Contract No.: D009805
Work Assignment# D009805-15

New York State Department of Environmental Conservation

Final Remedial Investigation Work Plan

New Process Cleaners (Site No. 518024)
Remedial Investigation/Feasibility Study
Johnstown, New York

February 18, 2022

CDM Smith

Certification Page

I, Lia Estrada, certify that I am currently a New York State registered professional engineer and that this *Final Remedial Investigation Work Plan for New Process Cleaners Site No. 518024* 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).

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Date: February 18, 2022

Signature

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Acronyms

bgs	below ground surface
CAMP	Community Air Monitoring Plan
CDM Smith	Camp Dresser McKee & Smith
CVOC	chlorinated volatile organic compound
DPT	direct push technology
DUSR	Data Usability Summary Report
EDD	electronic data deliverable
EDS	Environmental Data Services
EIMS	Environmental Information Management System
EPA	United States Environmental Protection Agency
FAP	field activities plan
FTS	file transfer service
gpm	gallons per minute
GPR/EM	ground penetrating radar/electromagnetic
HASP	health and safety plan
IDW	investigation derived waste
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
ng/L	nanograms per liter
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PFAS	per - and polyfluoroalkyl substances
PID	photo-ionization detector
QA	quality assurance
QC	quality control
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
QAS	quality assurance specialist
RI/FS	remedial investigation/feasibility study
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCE	trichloroethene
TCL	Target Compound List
the site	New Process Cleaners site
TIC	top of inner casing
µg/L	microgram per liter
UST	underground storage tank
VOC	volatile organic compound
WA	work assignment

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Section 1

Introduction

Camp Dresser McKee & Smith (CDM Smith) received Work Assignment No. D009805-15 from the New York State Department of Environmental Conservation (NYSDEC) under the NYSDEC Standby Contract No. D009805. to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the New Process Cleaners site (the site) located in the City of Johnstown, Fulton County, New York. The purpose of this work assignment is to identify the nature and extent of contamination in all media at or emanating from the site, define the pathways for migration of such contamination, and develop remedial alternatives that will eliminate the site's potential threat to public health or the environment. This RI Work Plan provides information on the site background, a detailed discussion of the planned RI sampling scope, and a schedule for the planned activities.

1.1 Site Location and Background

The New Process Cleaners site (the site) is located in a residential and commercial area at 115 North Market Street in the City of Johnstown, Fulton County, New York (**Figure 1**). The 0.11-acre property is zoned as commercial and houses an active dry cleaner, New Process Cleaners. The building, parking lot, and driveway occupy the majority of the parcel which has little undeveloped space. The property has a one-story building with a basement located in the front of the building, while the rear of the building was constructed with a slab-on-grade foundation. The primary use of the site was for dry cleaning; however, the current owner stated that the site was previously used to store coffins before the dry-cleaning operations began. The site is bordered to the west and south by a commercial property that formerly operated as a car maintenance facility (referred to as "adjacent commercial property" in this report), to the north by residential properties, and to the east by North Market Street (**Figure 1**).

During a 2018 site characterization performed at the site, the site was found to be contaminated with chlorinated solvents in both soil and groundwater. Tetrachloroethene (PCE), trichloroethene (TCE), and their associated degradation products were detected in groundwater at the south-west portion of the New Process Cleaners site property at levels exceeding appropriate groundwater standards. PCE and TCE were also detected in shallow soil at the site. During the site characterization, 1,4-dioxane and per-and polyfluoroalkyl substances (PFAS) were detected in groundwater of the western portion of the site. However, concentrations of 1,4-dioxane in groundwater were below the appropriate screening levels and PFAS concentrations exceeded the appropriate screening levels at only one location.

1.1.1 Summary of Environmental Investigations

In 2013, a petroleum tank removal action was performed at the adjacent commercial property immediately south of the New Process Cleaners site. . During the removal action, it was discovered that the sewer line from the New Process Cleaners site was not connected to the municipal sewer main, but rather discharged sub-grade in the area of the underground storage tank (UST) locations on the adjacent commercial property. The sewer line is assumed to be at a depth of approximately 6 feet below ground surface (bgs). During the 2013 removal action, the USTs on the adjacent commercial property were removed and the sewer discharge pipe from the New Process Cleaners site was connected to the municipal sewer manhole located adjacent to the Cayadutta Creek bridge on North Market Street (C.T. Male Associates 2016).

During a subsequent 2014 investigation of the adjacent commercial property that aimed to delineate petroleum-related contamination, eight exploratory soil borings were advanced to depths ranging from 14.7 to 19.5 feet bgs. After soil sampling was completed, all soil borings were subsequently converted to overburden monitoring wells (GP-1 through GP-8). Chlorinated volatile organic compounds (CVOCs), contaminants typically associated with dry cleaning activities, were detected in the groundwater. The presence of CVOCs was attributed to the New Process Cleaners site and the discharges of dry cleaner sewage onto the adjacent commercial property prior to the connection of the dry cleaner sewer pipe to the municipal sewer line (C.T. Male Associates 2016). In 2015, additional groundwater investigations were performed. CVOCs were detected at concentrations similar to the 2014 investigation. The highest CVOC concentrations in groundwater at the adjacent commercial property were detected at GP-3 and GP-6; GP-3 is located immediately south of the garage building near a former UST and GP-6 is located southwest of the 2013 UST removal area (C.T. Male Associates 2016).

In 2016, a supplemental site investigation was performed on the adjacent commercial property in which an additional eight soil borings were advanced to depths ranging from 12 to 20 feet bgs. After soil sampling was completed, all soil borings were subsequently converted to overburden monitoring wells (MW-1 through MW-8). The 2016 supplemental site investigation confirmed the findings from the 2014 and 2013 investigations, concluding that there are coalescing plumes of petroleum products and CVOCs at the site. The highest concentrations of CVOCs were detected at MW-8 and GP-6, located west of the UST removal area (C.T. Male Associates 2016).

In response to the discovered CVOC groundwater contamination at the adjacent commercial property, HDR performed a site characterization of the New Process Cleaners site in 2018 under NYSDEC's direction (HDR 2018). The objective of the investigation was to determine whether the New Process Cleaners site was the source for the CVOC contamination detected at the adjacent commercial property. The investigation was also performed to determine whether contamination may have migrated via the subgrade sewer pipe discovered during the tank removal at the adjacent commercial property. The investigation revealed contamination in soil and groundwater on the New Process Cleaners site that could be attributable to dry cleaning operations; however, the investigation also discovered secondary contamination attributed to the presence of historic fill on the property as well as the commercial and industrial uses on neighboring properties including the adjacent commercial property that formerly operated as a car maintenance facility (HDR 2018).

During the 2018 site characterization, six monitoring wells were installed in the overburden (NPC-MW1 through NPC-MW6). Most of the monitoring wells were screened from 6 to 16 feet bgs, with the exception of NPC-MW3 which was screened from 4 to 14 feet bgs. and a test pit was excavated alongside the sewer pipe identified as a potential source during previous investigations. In an effort to minimize potential damage to the sewer pipe, the test pit was excavated alongside the pipe to a depth of approximately 7 feet bgs. The sewer pipe was assumed to be at a depth of approximately 6 feet bgs based on observations from the connecting manhole. Soil samples were collected from each well location and from inside the test pit. Groundwater samples were collected in two rounds from each of the newly installed monitoring wells and water level measurements were recorded. The results from this investigation are summarized in Section 1.2.4.

1.2 Site Characteristics

The following sections summarize the site characteristics and are adapted from the *Site Characterization Report* (HDR 2018). Site location and topography are shown on **Figure 1**.

1.2.1 Geology

The site is located in southern Fulton County, approximately 0.25 miles due north of the intersection of North Market Street and West Main Street in the City of Johnstown. A geological map for the site is shown on **Figure 2**. The surficial geology in the region is mapped as Pleistocene aged lacustrine sands (Cadwell et al. 1986). The underlying bedrock is mapped as Ordovician aged Canajoharie Shale which is part of the Lorraine, Trenton, and Black River Groups on the bedrock geology map of New York State—Hudson Mohawk sheet (Fischer et al. 1970). Soils on-site are mapped as Scio-Urban land complex, 0 to 3 percent slopes, and ranges from silt loam to variable gravelly sandy loam (United States Department of Agriculture [USDA] 2011).

During well installation and test pit excavation conducted as part of the 2018 site characterization, historic fill was found throughout the site, along with sands with varying silt and gravel content characteristic of glacial till. A notable underlying clay layer was also observed with a thickness of at least several feet. None of the sampling locations confirmed depth to bedrock. The deepest borings advanced on the New Process Cleaners site and the adjacent commercial property reached a depth of 16 and 20 feet bgs, respectively. For purposes of this RI Work Plan, it is assumed based on these historical investigations that bedrock would be encountered at 20 feet bgs at this site. While outcrops were not noted in the vicinity of the site, bedrock outcrops are mapped in the area on the Surficial Geologic Map of NY State (Cadwell et al. 1986).

1.2.2 Hydrogeology

In general, a shallow unconsolidated aquifer and deeper bedrock aquifer are found within the region (Nystrom and Scott 2011). Depending on the character and structure of the geologic formations, either aquifer may provide low to moderate yields. The unconsolidated aquifer in the vicinity of the site is mapped as a principal aquifer with yields of less than10 gallons per minute (gpm) (Bugliosi et al. 1987), while the Canajoharie Shale that makes up the bedrock aquifer in the vicinity of the site is considered to be one of the chief water-bearing rocks of the region (Arnow 1951). However, neither aquifer in the vicinity of the site is a current source of drinking water for local residents. Residents local to the site are part of the City of Johnstown and Aspen Hills Water District, whose water source is Christman Reservoir, Cork Center Reservoir, and Larabee Reservoir located west of the City of Johnstown (City of Johnstown 2017). Based on previous investigations, groundwater is encountered at 9 to 10 feet bgs and the local ground water flow direction is south-southeast towards nearby Cayadutta Creek.

1.2.3 Wetlands

There are no New York State regulated wetlands or wetland buffer zones at the site. New York State regulated wetlands and wetland buffer zones within the vicinity of the site are shown on **Figure 3**.

1.2.4 Nature and Extent of Contamination

The results of the 2018 site characterization indicate that PCE is the primary contaminant observed on-site in soil and groundwater. The highest concentrations of PCE observed in soil and groundwater are located near the rear of the New Process Cleaners site suggesting a potential source in this area. In addition, discrete soil sampling of the test pit surrounding the sewer discharge pipe did not reveal high PCE concentrations, further suggesting that the pipe may not be the source of contamination.

In soil, PCE concentrations ranged from non-detect to 40 milligrams per kilogram (mg/kg)—the maximum concentration was detected at NPC-MW4. Except for the results from NPC-MW4, no soil samples contained concentrations of PCE greater than the 375-6.8(a) Unrestricted Use Soil Cleanup Objectives. In groundwater, concentrations of PCE ranged from non-detect to 15,000 micrograms per liter (µg/L)—the maximum concentration was detected at NPC-MW5. Concentrations of PCE at NPC-MW-4, NPC-MW5 and NPC-MW6 exceeded the applicable Part 703.5 class GA groundwater standard for PCE of 5 µg/L. The nature and extent of PCE in site groundwater is shown on **Figure 4**. TCE was also detected in site groundwater with a maximum concentration of 6.6 µg/L at NPC-MW4. Based on localized groundwater flow from the synoptic rounds, the monitoring wells that contain TCE and cis-1,2-dichloroethene (cis-1,2-DCE) are downgradient of the area of highest concentration, suggesting some downgradient degradation of PCE may be potentially occurring.

In addition, 1,4-dioxane and PFAS were found in groundwater of the western portion of the site at low levels. 1,4-Dioxane was detected at a maximum concentration of 0.34 µg/L, which is below the 1 µg/L screening level. Perfluorooctanoic acid (PFOA) was detected at a maximum concentration of 9.6 nanograms per liter (ng/L), which is below the 10 ng/L screening level; perfluorooctane sulfonic acid (PFOS) was detected at a maximum of 15 ng/L, which slightly exceeds the 10 ng/L screening level. There are several possible explanations for the presence of PFAS including leaching of historic fill or potential historical use of clothing waterproofing. 1,4-Dioxane is likely related to the usage of detergents during dry cleaning activities.

Concentrations of polycyclic aromatic hydrocarbons (PAHs), and elevated concentrations of arsenic, barium, copper, lead, iron, mercury, and zinc were detected at soil sampling locations in close proximity to the adjacent commercial property. These same compounds were either not observed or were observed in lower concentrations at soil sampling locations further upgradient from the adjacent commercial property. Based on the known site history of both the New Process Cleaners site and the adjacent commercial property, the *Site Characterization Report* concluded that this contamination is attributed to the presence of historic fill and the property and/or the former car maintenance activities occurring on the adjacent commercial property in close proximity to the New Process Cleaners building.

1.3 Current Conditions

On May 19, 2021, CDM Smith and NYSDEC conducted a site visit to assess the condition of the wells and general accessibility of the site for field investigation activities, and to determine viable locations for soil vapor intrusion sampling. The site building is currently occupied by an active dry cleaner, New Process Cleaners. An adjacent commercial property was inspected as a part of the site visit to determine how downgradient CVOC impacts would be investigated. The site visit included visual inspection of existing monitoring wells and temporary monitoring wells to determine their viability.

