropriate, throughout the firm, to demonstrate the importance of the Stop-Work interventions.

Please note: Any form of retribution or intimidation directed at any individual or company for exercising their right to issue a stop work authority will not be tolerated.

APPENDIX G

Community Air Monitoring Plan

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. 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 and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. 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.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion 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, particularly if wind direction changes. 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.

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

2. 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 of 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.

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

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. 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 all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) 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 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 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 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Depending upon the nature of contamination, chemical-specific colorimetric tubes of sufficient sensitivity may be necessary for comparing the exposure point concentrations with appropriate pre-determined response levels (response actions should also be pre-determined). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m^3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m^3 or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

Special Requirements for Indoor Work With Co-Located Residences or Facilities

Unless a self-contained, negative-pressure enclosure with proper emission controls will encompass the work area, all individuals not directly involved with the planned work must be absent from the room in which the work will occur. Monitoring requirements shall be as stated above under "Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures" except that in this instance "nearby/occupied structures" would be adjacent occupied rooms. Additionally, the location of all exhaust vents in the room and their discharge points, as well as potential vapor pathways (openings, conduits, etc.) relative to adjoining rooms, should be understood and the monitoring locations established accordingly. In these situations, it is strongly recommended that exhaust fans or other engineering controls be used to create negative air pressure within the work area during remedial activities. Additionally, it is strongly recommended that the planned work be implemented during hours (e.g. weekends or evenings) when building occupancy is at a minimum.