Five (NPC-MW1 through NPC-MW5) of the six monitoring wells were identified on the New Process Cleaners property. Monitoring well, NPC-MW6, located off the northwest corner of the site building, could not be visually assessed during the site visit as it appeared to be under a dense pile of heavy brush, trash, and leaves. The remaining wells associated with the site all appeared to be in good condition and were able to be accessed easily. Seven (MW-1 through MW-5, MW-7, and MW-8) of the eight monitoring wells on the adjacent commercial property were visually assessed during the site visit. All were found to be in good condition. Monitoring wells alongside the Cayadutta Creek were all generally covered in brush but were still accessible. MW-6 was not located during the site visit, as it appeared to be in a very densely vegetated area with several new growth trees. A total of five (GP-3, and GP-5 through GP-8) of the eight temporary monitoring wells (GP-1 through GP-8) were visually assessed during the site visit. The remaining three temporary wells were not found, and all identified temporary wells were not capped. Both the site property and the adjacent commercial property are fairly open and easily accessed. The site property is generally asphalt paved. The adjacent commercial property is mostly unpaved (sparse vegetation with some debris on the ground surface) with areas of gravel and concrete immediately adjacent to the former service buildings. However, the edges of both properties have a fair amount of brush and vegetation. CDM Smith and NYSDEC were not able to access the interior of the New Process Cleaners building at the time of the site visit.

Three adjacent residential properties identified as Residence 1, 2, and 3 on **Figure 1** were also identified during the site visit as properties proposed for soil vapor intrusion sampling. CDM Smith and NYSDEC were not able to access these properties during the May 2021 site visit. Additional properties may be identified in the future for soil vapor intrusion sampling pending sampling results from Residence 1, 2, and 3 and/or any access issues that may be encountered.

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Section 2

Work Plan Approach

2.1 Technical Document Development

To develop the technical documents for the site, CDM Smith utilized, to the extent possible, existing information provided in the *Site Characterization Report* (HDR 2018). CDM Smith also conducted a site visit to observe the current conditions and to develop the project scope as summarized in Section 1.3. The investigations and sequence of implementation proposed in this work plan were developed by CDM Smith in accordance with Section 3.3 of DER-10, *Technical Guidance for Site Investigation* and *Remediation* and the most current version of NYSDEC's *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS)* guidance (NYSDEC 2021).

2.2 Quality Assurance

All CDM Smith work on this work assignment will be performed in accordance with the CDM Smith Quality Assurance Project Plan (QAPP) NYSDEC Standby Engineering Services Contract D009805 (May 2020a) and Field Activities Plan (FAP) (May 2020b) provided in Appendix A.

The quality assurance specialist (QAS) will maintain quality assurance (QA) oversight for the duration of the work assignment. A CDM Smith QAS has reviewed this work plan for QA requirements.

The CDM Smith project manager (PM) is responsible for implementing appropriate quality control (QC) measures on this work assignment. Such QC responsibilities include:

- Implementing the QC requirements referenced in this work plan and the QAPP
- Organizing and maintaining work assignment files
- Conducting planning meetings, as needed, in accordance with the Schedule (Table 1)

Document control aspects of the program pertain to controlling and filing documents. CDM Smith has developed a document control system to ensure that the documents and records are properly stored and filed. This system will be implemented to control and file all documents associated with this work assignment. The system includes document control procedures, file review, and file security measures.

The QA program includes assessments as checks on the quality of data generated on this work assignment. Self-assessments include project reviews, field mobilization readiness checks, and calculation checking; independent reviews include data validation, and QA, editorial and technical reviews.

2.3 Project Schedule

A project schedule for this work plan is included as **Table 1**. The project schedule is based on assumptions for durations and conditions of key events occurring on the critical and non-critical paths. The project schedule assumes a timely review and approval of the work plan and other documents and the provision of adequate funding by NYSDEC.

Table 1 Project Schedule

Project Milestone	Date
Issue Work Assignment Notice to Proceed	January 22, 2021
Conflict of Interest Complete	January 28, 2021
Kick-off Meeting with NYSDEC PM to Review Scope	March 18, 2021
Submit Draft Schedule 1 and 2.11s to NYSDEC PM for Review and Comment	May 7, 2021
Gain Access to Site (115 North Market Street)	May 17, 2021
Site Visit	May 19, 2021
NYSDEC PM Comment on Draft Schedule 1 and 2.11s	June 9, 2021
Submit Draft Schedule 1 and 2.11s to NYSDEC Contract Manager for Review and Comment	June 17, 2021
NYSDEC CM Comment on Draft Schedule 1 and 2.11s	September 17, 2021
Address comments to & resubmit Schedule 1 and 2.11s	September 27, 2021
Approval of Funding for Schedule 1 and 2.11s	October 20, 2021
Task 1 – Preliminary Activities	
Task 1 – Schedule 1 and 2.11s Package	January 28 –October 20, 2021
Task 1 – Project Management	January 28, 2021 – February 3, 2023
Task 2 – Remedial Investigation	
Task 2 – Submit Draft Remedial Investigation Work Plan	January 14, 2022
Task 2 – Receive comments from NYSDEC and NYSDOH	February 4, 2022
Task 2 – Submit Final Remedial Investigation Work Plan	February 18, 2022
Task 2 – Initial Well Survey and Synoptic Water Level Round	March 2, 2022
Task 2 – Geophysical Survey, Soil Borings/Soil Sampling, and Groundwater Screening	March 14-18, 2022
Task 2 – Overburden and Bedrock Monitoring Well Installation	April 18, 2022 – April 26, 2022
Task 2 – Groundwater Sampling and Slug Testing	May 9-13, 2022
Task 2 – Vapor Intrusion Sampling	March 14-15, 2022
Task 2 – Laboratory Analysis	May 27, 2022
Task 2 – Data Validation Submittal	June 24, 2022
Task 3 – Remedial Investigation Report	
Task 3 – Submit Draft RI Report to NYSDEC PM and NYSDOH for Review and Comment	July 29, 2022
Task 3 – Receive comments from NYSDEC and NYSDOH	August 19, 2022
Task 3 – Submit Final RI Report	September 2, 2022
Task 4 – Feasibility Study	
Task 4 – Review draft FS alternatives with NYSDEC PM	October 21, 2022
Task 4 – Submit Draft FS Report to NYSDEC PM and NYSDOH for Review and Comment	November 18, 2022
Task 4 – Receive comments from NYSDEC and NYSDOH	December 23, 2022
Task 4 – Submit Final FS Report	January 6, 2023

2.4 General Requirements

General requirements include those relating to sustainable (or green) remediation and project data management, as described in the following sections.

2.4.1 Sustainable Remediation/Green Remediation

Green remediation is the practice of considering all environmental effects of the implementation of a remedy and incorporating options to maximize the net environmental benefit of cleanup actions. In accordance with Chapter 1.14 of DER-10 and DER-31 for compliance and environmental stewardship, NYSDEC strives for cleanup programs that use natural resources and energy efficiently, reduce negative impacts on the environment, minimize or eliminate pollution at its source, and reduce waste to the maximum extent possible.

NYSDEC supports the adoption of "green site assessment and remediation," which is defined as the practice of considering all environmental impacts of studies; selecting and implementing a given remedy; and incorporating strategies to maximize the net environmental benefit of cleanup actions.

Green remediation objectives will be implemented by planning field activities that minimize fuel usage and impact to the environment. Planning that can minimize environmental impact includes the following measures:

- Minimize the number of field mobilizations
- Use non-phosphate detergents for decontamination
- Schedule sampling to minimize shipping
- Use in-situ treatment and natural degradation processes to minimize energy usage and generation of greenhouse gases

To the extent practicable, CDM Smith will explore and implement green remediation strategies and applications in the performance of the requirements of this work assignment to maximize sustainability, reduce energy and water usage, promote carbon neutrality, promote industrial materials reuse and recycling, and protect and preserve land resources.

The following guidance documents provide additional information on implementing "Green Remediation" practices.

- NYSDEC DER 10 https://www.dec.ny.gov/docs/remediation_hudson_pdf/der10.pdf
- NYSDEC DER-31 https://www.dec.ny.gov/docs/remediation_hudson_pdf/der31.pdf

2.4.2 Project Data Management and Electronic Data Deliverable Requirements

The goals of project data management are to store and manage the data generated during the project so it is ready and available for analysis and reporting. NYSDEC standardized electronic data deliverable (EDD) format will be utilized to streamline the electronic submittal of all environmental data. CDM Smith will provide all field collected data, laboratory analytical results, and well locations data in the most current NYSDEC EDD format to the NYSDEC Environmental Information Management System (EIMS) team. Requirements are contained in the *NYSDEC Electronic Data Deliverable Manual* (NYSDEC 2018).

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Section 3

Scope of Work

The scope of work was prepared in accordance with Section 3.3 of DER-10, *Technical Guidance for Site Investigation and Remediation* and NYSDEC's *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS)* guidance (NYSDEC 2021). The tasks are also summarized in Table 2.

3.1 Health and Safety Plan and Community Air Monitoring Plan

CDM Smith will prepare a site-specific Health and Safety Plan (HASP) that specifies employee training, protective equipment, medical surveillance requirements, standard operating procedures and a contingency plan in accordance with 40 Code of Federal Regulations (CFR) 300.150 of the National Contingency Plan (NCP) and 29 CFR 1910.120 (l)(1) and (l)(2).

CDM Smith will prepare a Community Air Monitoring Plan (CAMP) to be implemented during drilling activities. The CAMPs purpose will provide a measure of protection for communities downwind of the intrusive activities.

The HASP and CAMP documents are included as Appendix B and Appendix C, respectively.

3.2 Water Level Measurements and Monitoring Well Survey

Prior to the commencement of drilling activities, one CDM Smith representative will mobilize to the site to collect a baseline round of synoptic water levels from all viable existing monitoring wells (assumed to be 14 wells) from both the site and the adjacent commercial property. A professional land surveyor will be subcontracted to perform an initial survey of the existing monitoring wells. The surveyor will record location coordinates in North American Datum 1983 (NAD 1983) and New York State Plane East coordinates [feet] and elevation of the top of inner casing (TIC) and adjacent ground surface in North American Vertical Datum 1988 (NAVD 1988). It is assumed that both the synoptic round of water levels and initial well survey will be performed concurrently. Collection of this data will provide a baseline understanding of the groundwater elevations present on-site and the general groundwater flow direction for the overburden zone. This information will aid in determining the initial placement of the soil borings (Section 3.4).

3.3 Geophysical Survey

Prior to beginning intrusive activities, a ground penetrating radar/electromagnetic (GPR/EM) survey will be performed throughout the entire site to pre-clear the proposed soil boring and monitoring well locations, and to identify underground utilities/vaults/anomalies. Following completion of the GPR/EM survey, the subcontractor will submit a plan view (aerial photo basemap) figure showing the approximate location of any underground utilities/vaults/anomalies found. Delta Geophysics from Catasauqua, Pennsylvania will perform the GPR/EM survey. A CDM Smith representative will be on-site to oversee geophysical survey activities.

3.4 First Mobilization – Subsurface Investigation (Soil and Groundwater Screening)

North Star Drilling from Homer, New York, will advance soil borings for soil and groundwater screening sampling. CDM Smith will provide oversight of the drilling and collect the soil and groundwater screening samples during this event.

During the first mobilization at the site, ten soil borings will be advanced to 20 feet below ground surface (bgs) via direct push technology (DPT) or until refusal. As previously mentioned in Section 1.2.1, it is assumed that bedrock would be encountered at a depth of 20 feet bgs. The proposed locations are shown on **Figure 5**—the results of the monitoring well survey (Section 3.2) may require changes to the proposed locations. Any changes to the proposed locations will be reviewed with NYSDEC. During drilling, continuous 2-inch macrocores will be collected, lithology will be documented, and photoionization detector (PID) readings will be recorded. At each boring, up to three soil samples and one groundwater screening sample will be collected. Soil samples will target the ground surface, the water table interface, and depths with the highest PID readings and/or visual-olfactory observations indicative of contamination. A groundwater screening sample will be collected at the water table at each location via screen point sampler. Samples will be collected via high density polyethylene tubing/ stainless steel foot valve or peristaltic pump. Groundwater will be purged to allow for turbidity to clear. A set of water quality parameters will be collected at each location.

Soil and groundwater screening samples will be analyzed at a NYSDEC Callout Laboratory. The soil and groundwater screening samples will be analyzed for Target Compound List (TCL) volatile organic compounds (VOCs) via United States Environmental Protection Agency (EPA) Method 8260D. Approximately 25 percent of soil samples will also be analyzed for PFAS via EPA Method 537modified, 1,4-dioxane via EPA Method 8270D selected ion monitoring (SIM), total organic carbon via Lloyd Kahn, TCL semivolatile organic compounds (SVOCs) via EPA Method 8270, polychlorinated biphenyls (PCBs) via EPA Method 8082, pesticides via EPA Method 8081, Total Analyte List (TAL) metals via EPA Method 6010, and total cyanide via EPA Method 9012. Locations selected for the full analyte list will be determined in the field to obtain an appropriate spatial distribution of these contaminants to better define their extent of contamination in soil. In addition, the location of the samples selected for PFAS and 1,4-dioxane analysis will also be biased towards areas of elevated PID readings to determine if emerging contaminant impacts are related to the chlorinated solvent impacts emanating from the site. The results from the monitoring well survey described in Section 3.2 will be used to determine these locations. Final locations will be reviewed with NYSDEC. Soil samples from two soil boring locations will also be analyzed for moisture via ASTM D2216, particle size distribution via ASTM D6913, particle size distribution with hydrometer for fine-grained soils via ASTM 7928, and soil porosity via ASTM D425M to assist in determining the viability of in-situ alternatives to be assessed in the proposed feasibility study. These samples will be analyzed by RSA Geolab, LLC in Union, New Jersey.

In an effort to reduce soil investigation derived waste (IDW), the drill cuttings from borings will be used as backfill from the terminating depth of the boring to 1-foot bgs as long as the soil meets the conditions outlined in DER-10 Section 3.3(e)ii. The remainder of the borehole (0 to 1-foot bgs) will be backfilled with bentonite. Purge water generated from the aforementioned activities will be containerized onsite for characterization and disposal (Section 3.10).

3.5 Second Mobilization – Monitoring Well Installation and Development

During the second mobilization at the site, three overburden wells and three bedrock wells will be installed in the vicinity of the site and adjacent commercial property (**Figure 6)**. North Star Drilling from Homer, New York will install and develop the monitoring wells, and CDM Smith will provide oversight during this event. Locations selected for monitoring well installation may change pending CDM Smith and NYSDEC's review of the analytical results from the subsurface investigation described in Section 3.4. The analytical results from the subsurface investigation will aid in determining where best to place the proposed monitoring wells to effectively monitor the nature and extent of contamination at the site. CDM Smith and NYSDEC will discuss the plans for the monitoring well installation work prior to commencement of the effort. During installation, investigation into whether or not there is a confining layer between the bedrock and overburden will be performed.

3.5.1 Overburden

Three overburden wells will be installed within the vicinity of the site (**Figure 6)**. Monitoring well locations and terminal depths will be determined by the project team based on field observations, depth of the water table (assumed to be 9 to 10 feet bgs based on historical investigations), PID readings from soil borings advanced during the subsurface investigation, and analytical results from the subsurface investigation. The overburden wells will be constructed of 2-in diameter Schedule 40 polyvinyl chloride (PVC) riser and screen (#10 slot). Surface completions will be flush mount with a concrete apron. It is assumed that all overburden wells will be screened approximately from 10 to 20 feet below ground surface.

3.5.2 Bedrock

Three bedrock monitoring wells will be installed within the vicinity of the site (**Figure 6)**. One well location will be installed adjacent to existing monitoring well NPC-MW-5 and the remaining two bedrock wells will be installed adjacent to two of the downgradient overburden monitoring wells on the adjacent commercial property. Exact bedrock monitoring well locations and terminal depths are subject to change based on field and hydrogeologic conditions. The casing will be installed within the upper 15-feet of the bedrock zone or once water is encountered (bedrock surface is estimated to be located approximately 20 feet bgs). Air rotary drilling will be utilized for this work; therefore, the mobilization of an additional drill rig will be required for the installation of the bedrock monitoring wells. Rock coring will also be performed at the source zone bedrock well location proposed to be installed adjacent to existing overburden monitoring well NPC-MW-5.

To install the bedrock wells, a borehole will be advanced into the top of the bedrock and a 6-inch steel casing will be set (with a cement bentonite grout) 5-feet into the competent bedrock to seal off the bedrock zone from the overburden above. The casing will be allowed to set for a minimum 12-hours prior to commencing borehole advancement. For the source zone bedrock monitoring well (located near NPC-MW-5), it is assumed that coring will start at 20 feet bgs and continue to a terminal depth of 35 feet bgs. A CDM Smith geologist will document the lithology and fracture zones at the source zone location. Coring will not be performed at the other two bedrock wells.

It is assumed that bedrock monitoring wells will be screened from approximately 25 to 35 feet bgs. The wells will be finished at the surface with a flush-mount protective casing with a concrete apron and will be constructed of 2-inch diameter Schedule 40 PVC riser and screen (#10 slot).

Soil cuttings and purge water generated from the activities mentioned in Section 3.5 will be containerized onsite for characterization and disposal (Section 3.10).

3.5.3 Monitoring Well Development

Monitoring well development will be performed at least 24 hours after installation has been completed to remove fines from the well and ensure a good hydraulic connection between the screen zone and the aquifer. Purge water will be monitored for pH, conductivity, temperature, dissolved oxygen, and turbidity to determine if the well is adequately developed. Development water will be containerized in drums staged on-site.

3.5.4 Staff Gauge Installation

To further understand the hydraulic connection between groundwater and surface water within Cayadutta Creek a staff gauge is proposed for installation in the Creek. Staff gauge installation will be performed concurrently with the monitoring well sampling. However, its installation will be coordinated with the Federal Emergency Management Agency (FEMA), as needed. Pending the installation of the staff gauge, the gauge will be surveyed concurrently with the newly installed monitoring wells.

3.5.5 Well and Staff Gauge Survey

Following installation, all of the newly installed monitoring wells will be surveyed for location, ground surface elevation and TIC elevation as a part of a second mobilization of the professional land survey subcontractor. The surveyor will also survey location and the top of gauge elevation of the newly installed staff gauge. The surveyor will record location coordinates in North American Datum 1983 (NAD 1983) and New York State Plane East coordinates [feet] and elevations in North American Vertical Datum 1988 (NAVD 1988).

3.5.6 Well and Staff Gauge Synoptic Round of Water Levels

It is anticipated that a synoptic round of water levels (from all existing and newly installed monitoring wells, as well as, the staff gauge) will be performed concurrently with the second well survey event as discussed in Section 3.5.5. Collection of this data will provide an updated understanding of the groundwater elevations present on-site and the general groundwater flow direction for the overburden and bedrock zones. This data will also provide an understanding of how the groundwater table is hydraulically connected to Cayadutta Creek.

3.6 Groundwater Sampling and Analysis

A minimum of two weeks following development of the new monitoring wells, CDM Smith will conduct groundwater sampling at the six newly installed wells, six existing wells on the New Process Cleaners property, and nine of the permanent/temporary wells (three temporary and six permanent) on the adjacent commercial property (total of 21 monitoring wells) (**Figure 6**). The existing wells to be sampled will be confirmed during the monitoring well survey described in Section 3.2. This work will include coordination of sample bottles and coolers with the NYSDEC Callout Laboratory, pre-field work preparation (e.g., labelling and organizing sample bottles, ordering rental field equipment, and purchasing consumable equipment items), a comprehensive synoptic round of water levels from all viable and accessible wells, purging of wells via low-flow methodology and measurement of field parameters (pH, turbidity, oxidation-reduction potential, specific conductivity, dissolved oxygen, and temperature), collection of groundwater samples from 21 monitoring wells, and shipment of samples to the NYSDEC Callout Laboratory. Groundwater samples will be analyzed for TCL VOCs, PFAS, 1,4-dioxane, SVOCs, PCBs, pesticides, TAL metals, total cyanide, and monitored natural attenuation (MNA) parameters. All groundwater samples will not be analyzed for the aforementioned list of analyte groups, with the exception of TCL VOCs. The frequency of the remaining analyte groups to be sampled in groundwater are discussed later in this section and are presented in Table 2.

Slug testing will be performed at three overburden monitoring wells and one bedrock monitoring well to evaluate hydraulic conductivity. Falling head and rising head tests will be performed using an appropriately sized solid slug. Pressure transducers will be used to monitor water levels. Three slug tests will be performed on each of the four wells. Wells chosen for slug testing will be based on observed lithology and the presence of contamination that would likely need to be addressed in the feasibility study.

During the groundwater sampling event, three co-located surface water and sediment samples (one background/upgradient, one immediately downgradient and one further downgradient past the site) will be collected from Cayadutta Creek to evaluate discharge of contaminated groundwater to surface water. The exact location of the co-located surface water and sediment samples will be determined based on a drafted potentiometric surface map showing groundwater flow and the understanding of the extent of contamination. The data to prepare the map will be collected during the water level measurements and monitoring well survey described in Section 3.2 and 3.5. The location of the surface water and sediment sample will also be dependent on accessibility and field conditions. All samples will be analyzed for TCL VOCs, PFAS, and 1,4-dioxane. Samples will be analyzed and shipped to the NYSDEC Callout Laboratory. Based on review of the results from the co-located surface water and sediment samples, additional background and/or downgradient samples may be required per DER-10. As such, additional sampling may be requested by NYSDEC to further delineate potential contamination in this area.

Groundwater, surface water, and sediment samples will be analyzed for TCL VOCs via EPA Method 8260D, PFAS via EPA Method 537 modified, and 1,4-dioxane via EPA Method 8270D SIM. All monitoring well samples will be analyzed for TCL VOCs, and approximately 50 percent of the monitoring well samples will also be analyzed for PFAS, 1,4-dioxane, and monitored natural attenuation (MNA) parameters including methane, ethane, ethene, chloride, nitrate, nitrite, sulfate, sulfide, total dissolved solids, total suspended solids, alkalinity, and total organic carbon.

In addition, approximately 25 percent of groundwater samples will be analyzed for SVOCs, PCBs, pesticides, TAL metals, and total cyanide. Locations selected for the full analyte list will be determined in the field to obtain an appropriate spatial distribution of these contaminants to better define their extent of contamination. At least one sample will be analyzed for the full list in the following areas: source area, upgradient of the source area, immediately downgradient of the source area, and at the edges of the plume. The results from the monitoring well survey described in Section 3.2 and the first mobilization sampling described in Section 3.4 will be used to determine to these locations. Final locations will be reviewed with NYSDEC. Locations selected for MNA parameters will be determined in the field to gather enough data to support an MNA evaluation for the entire plume that can be used during the FS. The Callout Laboratory will perform the analysis, prepare EDDs meeting the most current NYSDEC EIMS format, and submit Category B Analytical Services Protocol (ASP) reports.

3.7 Decommissioning of Temporary Wells

Following the sampling of the three interior temporary wells within the adjacent commercial property, all three well casings will be pulled and disposed of. The boreholes will then be backfilled with bentonite and patched at the surface.

3.8 Soil Vapor Investigation

Vapor intrusion sampling will be conducted in accordance with the New York State Department of Health (NYSDOH) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. Vapor intrusion sampling will be performed in the New Process Cleaners one-story building and at three adjacent two-story residences with basements located north of the site (Residence 1, 2, and 3) (**Figure 7**). The vapor intrusion investigation will include the following components:

- An interview of each of the building owners and completion of an inventory of household chemicals using the NYSDOH Indoor Air Quality Questionnaire and Building Inventory
- Installation of two permanent sub-slab sampling points (CDM Smith intends to purchase VaporPin® sub-slab sampling devices) in the New Process Cleaners building and the installation of one temporary sub-slab sampling point (permanent sub-slab sampling points may be utilized, as needed based on site condition) in each of the three basements of the residential houses (overall total of five sub-slab sampling points)
- Helium tracer test of floor seal at each sub-slab sampling point location
- Sub-slab air sample collection (24-hour) in the New Process Cleaners building at two locations and at one location at each of three residential properties (overall total of five sub-slab air samples)
- Indoor air samples in the New Process Cleaners building at two locations (24-hour)
- Indoor air samples in each of the three residences from both the basement floor and the first floor of each property (two indoor samples per residential property for an overall total of six indoor air samples for the residential properties)
- One outdoor air sample (24-hour)

Samples will be collected in Summa canisters provided by the NYSDEC Callout Laboratory and submitted to the laboratory following standard chain of custody procedures. It is assumed a total of 15 samples plus quality assurance/quality control (QA/QC) samples will be analyzed for VOCs via EPA Method TO-15. Should NYSDOH or NYSDEC determine additional structures require vapor intrusion sampling, additional sampling may be added to the current scope as per NYSDEC request.

In accordance with DER-10 Section 3.4, an investigation of the interior of the New Process Cleaners building will be conducted during the soil vapor investigation. The building interior investigation will document the presence of any tanks (above or below ground), piping, plumbing, floor drains, vents, trenches, duct work, gutters, leaders, or fissures in the floors, walls, or ceilings that create potential pathways for contaminant migration from the building interior to the environment outside of the building. Additional sampling in accordance with Section 3.9 of DER-10 may be required if the site features listed above are discovered. However, additional sampling for such features is not currently included in the RI scope.

3.9 Data Validation

Environmental Data Services (EDS) of Palm Beach Gardens, Florida, will be subcontracted to complete validation of the chemical analytical laboratory data. CDM Smith will review and prepare the draft EDDs from Callout Laboratory, and then send the EDDs and Category B ASP laboratory reports to EDS for validation. EDS will submit a Data Usability Summary Report (DUSR) and revised EDDs containing validation qualifiers.

3.10 Investigation Derived Waste Characterization and Disposal

CDM Smith will characterize and dispose of IDW in accordance with local, state, and Federal regulations specified in the CDM Smith QAPP NYSDEC Standby Engineering Services Contract D009805 (May 2020a) and FAP (May 2020b). It is anticipated that one soil and one aqueous IDW sample will be collected. It is assumed the samples will be analyzed for toxicity characteristic leaching procedure (TCLP) VOCs, SVOCs, pesticides, herbicides, and metals; Resource Conservation and Recovery Act (RCRA) characteristics including ignitability, corrosivity, and reactivity; PCBs; and PFAS. Chemtron Corporation from Honeybrook, Pennsylvania, is subcontracted to transport and dispose of all IDW drums generated during monitoring well drilling and installation activities. CDM Smith shall be onsite to sign manifests on behalf of NYSDEC.

3.11 Qualitative Human Health Exposure Assessment

CDM Smith will prepare a qualitative human health exposure assessment to evaluate and document how people might be exposed to site-related contaminants, and to identify and characterize the potentially exposed population(s) now and under the reasonably anticipated future use of the site. The exposure assessment will also evaluate if an exposure pathway exists, and must assess the quality, representativeness, and adequacy of the available data. The assessment will be completed in accordance with DER-10.

3.12 Fish and Wildlife Resources Impact Analysis

Per DER-10, the purpose of the Fish and Wildlife Resources Impact Analysis (FWRIA) is to identify actual or potential impacts to fish and wildlife resources from site contaminants of ecological concern. However, in accordance with DER-10 Section 3.10.1(b)(3), it is assumed no FWRIA is needed if the site is characterized by a point source of contamination to the groundwater (i.e., dry cleaner or gas station) which will be prevented from discharging to surface water, and there is no widespread soil contamination or habitat of an endangered, threatened or special concern species present. The New Process Cleaners site has minimal soil contamination and is located in a developed area where habitat for endangered, threatened, or special concern species is unlikely. One co-located surface water and sediment sample will be collected as discussed in Section 3.6 to determine if any site-related contamination is discharging or has discharged to Cayadutta Creek. At this time, it is unknown if groundwater from the New Process Cleaners site is discharging to Cayadutta Creek. Therefore, following a review of the results of the creek sampling, the need for a FWRIA will be evaluated as per a request from NYSDEC.

Section 4

Reporting

4.1 Daily Status Field Reports

During the field program CDM Smith will submit via email daily status field reports to the NYSDEC PM by the end of the following business day. The daily reports will include a summary of the field activities, photographs, samples collected, personnel onsite, daily safety meeting topics, CAMP data, and any deviations from the RIWP.

4.2 Remedial Investigation Report

CDM Smith will develop and submit an RI report that accurately establishes site characteristics, including the identification of contaminated media, definition of the extent of contamination in site media, and delineation of the physical boundaries of contamination. CDM Smith will obtain detailed sampling data to identify key contaminants and determine the movement and extent of contamination in the environment. Key contaminants will be identified in the report and will be selected based on toxicity, persistence, and mobility in the environment.

The RI Report will be prepared following the DER-10 requirements and will include the following sections:

- Background
- Summary of Field Investigation
- Physical Setting
- Nature and Extent of Contamination
- Fate and Transport
- Summary and Conclusions
- Tables, Figures, Appendices including the Data Usability Summary Report

CDM Smith will submit electronic copies of a Draft RI report for NYSDEC and NYSDOH review and comment. CDM Smith will revise the Draft RI report per the comments received. Electronic copies of the Final RI report will be submitted—text, tables, maps, photographs and other attachments will be submitted as a single .pdf file in a format that is in conformance with NYSDEC's American's with Disabilities Act (ADA)-Compliance Guidance document. All electronic files will be submitted to NYSDEC either on a compact disc or via the File Transfer Service (FTS).

4.3 Feasibility Study Report

CDM Smith will develop an FS report consisting of remedial technology/process option screening, assembly of remedial alternatives, screening of remedial alternatives, and a detailed evaluation of remedial alternatives including a cost-effectiveness analysis. CDM Smith will perform remedial alternative screening qualitatively against three criteria: effectiveness, implementability, and relative cost. CDM Smith assumes that four alternatives will pass through alternative screening and be retained for detailed evaluation. It is assumed that a no action alternative, an unrestricted use alternative, and two alternatives capable of achieving the most feasible/least restrictive use will be retained for detailed evaluation. During detailed analysis, CDM Smith will evaluate the retained remedial alternatives against the criteria detailed in Section 4.2 of DER-10. Alternatives will be reviewed with the NYSDEC PM prior to the submission of the Draft FS Report**.** The FS Report will be prepared following the DER-10 requirements and will include the following sections:

- Introduction
- Site Description and History
- Summary of RI and Exposure Assessment
- Remedial Goals and Remedial Action Objectives
- General Response Actions
- Identification and Screening of Technologies
- Development and Analysis of Alternatives, which
    - assembles technologies into alternatives;
    - evaluates alternatives with respect to the criteria set forth in 6 NYCRR 375-1.8(f) and as follows:
        - *community acceptance,*
        - *overall protectiveness of public health and the environment,*
        - *standards, criteria and guidance,*
        - *long-term effectiveness and permanence,*
        - *reduction of toxicity, mobility or volume of contamination through treatment,*
        - *short-term impact and effectiveness,*
        - *implementability,*
        - *cost-effectiveness, and*
        - *land-use; and*

- evaluates the institutional/engineering controls for the selected remedy.

- Recommended Remedy

CDM Smith will submit electronic copies of an FS Report to NYSDEC and NYSDOH for review and comments. CDM Smith will revise the draft FS Report per the comments received. Electronic copies of the Final FS report will be submitted—text, tables, maps, photos, and any other attachments will be submitted as a single .pdf file in a format that is in conformance with NYSDEC's ADA-Compliance Guidance document. All electronic files will be submitted to NYSDEC either on a compact disc or via the FTS.

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Section 5

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Tables

Table 2
Field Sampling Program Summary
New Process Cleaners

Event/Activity	Sample Identification	Figure	Objective	Sampling/Measurement Activities: Frequency / Intervals	Field Parameters	Analytical Parameters: Analysis	Analytical Parameters: Method	Total Number of Environmental Samples
Reconnaissance/Surveys								
Site Visit	NA	NA	Identify logistical issues related to proposed sampling activities	NA				
Monitoring Well Survey			Obtain horizontal & vertical coordinates to create potentiometric map					
Synoptic Water Level			Develop understanding of groundwater flow					
Geophysical/Electromagnetic Survey			Clear all soil and boring well location and identify underground utilities/vaults and anomalies					
First Mobilization								
Soil Sampling	NPC-SBXX-depth-Date	**TBD**	Characterize contaminant concentrations in the alluvial soils.	Up to 3 samples from: (1) 0-0.5 feet (2) Water Table (~9 to 10 feet bgs) (3) High PID Reading/observed staining	PID	TCL VOCs, Percent Moisture	8260D	30
						TCL SVOCs	EPA 8270	8
						PCBs	EPA 8082	8
						Pesticides	EPA 8081	8
						TAL Metals	EPA 6010	8
						Cyanide	EPA 9012	8
						PFAS	537 Modified	8
						1,4-Dioxane	8270D	8
						TOC	Lloyd Kahn	8
			Determine the viability of insitu alternatives proposed for the feasibility study	NA	NA	Soil Moisture	ASTM D2216	2
						Particle size distribution	ASTM D6913 & ASTM7925	2
						Soil Porosity	ASTM 7928	2
Groundwater Screening	NPC-SBXX-GWS-Date		Characterize groundwater impacts, and determine locations of shallow and bedrock monitoring wells to be installed	Based on field observations	pH, Temp, Cond, DO, Redox Potential, Turbidity	TCL VOCs	8260D	10

Table 2
Field Sampling Program Summary
New Process Cleaners

Event/Activity	Sample Identification	Figure	Objective	Sampling/Measurement Activities: Frequency / Intervals	Field Parameters	Analytical Parameters: Analysis	Analytical Parameters: Method	Total Number of Environmental Samples
Second Mobilization								
Monitoring Well Installation	NA	2	Support characterization of groundwater impacts and develop understanding of groundwater flow	3 overburden and 3 bedrock wells. Intervals TBD based on soil and groundwater screening data	NA	NA	NA	NA
Monitoring Well Development			Remove fines and connect MWs to the aquifer	Once	pH, Temp, Conductivity, Turbidity	NA	NA	NA
Slug Testing			Calculate estimated transmissivity of the shallow and deep groundwater zone	3 overburden wells and 1 bedrock well	NA	NA	NA	NA
Monitoring Well Sampling & Synoptic Gauging	NPC-MWXX-Date MW-X-Date GP-X-Date		Characterize groundwater impacts and develop understanding of groundwater flow	**Existing Wells** New Process Cleaners: NPC-MW01 to NPC-MW06 (Screen 6-16 feet bgs) Adjacent Commercial Property: *Permanent Monitoring Wells* MW-1 (Screen 6.3-16.3 feet bgs), MW-2 (Screen 5.1-17.1 feet bgs), MW-3 (Screen 6-16 feet bgs), MW-4 (Screen 6-16 feet bgs), MW-5 (Screen 6-16 feet bgs), MW-8 (Screen 4-9 feet bgs). *Temporary Monitoring Wells* GP-5, GP-6, GP-7 **New Wells** Overburden: NPC-MW07 to NPC-MW09 (screen 10-20 feet bgs) Bedrock: NPC-MW10 to NPC-MW12 (screen 25-35 feet bgs)	pH, Temp, Cond, DO, Redox Potential, Turbidity, Ferrous Ion	TCL VOCs	EPA 8260D	21
						PFAS	537.1	9
						1,4-Dioxane	EPA 8270D	9
						TCL SVOCs	EPA 8270	5
						PCBs	EPA 8082	5
						Pesticides	EPA 8081	5
						TAL Metals	EPA 6010	5
						Cyanide	EPA 9012	5
						MEE	RSK 175	9
						Chloride	SM4500	9
						Nitrate	SM4500/300	9
						Nitrite	SM 4500/300	9
						Sulfate	EPA 375.2/300	9
						Sulfide	SM 4500	9
						TDS	SM2540C	9
						TSS	SM2540D	9
						Alkalinity	SM 2320B	9
						TOC	5310 Standard	9
Cayadutta Creek Sediment & Surface Water	NPC-CCSED-XX-Date		Determine the presence of contamination within the creek	Top 2 inches of sediment in creek bed	PID	TCL VOCs, Percent Moisture	8260D	3
						PFAS	537.1	3
						1,4-Dioxane	8270D	3
	NPC-CCSW-XX-Date			NA	pH, Temp, Cond, DO, Redox Potential, Turbidity,	TCL VOCs	8260D	3
						PFAS	537 Modified	3
						1,4-Dioxane	8270D	3

Table 2
Field Sampling Program Summary
New Process Cleaners

<table>
<tr><th rowspan="3">Event/Activity</th><th rowspan="3">Sample Identification</th><th rowspan="3">Figure</th><th rowspan="3">Objective</th><th colspan="5">Sampling/Measurement Activities</th></tr>
<tr><th rowspan="2">Frequency / Intervals</th><th rowspan="2">Field Parameters</th><th colspan="2">Analytical Parameters</th><th rowspan="2">Total Number of Environmental Samples</th></tr>
<tr><th>Analysis</th><th>Method</th></tr>
<tr><td colspan="9">Vapor Investigation</td></tr>
<tr><td rowspan="2">Vapor Intrusion</td><td>NPC-SSV-XX-Date
NPC-IA-XX-Date
NPC-AA-XX-Date</td><td rowspan="2">7</td><td rowspan="2">Identify and address existing and potential human exposures to contaminated subsurface vapors associated with known or suspected volatile chemical contamination</td><td>2 co-located sub-slab vapor and indoor air locations within the New Process Cleaners building</td><td rowspan="2">PID</td><td rowspan="2">VOCs</td><td rowspan="2">TO-15</td><td rowspan="2">15</td></tr>
<tr><td>SSV-RXX-XX-Date
IA-RXX-Floor-XX-Date</td><td>1 co-located sub-slab and indoor air sample location per basement in each of the three buildings and 1 indoor air sample on the first floor of each building</td></tr>
<tr><td colspan="9">Investigation Derived Waste</td></tr>
<tr><td rowspan="2">Investigation Derived Waste</td><td>NPC-IDW-Soil-1-Date</td><td>NA</td><td rowspan="2">Collect and characterize aqueous and soil IDW and satisfy requirements for disposal</td><td rowspan="2">NA</td><td rowspan="2">NA</td><td rowspan="2">TCLP VOCs, SVOCs, pesticides, herbicides and metals, RCRA characteristics including ignitability, corrosivity, and reactivity, PCBs, and PFAS.</td><td rowspan="2"></td><td>1</td></tr>
<tr><td>NPC-IDW-AQ-1-Date</td><td>NA</td><td>1</td></tr>
</table>

Acronyms

bgs = below ground surface
NA = not applicable
TBD=to be determined
Temp = temperature
RCRA= Resource Conservation and Recover Act
TCLP= Toxicity Characteristic Leaching Procedure

Cond = conductivity
DO = dissolved oxygen
PID=photoionization detector
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids

TAL=Target Analyte List
MEE = methane, ethane, ethene
PCB=polychlorinated biphenyl
PFAS=per-and polyfluoroalkyl substances
SVOC= semi-volatile organic compounds
VOCs = volatile organic compounds

Figures

Legend

× — Fence

Tax Parcel Boundary

City of Johnstown 2-foot Topographic Contour

1 inch = 67 feet

0 15 30 60 Feet

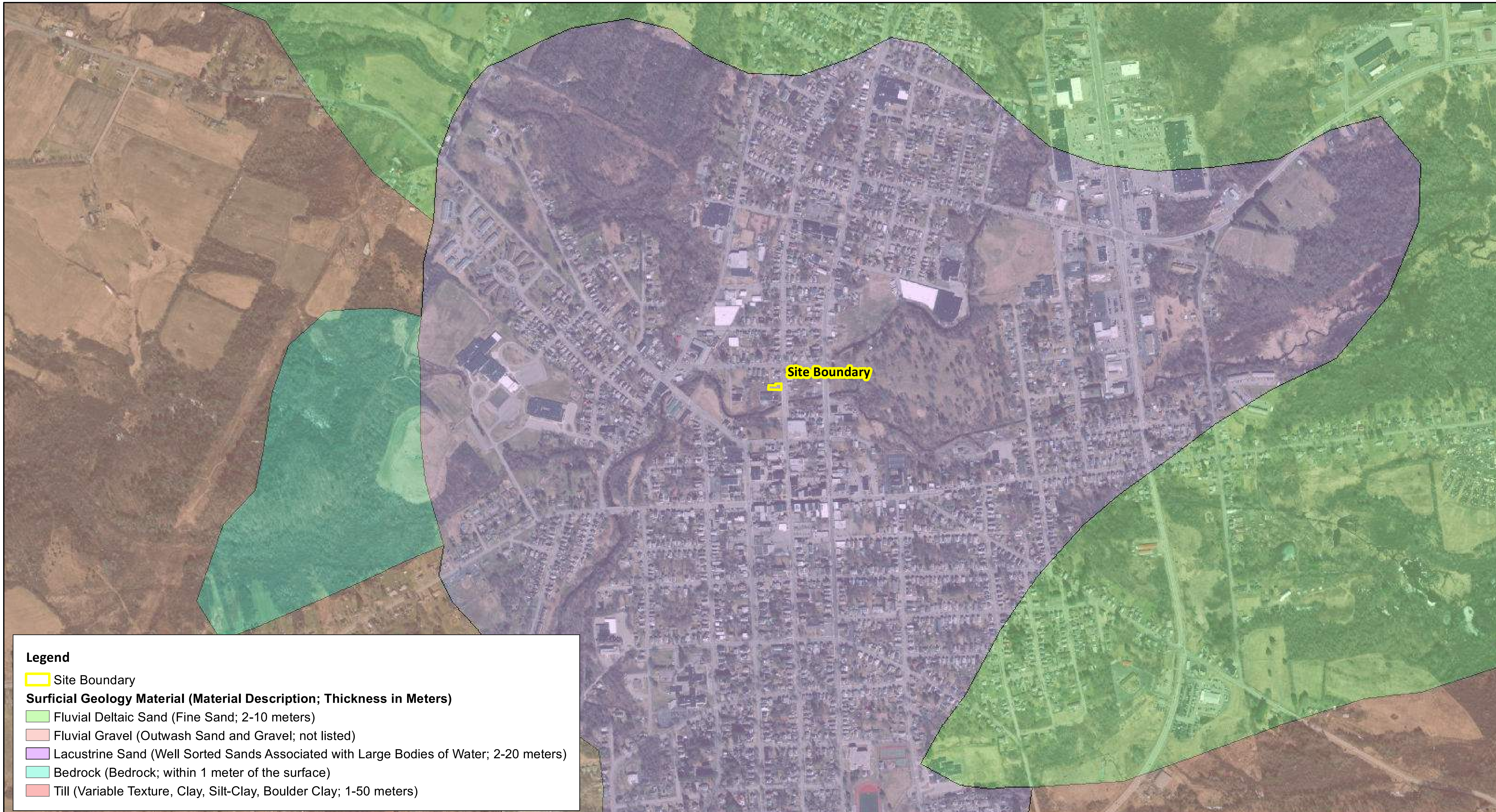
Figure 1

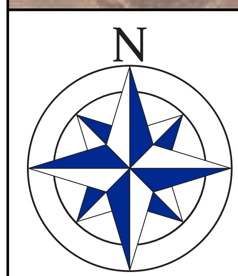
Site Location

New Process Cleaners

Johnstown, New York

CDM Smith





Notes:

1. Surficial geology boundaries are provided by the University of the State of New York State Education Department Surficial Geologic Maps.

1 inch = 900 feet

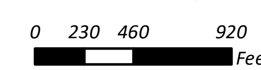


Figure 2

Geological Map

New Process Cleaners

Johnstown, New York

CDM Smith

ESTRADAL C:\Users\estradal\OneDrive - CDM Smith\Desktop\Figure2_Geological_Map.mxd 2/10/2022

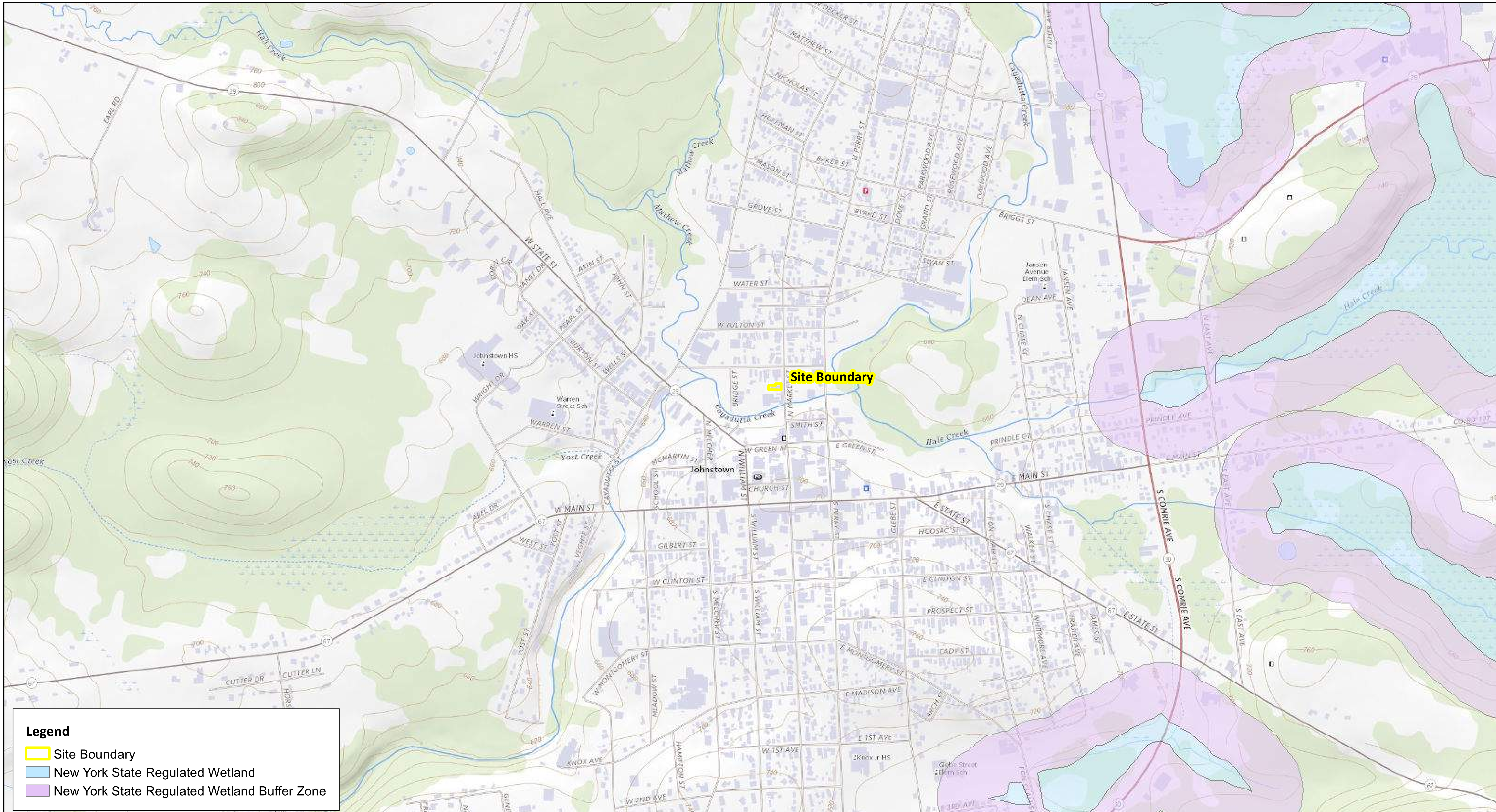


Figure 3

Wetland Map

New Process Cleaners

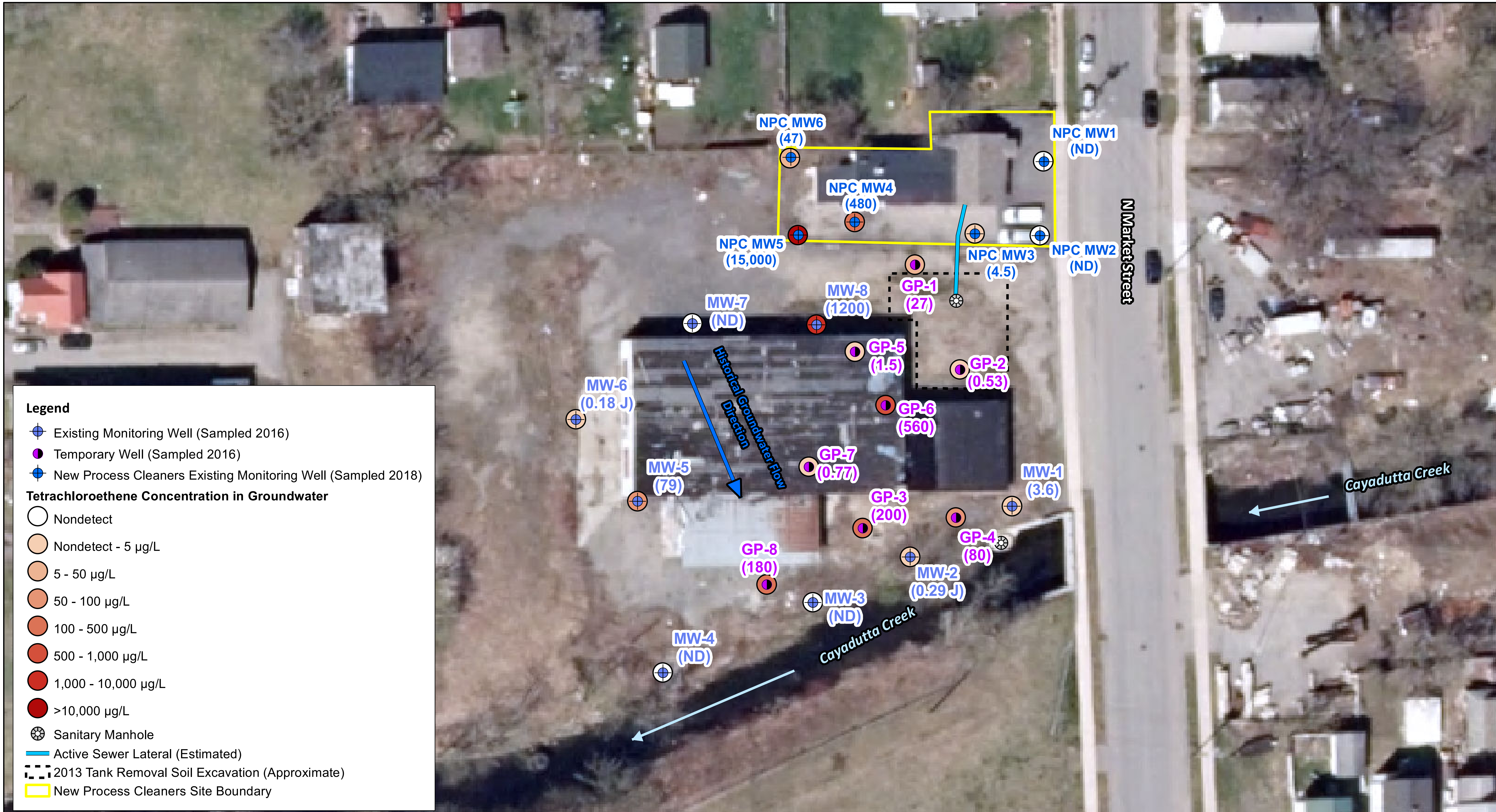
Johnstown, New York

1 inch = 900 feet

0 230 460 920 Feet

CDM Smith

ESTRADAL C:\Users\estradal\OneDrive - CDM Smith\Desktop\Figure3_Wetland_Map.mxd 2/10/2022



Notes

1. Result values listed in parathesis after each sample identification number indicate the tetrachloroethene concentration in micrograms per liter (µg/L).
2. J - estimated result
3. ND - nondetect

1 inch = 42 feet

0 10 20 40 *Feet*

Figure 4

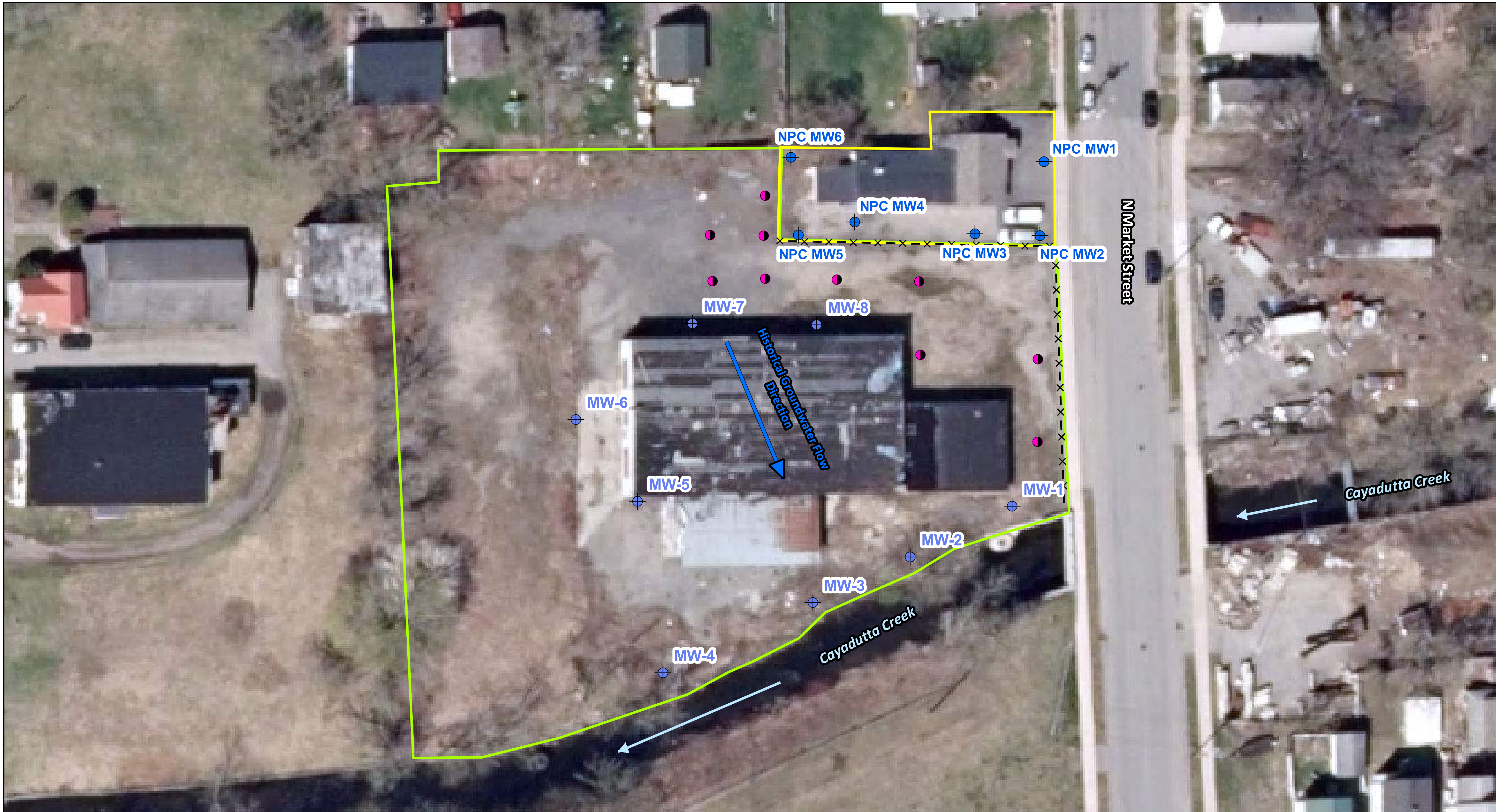
Groundwater Nature and Extent of Tetrachloroethene

New Process Cleaners

Johnstown, New York

CDM Smith

ESTRADAL C:\Users\estradal\OneDrive - CDM Smith\Desktop\Figure4_Nature_and_Extent.mxd 2/18/2022



N

Legend

- Preliminary Soil Boring/Groundwater Screening Location
- Existing Monitoring Well
- New Process Cleaners Existing Monitoring Well
- Fence Line
- New Process Cleaners Site Boundary
- Adjacent Property Boundary

Notes

1. Preliminary boring and groundwater screening locations are subject to change based on the initial well survey and synoptic round of water level measurements.

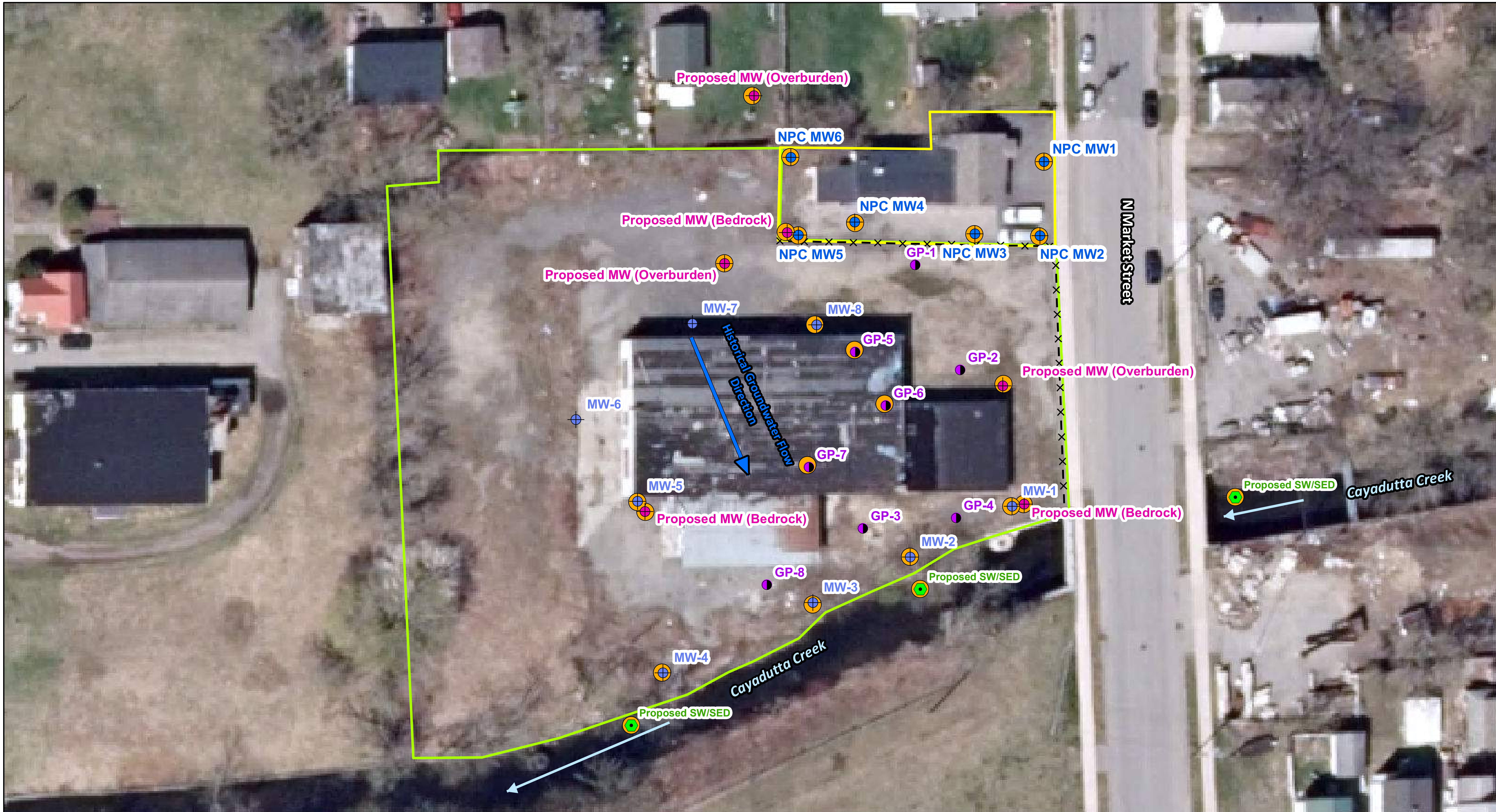
1 inch = 42 feet

0 10 20 40 Feet

Figure 5

First Mobilization Sample Location Plan
New Process Cleaners
Johnstown, New York

CDM Smith



N

Legend

- Proposed Monitoring Well (MW) Location
- Proposed Sediment (SED) and Surface Water (SW) Location
- Existing Monitoring Well
- Temporary Monitoring Well
- New Process Cleaners Existing Monitoring Well
- Location Proposed For Sampling
- Fence Line
- New Process Cleaners Site Boundary
- Adjacent Property Boundary

Notes

1. Proposed monitoring well locations will be based on the results from the first mobilization.
2. The sediment and surface water sample location will be based on groundwater flow direction and ease of accessibility.

1 inch = 42 feet

0 10 20 40 Feet

Figure 6

Second Mobilization Sample Location Plan
New Process Cleaners
Johnstown, New York

CDM Smith

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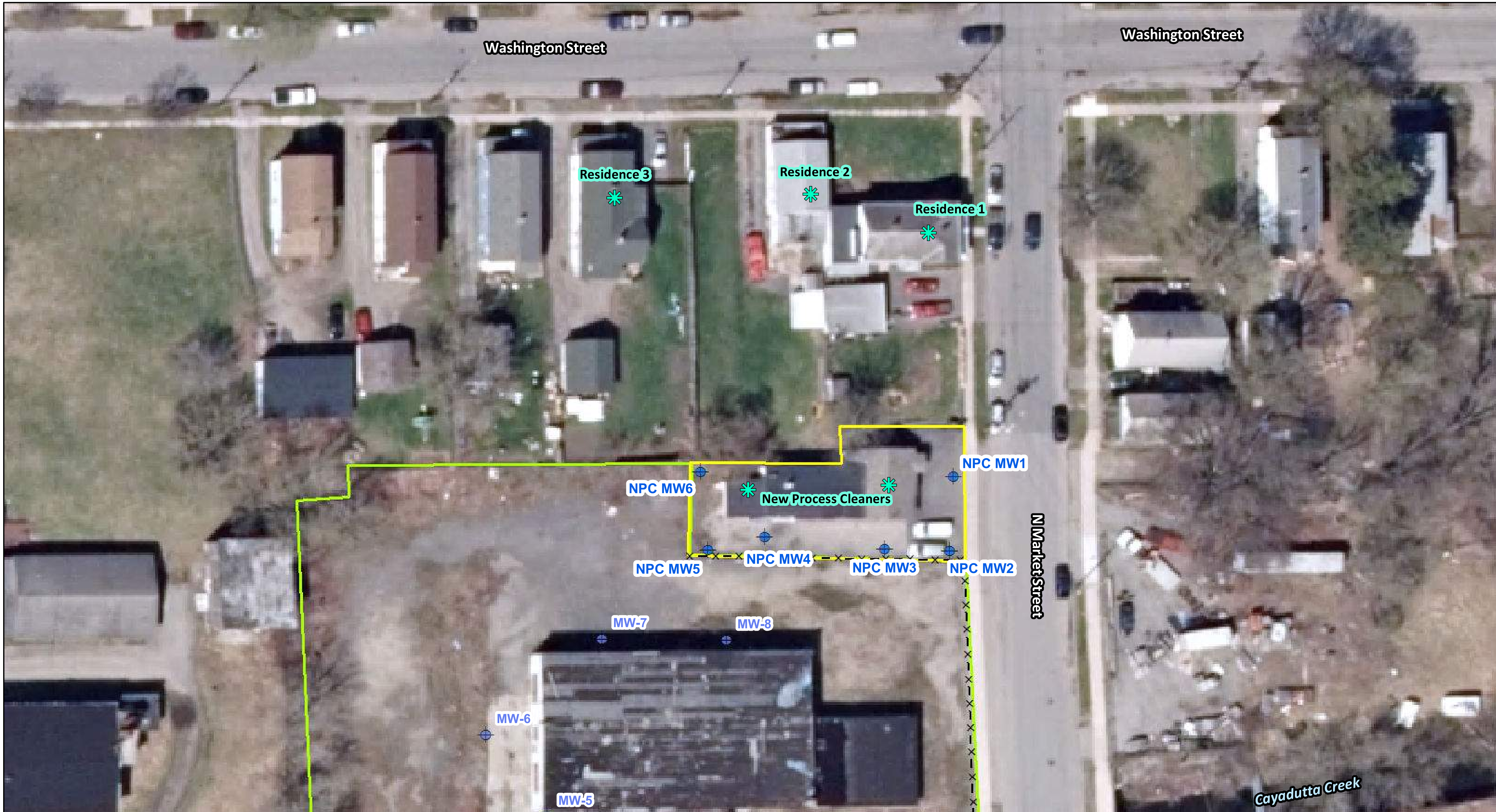

N

Legend

- Soil Vapor Intrusion Sample Location
- Existing Monitoring Well
- New Process Cleaners Existing Monitoring Well
- Fence Line
- New Process Cleaners Site Boundary
- Adjacent Property Boundary

Notes

1. Soil vapor instrusion locations will include both indoor air and sub-slab vapor samples. Where multiple floors exist, indoor air samples will be collected from both the basement and first floor.
2. One outdoor air sample will be collected that is representative of the area. The location of the sample will be based on the wind direction the day of the sampling event.

1 inch = 42 feet

0 10 20 40 *Feet*

Figure 7

Soil Vapor Intrusion Plan

New Process Cleaners

Johnstown, New York

CDM Smith

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Appendix A

CDM Smith Quality Assurance Project Plan (QAPP) NYSDE Standby Engineering Services Contract D009805 and Field Activities Plan (FAP)

11 British American Boulevard, Suite 200
Latham, New York 12110
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May 1, 2020

Ms. Lisa Lewis
Contract Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation
Bureau of Program Management
Contracts and Payments Section
625 Broadway, 12th Floor
Albany, New York 12233-7012

Subject: NYSDEC Standby Contract No. D009805
Field Activities Plan

Dear Ms. Lewis:

Camp Dresser McKee & Smith (CDM Smith) is pleased to submit our Field Activities Plan (FAP) for the New York State Department of Environmental Conservation (NYSDEC) Standby Engineering Services Contract D009805.

This document provides general information and procedures that will be conducted for field work performed under Standby Engineering Services Contract D009805. Site-specific procedures will be included as an attachment to the site-specific Work Plan for each work assignment, as needed.

If you have any questions, or need additional information, please call me at 518-782-4526.

Very truly yours,

Amy E. Picunas, P.E.
Environmental Engineer
Camp Dresser McKee & Smith

Attachments: FAP, April 2020

cc: D. Gardner, NYSDEC
D. Durfee, CDM Smith
File

FIELD ACTIVITIES PLAN

New York State Department of Environmental Conservation

Standby Engineering Services
Contract D009805

Prepared for:
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7017

Prepared by:
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April 2020

CDM Smith

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Section 1

Introduction

This generic Field Activities Plan (FAP) has been prepared by Camp Dresser McKee & Smith (CDM Smith) for the New York State Department of Environmental Conservation (NYSDEC) to document quality assurance/quality control (QA/QC) under the NYSDEC Standby Contract for Engineering Services D009805. Site-specific procedures will be included in the Field Activities Plan as an attachment to the site-specific Work Plan for each work assignment, as needed. General information and procedures applicable to the field activities and analytical program are provided in the Quality Assurance Project Plan (QAPP) prepared by CDM Smith for NYSDEC.

1.1 Purpose

The principal purpose of this document is to specify QA/QC procedures for the collection, analysis, and evaluation of data that will be legally and scientifically defensible.

1.2 Objectives

The FAP provides general information and procedures applicable to the field activities and analytical program detailed in each site-specific Work Plan provided by NYSDEC for each work assignment. This information includes definitions and generic goals for data quality and required types and quantities of QA/QC samples. The procedures address field documentation; sample handling, chain of custody, and shipping; instrument calibration and maintenance; auditing; data deliverable and reduction, validation, and reporting; corrective action requirements; and QA reporting specific to the analyses performed by the laboratories subcontracted by CDM Smith.

Section 2

Anticipated Field Activities

CDM Smith's point of contact for any field investigation activities is the field team leader and the onsite NYSDEC representative or PM. Any minor changes in sampling activities that are within the proposed scope of the project will be documented each day in the field logbook and signed by both representatives. Any modifications that are inconsistent with the approved work plan are to be approved by NYSDEC PM prior to implementation.

2.1 Soil Vapor Sampling

Soil vapor sampling will be conducted in accordance with the New York State Department of Health (NYSDOH) "*Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006*" including the May 2017 updates to Soil Vapor/Indoor Air Decision Matrices, and the NYSDEC "*Division of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation, dated May 2010*".

2.1.1 Soil Vapor Probe Installation

A soil vapor probe installation at all locations will be performed using a Geoprobe device. Each soil vapor point will be installed using a six inch stainless steel woven screen drive point. The probe will be driven to the desired depths with the maximum depth located approximately two feet above the water table.

2.1.2 Tracer Testing

Tracer tests will be conducted at fifty percent of soil vapor locations to verify the integrity of the soil vapor probe seal. Helium should be injected through the bottom of the device to enrich the atmosphere to approximately 80 percent Helium. If the concentration of tracer gas drawn into the sample probe is read to be below 10 percent, the seal is sufficient.

2.1.3 Soil Vapor Sampling Procedures for Laboratory Analysis

Once the soil gas probe is installed and a tracer test is conducted, soil gas samples for laboratory analysis will be collected using a certified clean Summa canister with a two-hour regulator. Each Summa canister vacuum reading should be approximately 25-30 inches of mercury (Hg) at the start of the sampling. If not, a different canister should be used due to improper evacuation. It is critical to ensure that moisture does not enter the Summa canister since this could compromise the analytical results. Field personnel will label, pack and ship the samples to an NYSDOH Environmental Laboratory Approval Program (ELAP) approved laboratory at the completion of the sampling. The serial numbers for the Summa canisters and the regulators as well as the initial and ending pressures of the canisters will be recorded on the chain of custody (COC) and in the logbook. The field sampling team will maintain a sample log sheet summarizing the following: Sample identification, date and time of sample collection, sampling depth, Serial numbers for Summa canisters and regulators, sampling methods and devices, and vacuum of Summa canisters before and after sample collection.

2.2 Indoor Air Monitoring

The NYSDOH *Indoor Air Quality Questionnaire and Building Inventory* shall be completed for each structure where indoor air testing is being conducted. The following should be documented to ultimately aid in the interpretation of the sampling results:

- Historic and current uses and storage of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance).
- A product inventory survey documenting sources of volatile chemicals present in the building during the indoor air sampling that could potentially influence the sample results.
- The use of heating or air conditioning systems during sampling.
- Floor plan sketches should be drawn that include the floor layout with sampling 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), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) reported.
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via photoionization detector [PID], etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following: sample identification, date and time of sample collection, sampling location and approximate height, identity of samplers, sampling methods and devices, and vacuum of canisters before and after samples collected.

2.2.1 Indoor (Ambient) Air Sampling

All indoor air samples will be collected with a 6 liter laboratory certified Summa canister regulated for a 24 hour sample collection. Sample collection will be similar to outdoor ambient air sample collection. The Summa canister will be placed in an appropriate location as to collect a representative sample from the breathing zone at 4 to 6 feet above the floor. Personnel should avoid lingering in the immediate area of the sampling device while samples are being collected.

2.2.2 Sub-Slab Soil Vapor Sampling Procedures

Sub-slab soil gas samples for laboratory analysis will be collected according to the following procedures:

- Prior to installation of the sub-slab vapor point, the building floor should be inspected and any penetrations (cracks, floor drains, utility, sumps, etc.) should be recorded. Sub-slab points should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.
- After the slab has been inspected and the location of any subsurface utilities determined, the ambient air surrounding the proposed sampling location will be screened with a PID.
- A hammer drill, equipped with a ½-inch to ¾-inch drill bit, will be used to advance a hole to a depth of approximately six inches beneath the bottom of the slab. Using a larger approximately 1.25-inch diameter drill bit (about the size of a rubber stopper) drill a hole approximately 1.5 inches into the slab. When drilling is complete, clean around drilled area.
- Insert tubing constructed with 3/8-inch outer diameter poly, ¼-inch inner diameter Teflon® tubing through the hole in the rubber stopper and into the hole in the slab making sure the tubing does not extend further than 2 inches into the sub-slab material.
- The annular space between the borehole and the sample tubing will be filled and sealed with electrical conduit putty (or volatile organic compound [VOC] free equivalent) at the surface. Conduct tracer testing in accordance with the procedures specified in site specific plan.
- The samples will be collected using a six liter laboratory-certified clean Summa canister with a 24-hour flow regulator and an initial vacuum of 28 inches Hg ± 2 inches. Record the initial pressure in the Summa canister to be used for the sample prior to connecting the tubing. If an initial vacuum reading of less than 25 inches of Hg is observed, use a different canister as this indicates the canister was not properly evacuated.
- The end of the tubing will be connected directly to the Summa canister's regulator valve. Flexible silicone tubing will be used as a tubing adapter only.
- When the vacuum gauge reads five inches of Hg or less, close the valve. Sampling is complete. A vacuum of five inches Hg ± 1 inch must be present when sample collection is terminated to prevent contamination during transit. Record the final pressure reading in the Summa canister.
- CDM Smith personnel will label, pack and ship the samples to an NYSDOH ELAP approved laboratory. The serial numbers for the Summa canisters and the regulators as well as the initial and ending pressures of the canisters will be recorded on the COC and in the field logbook. Custody seals will be placed on all packages containing laboratory samples during shipment.

2.3 Outdoor (Ambient) Air Monitoring

All outdoor air samples will be collected with a laboratory certified clean Summa canister regulated for a 24 hour sample collection using a 6 liter Summa canister. The Summa canister will be placed in such a location as to collect a representative sample from the breathing zone at four to six feet above the ground.

Personnel will avoid lingering in the immediate area of the sampling device while samples are being collected. Ambient air samples will be collected in a location far away from any boring or dust generating activities.

The following actions will be taken to document conditions during ambient air sampling:

- Outdoor plot sketches will be drawn that include the building site, area streets, ambient air sample locations, the location of potential interferences, compass orientation, and paved areas.
- Weather conditions (e.g. precipitation, temperature, wind direction and barometric pressure)
- Any pertinent observations, such as odors, reading from field instruments, and significant activities in the vicinity (e.g. operation of heavy equipment) will be recorded.

The field sampling team will 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, volume of air sampled, and vacuum of canisters before and after samples collected.

2.4 Monitoring Well Installation

This section provides procedures for well design and well construction to aid in the development of drilling subcontracts. Drilling operation and well development guidelines are presented to aid the reader in the oversight of the installation of monitoring wells.

The principal reason that monitoring wells are constructed is to collect groundwater samples that, upon analysis, can be used to delineate a contaminant plume and track movement of specific chemical or biological constituents. A secondary consideration is the determination of the physical characteristics of the groundwater flow system to establish flow direction, transmissivity, quantity, etc. The spatial and vertical locations of monitoring wells are important. Of equal importance are the design and construction of monitoring wells that will provide easily obtainable samples and yield reliable, defensible, and meaningful information. In general, monitoring well design and construction follows production well design and construction techniques. However, emphasis is placed on the effect these practices may have on the chemistry of the water samples being collected rather than on maximizing well efficiency.

From this emphasis, it follows that an understanding of the chemistry of the suspected pollutants and of the geologic setting in which the monitoring wells are constructed plays a major role in determining the drilling technique and materials used.

2.4.1 Types of Monitoring Wells

Two different types of monitoring wells will be installed depending upon site conditions and the project work plan. Permanent monitoring wells will be proposed at locations in which long term monitoring is required, whereas temporary monitoring wells will be used in locations for short term monitoring. Well depth will be dependent upon monitoring objectives, site specific conditions, contaminant behavior, and site geology.

2.4.2 Well Siting

Specific well siting requires personnel to review and be familiar with pertinent proposal sections, specifications, and subcontractor's contracts, any regulations governing how, where or when the well is drilled and, with data (supplied by the Client, or any other data available) used for program planning. Once a well site is identified on a topographic map or other project base map, the landowner must be contacted to establish whether drilling will interfere with the established land use. Unless the property is owned by the client, the landowner is always contacted before entering the property, even if he is leasing back the property from the client. The well site should also be reasonably level and absent of large boulders or other hazardous obstructions.

A check should be performed to insure the absence of buried high-pressure gas, oil or water lines. If any lines are present relocate the well site a safe distance away from them. Be sure to check with the subcontractor to insure his/her agreement. The absence of overhead power transmission lines should also be checked. If any overhead power lines are present, relocate the well site a safe distance away from them. Be sure to check with the subcontractor to insure his/her agreement.

Lastly, consult the landowner about water source and access, and then notify the driller of these decisions and explain to the driller the need for care and accurate retrieval of drill cuttings and, if necessary, placement and accounting of materials during well completion. If necessary, request access agreement to the well site.

2.4.3 Well Design and Construction

Permanent and temporary monitoring wells differ in the materials in which they are placed and also the methods in which they are constructed. Temporary monitoring wells are typically installed using direct-push techniques. Permanent monitoring wells are typically placed in either bedrock or overburden soils and usually require a hollow-stem auger or rock coring/air rotary drill to be used.

2.4.3.1 Temporary Direct Push Well Installation

Wells will be constructed of a pre-packed 2.5 inch OD (one inch ID) slotted polyvinylchloride (PVC) well screen (pre-packed with sand and stainless steel mesh) and 1 inch ID, schedule 40 PVC riser casings (a one inch ID PVC well screen may also be utilized). The pre-packed well screens are manufactured prior to mobilization. Install a sand filter around the well screen to directly above the screen. Grain size of the sand will be appropriate for the slot size of the screen (normally 0.01-inch). Retract the probe rods to a point above the screen. Install a two foot Bentonite pellet seal using "00" gravel or bankrun sand. Backfill the remainder of the hole with bentonite-cement grout until it flows at the surface. Install protective flush-mount or stick-up casing around new well as appropriate.

2.4.3.2 Permanent Overburden Well Installation

Overburden wells are typically installed by a hollow-stem auger. They range from a two inch diameter well using a 4-1/4 inch (ID) hollow-stem auger to a four inch diameter well using a 6-1/4 (ID) hollow stem auger. Boreholes typically extend at least five feet into the ground, but this is depending upon the site-specific plan. The slot sized well screen will be of schedule 40 PVC flush-joint casing up to the ground surface. The space between the boring wall and the PVC will be filled with size Morie Sand or its equivalent. The sand will extend at least two feet above the screen to be followed by at least two foot Bentonite pellet seal. The remaining fill will be a mixture of cement/Bentonite grout filling. The monitoring wells will be completed at the ground surface and if they extend beyond the surface will need to be encased in a steel casing. All permanent wells need a secure cap and locking cover. Alternative methods will be specified in the site-specific plan.

2.4.3.3 Permanent Bedrock Well Installation

Bedrock wells can be installed by either hollow-stem auger or rock coring/air rotary drill. Borings are typically drilled with a 6-1/4 inch inside diameter bit. Once bedrock in encountered a "rock socket" (typically six inch) is installed into the rock. It is typically assumed that cores samples are not to be kept, but this could differ depending upon the site-specific plan. The requirements for backfilling materials and procedures are the same as that for overburden wells and can be referenced above.

2.5 Monitoring Well Development

All completed wells, whether production or monitoring, must be developed in order to facilitate unobstructed and continuous groundwater flow into the well. Well development is the process of cleaning the fines from the face of the borehole and the formation near the well screen. During any drilling process the side of the borehole becomes smeared with drilling mud, clays or other fines. This plugging action substantially reduces the permeability and retards the movement of water into the well screen. If these fines are not removed, especially in formations having low permeability, it then becomes difficult and time consuming to remove sufficient water from the well before obtaining a fresh groundwater sample because the water cannot flow easily into the well.

The development process is best accomplished for monitoring wells by causing the natural formation water inside the well screen to move vigorously in and out through the screen in order to agitate the clay and silt and move these fines into the screen. The use of water other than the natural formation water is not permitted. Well development methods may include using a surge block, using a bailer, or by using a surge and pumping technique.

2.6 Monitoring Well Purging and Sampling

Well purging can be performed on a volume basis or on a field parameter stabilization basis, also known as low flow. In both cases, field parameters are recorded; however, for the former case purging is concluded after a target number of well volumes (typically three to five) regardless of whether parameters have stabilized. In the latter case, purging continues until field parameters stabilize within 10 percent.

2.6.1 Volumetric Method of Well Purging

The following steps should be followed when purging a well by the volumetric method:

- Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.
- Determine the depth to static water level and depth to bottom of well casing. Calculate the volume of water within the well bore based on the well volumes in **Table 2-1** and record all data and calculations in the field logbook.

Table 2-1 Well Volumes

Well Diameter (inches)	Gallons (per foot)
2	0.16
4	0.65
6	1.5
8	2.6
10	4.1
12	5.9

- Set up field parameter probes at the discharge orifice or dedicated probe port of the pump assembly or within the flow-through chamber.
- Prepare the pump and tubing, or bailer, and lower it into the casing.
- Remove the number of well volumes specified in the site-specific plans. Generally, three to five well volumes will be required. Field parameters should be measured and recorded, if required by site-specific plans. In low recharge aquifers, the well commonly will be pumped or bailed to dryness before three well volumes of water are removed. If this is the case, there is no need to continue with purging operations. Record pertinent data in the field logbook and collect the samples once the well recharges.
- Remove the pump assembly or bailer from the well, decontaminate it (if required), and clean up the site. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plan.

2.6.2 Low-Flow Groundwater Purge and Sampling

Low-flow purge and sampling is appropriate at locations where disturbance of the media around the well screen needs to be minimized. A common concern is turbidity in the monitoring wells and the consequent undesirable effects on metals sampling results.

The low-flow purge and sample method creates less disturbance and agitation in the well, and therefore excess turbidity is not generated during the purging and sampling process. The result is a more rapid stabilization of turbidity and other parameters (pH, oxidation reduction potential [ORP], specific conductivity, and dissolved oxygen), and a sample more representative of conditions in the formation is collected.

The low flow purge and sample method consists of using a submersible or bladder pump to purge the well at a very low flow rate (0.5 to 1.5 liter/minute). The pump intake is set approximately in the middle of the well screen, with a stagnant water column over the top of the pump. The well is purged at the low rate until the field parameters (temperature, pH, ORP, specific conductivity, turbidity, and dissolved oxygen) have stabilized. The sample is then collected directly from the pump discharge at a low flow rate.

2.6.2.1 Low Flow Purging Procedures

- Check and record the condition of the well for any damage or evidence of tampering. Remove the well cap. Measure well headspace with a PID and record the reading in the field logbook. For wells installed on a landfill, also measure the headspace with a combustible gas indicator.

- Measure and record the depth to water with an electronic water level device and record the measurement in the field logbook. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated). Obtain depth to bottom information from installation information in the field logbook or drilling logs. Calculate volume of the water column by depth of water column times the cross-sectional area of the well.

- Lower pump to desired sampling depth. During purging, monitor the water level and field parameters (temperature, pH, turbidity, ORP, specific conductance and dissolved oxygen) approximately every three to five minutes or using a flow through cell such as a YSI. Continue monitoring until the water level stabilizes and field parameters have stabilized to within 10 percent (plus or minus five percent) over a minimum of three readings. Turbidity and dissolved oxygen are typically the last parameters to stabilize. Once turbidity readings get below 10 nephelometric turbidity units (NTUs), then the stabilization range can be amended to 20 percent (plus or minus 10 percent) over a minimum of three readings.

- If a flow through cell is not used, readings should be taken in a clean container and the monitoring instrument allowed to stabilize before collection of the next sample. The Horiba instrument takes the readings consecutively and therefore the process to record all the measurements may take longer than five minutes. If so, measurements should be taken as often as practicable.

- Once the water level and field parameters have stabilized, collect the samples from the pump.

2.7 Groundwater Sampling by Bailer

Groundwater is typically sampled by bailer after purging three to five well volumes using the volumetric method above. After the well is purged, allow water level to recover to a depth which will allow submergence of the bailer without contacting the well bottom. Ideally, the water level should recharge to 75 percent of the static level. Samples shall be collected within three hours of purging if recharge is sufficient. Wells with a low recharge rate must be collected within 24 hours of purging. Lower and retrieve the bailer slowly to minimize disturbance.

2.8 Surface Water Sampling

Four surface water sampling scenarios are provided below. These include 1) shallow surface water samples for VOC analysis (preserved and unpreserved), 2) shallow surface water samples for non-VOC or inorganic compound analysis (preserved and unpreserved), 3) deep surface water samples using a weighted bottle sampler and 4) deep surface water samples using a peristaltic pump.

When preparing for surface water sampling, personnel should follow all procedures established within the Health and Safety Plan and should also identify the sampling locations as directed from the work plan. The sampling site should be prepared by laying out clean plastic sheeting on the ground or other flat surface to place all equipment upon. All field measurements should take place prior to sampling and include physical, chemical, and biological characteristics of the water. All samples should be collected from areas of least to greatest contamination, when known, and from downstream to upstream. The sampler should always be facing upstream when sampling and documentation of the sampling events should be kept in the field notebook.

2.8.1 Collecting Shallow Surface Water Samples

When collecting shallow surface water samples, the location must be approached from downstream without entering the sample area. VOC vials should be slowly submerged in an area of gently flowing water and care should be taken to not disturb the bottom sediments. If wading or entering the area with a gas-powered vessel is necessary, always do so from downstream, make sure that all engines are turned off and do not physically enter the actual sample area.

When collecting samples for VOC analysis, avoid collecting from a surface water point where water is cascading and aerating. Cap the VOC vial while it is under water. After the vial is capped, check the vial to see if there are any air bubbles trapped in it. If air bubbles are present discard the sample.

2.8.2 Collecting Deep Surface Water Samples at Specified Depth Using a Weighted Bottle Sampler

To use a weighted bottle sampler, lower the weighted bottle sampler to the depth specified in the site-specific plan. Remove the stopper by pulling on the sampler line; allow the sampler to fill with water. Release the sampler line to reseat the stopper and retrieve the sampler to the surface.

2.8.3 Collecting Deep Surface Water Sample Collection Using a Peristaltic Pump

When collecting deep surface water samples using a peristaltic pump, select the appropriate length of Teflon®-lined intake tubing, in order to reach the specified sampling depth. When sampling for per- and polyfluoroalkyl substances (PFAS),high density polyethylene (HDPE) tubing shall be used and any Teflon®-containing materials must be avoided. Attach the intake sampling tube to the intake pump tube. Lower the intake tube into the surface water at the specified sampling location to the specified depth; make sure the end of the intake tube does not touch underlying sediments.

Start the pump and allow at least three tubing volumes of liquid to flow through and rinse the system before collecting any samples. Do not immediately dispense the purged liquid back to the surface water body. Instead, collect the purged liquid and return it to the source after sample collection is complete.

2.9 Direct Push Groundwater Sampling

2.9.1 Macro Core Sampling

Direct push methods will be used to collect 48 or 60 inch macro-core samples continuously at each of the groundwater sample locations. The samples will be used by the CDM Smith engineer, geologist or field scientist to determine the depth to groundwater at each location. Once saturated soil is verified, a screen point groundwater sampler will be set approximately five feet into the water table.

2.9.2 Purge and Sampling

Standard purge techniques will be utilized to purge and sample groundwater. Standard purge and sampling techniques consist of using a check valve and tubing to purge the well at a low flow rate. The check valve intake is set approximately in the middle of the screen. The well is purged at the low rate until the water flows clear or the turbidity is reduced to 50 nephelometric turbidity units (NTUs) or less, or to a level deemed acceptable to the field team leader. The sample is then collected directly from the tubing or bailer.

2.10 Well Abandonment

Once it is deemed that a temporary or permanent monitoring well is no longer needed, the well will be abandoned by a New York State certified well driller as follows:

- The well will be sounded (its depth measured with a weighted line or appropriate method) immediately before it is destroyed to make sure that it contains no obstructions that could interfere with filling and sealing. If an obstruction is observed the well may need to be over drilled to the wells original depth before abandoned.
- Where possible, remove all material within the original borehole – including the well casing, filter pack and annular seal. If the casing, filter pack and annular seal materials cannot be removed, they may be left in place.
- The casing left in place may require perforation or puncturing to allow proper placement of sealing materials. Where the casing is left in the hole, the casing may be cut at the surface.
- Fill well screen with sand per NYSDEC specifications.
- The monitoring well should be filled to the surface with cement grout, or within 20 feet of the surface with Bentonite grout. After the placement of the Bentonite grout (if used), the remaining portion of the well then should be sealed with a Portland Type I, II or Type I/II cement with two percent to five percent Bentonite.

2.11 Sediment/Sludge Sampling

When preparing for sampling sediment/sludge, personnel should follow all procedures established within the Health and Safety Plan and should also identify the sampling locations as directed from the work plan. The sampling site should be prepared by laying out clean plastic sheeting on the ground or other flat surface to place all equipment upon. All field measurements should take place prior to sampling and include physical, chemical, and biological characteristics of the water. All samples should be collected from areas of least to greatest contamination, when known, and from downstream to upstream. The sampler should always be facing upstream when sampling and documentation of the sampling events should be kept in the field logbook. When conducting sampling for PFAS analysis, no Teflon®-containing materials or equipment should be used.

2.11.1 Sediment/Sludge Sample Collection from Shallow Waters

Use a decontaminated stainless steel or Teflon, long-handled scoop, corer, push tube, or dredge to collect the entire sample in one grab. If wading is necessary, approach the sample location from downstream. Do not enter the actual sample area. Retrieve the sampling device and slowly decant off any liquid phase.

2.11.2 Subsurface Sediment/Sludge Sample Collection Using a Corer or Auger from Shallow Waters

At the specified sampling location, force or drive the corer to the specified depth. Twist and withdraw the corer in a smooth motion. Retrieve the sampling device, remove the corer nosepiece (if possible), and extrude the sample into the specified sampling container(s). Use a clean stainless steel or Teflon spoon or spatula to completely fill the container(s), ensuring no headspace.

2.11.3 Sediment/Sludge Sample Collection Using a Dredge from Deep Waters

Attach a clean piece of 12 to 19 mm (½ to ¾ inch) braided nylon line or Teflon-coated wire rope to the top of the sampler. The line must be of sufficient length to reach sediment or sludge and have enough slack to release the mechanism. Mark the distance to the bottom on the line. At the specified sampling location, open the sampler jaws and slowly lower the sampler until contact with the bottom (sediments/sludge) is felt. Slowly raise the sampler and once the sampler is above the water surface, place the sampler in a stainless steel or Teflon lined tray or pan and open the sampler.

2.11.4 Restrictions/Limitations

Core sampling devices may not be usable if cobbles exist in the sediment/sludge. Bumping of core sampling devices and Ponar dredge samplers may result in the loss of some of the sample.

For VOC analysis or for analysis of any other compound(s) that may be degraded by aeration, grab sampling is necessary to minimize sample disturbance and, hence, analyte loss. The representativeness of this sample, however, is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

2.12 Subsurface Soil Sampling

Methods of subsurface soil sampling to be used include manual (hand) auger sampling, split-spoon/split barrel sampling, direct-push, and sonic soil sampling. These methods will be used to collect subsurface samples from boreholes and will help to classify overburden soils quickly and cost effectively. These methods also facilitate the installation of temporary monitoring wells, permanent monitoring wells, piezometers, and soil vapor points. Procedures for these four drilling procedures can be found below.

In general, a few steps must always be followed when collecting subsurface soil samples. First, VOC samples or samples that may be degraded by aeration shall be collected first and with the least disturbance possible. Second, sampling information shall be recorded in the field logbook and on any associated forms. Third, a description of the lithology, including color, grains size, moisture, odor and other observations should be recorded. Additionally, when conducting sampling for PFAS analysis, no Teflon®-containing materials or equipment should be used.

2.12.1 Manual (Hand) Auger Sampling

When collecting hand-auger samples auger to the depth required for sampling. Place cuttings on plastic sheeting or as specified in the site-specific plans. If possible, lay out the cuttings in stratigraphic order. Throughout the sampling, make detailed notes concerning the geologic features of the soil or sediments in the field logbook. Cease augering when the top of the specified sampling depth has been reached. If required, remove the auger from the hole and decontaminate the auger or use a separate decontaminated auger, then obtain the sample. Scan sample with PID, as appropriate. Collect VOCs quickly to minimize loss of volatiles. When all sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.

2.12.2 Split-Spoon/Split Barrel Sampling

When collecting split-spoon samples the drilling contractor will set up the hollow-stem auger with the cutting head to the drill rig in order to begin drilling and will drill as specified within the site-specific plan. The drilling contractor will also be responsible for following the American Standard of Testing and Materials (ASTM) Method D-1586 when setting up the hammer to drive the split spoon and also for recording the number of blows till the full length of the spoon has been driven or upon refusal. Refusal can be defined by ASTM D1586-99 § 7.2.1 and 7.2.2 as greater than50 blows per 6 inch advance or a total of 100 blows. With the drive shoe and head assembly off, open (split) the split-spoon, being careful not to disturb the sample. Scan sample with PID, as appropriate. Collect VOCs quickly to minimize loss of volatiles.

2.12.3 Direct-Push Procedures

When collecting direct-push samples the drilling contractor should drive samples from the surface to the desired depth, using either four foot or five foot long direct push samplers, or two foot split-spoons. A discrete interval sampling (sampler end is plugged while driving to top of desired sample interval to exclude soil from non-desired depths) should be used when appropriate (for example, deeper than 8 feet or below the water table). At the top of sampling interval, release plug (if used) and drive sampler across desired sample interval. Once sample is retrieved, classify sample based on the Unified Soil Classification System (USCS). Record the following information in the soil boring log and field logbook when describing the sample: soil quality conditions, classification, sampling interval, PID reading, and any visual or olfactory observations. Samples can be secured for laboratory analysis based on visual signs of contamination, exhibiting the highest response to field screening device, existing in an interval above the water table interface, or as directed by NYSDEC project or field manager. At the conclusion of the boring, grout the borehole and decontaminate equipment.

Subsurface soil samples may be collected using a hand auger at depths of up to 10 feet (typical). In such cases, CDM Smith typically performs the boring and collects the samples for analysis. For deeper depths, a drilling subcontractor is typically used to perform a boring and collect subsurface soil samples by split spoon or Shelby tube via rotary drilling methods, or by direct push methods. In such cases, the driller provides the soil samples to CDM Smith, and CDM Smith then collects the laboratory samples.

2.12.4 Sonic Drilling Samples

When collecting sonic drilling samples, the drilling contractor should drive samples from the surface to the desired depth, using either five foot or 10 foot long barrow samplers. Once sample is retrieved, classify sample based on the USCS. Record the following information in the soil boring log and field logbook when describing the sample: soil quality conditions, classification, sampling interval, PID reading, and any visual or olfactory observations. Samples can be secured for laboratory analysis based on visual signs of contamination, exhibiting the highest response to field screening device, existing in an interval above the water table interface, or as directed by NYSDEC project or field manager. At the conclusion of the boring, grout the borehole and decontaminate equipment.

2.13 Surface Soil Sampling

When preparing for sample collection, locate sampling location(s) in accordance with project documents (e.g., work plan) and document pertinent information in the appropriate field logbook. When possible, reference locations back to existing site features such as buildings, roads, intersections, etc. The processes for verifying depth of sampling must be specified in the site-specific plans. Surface soil samples should be collected from the least contaminated to the most contaminated areas, if known. When taking the sample place clean plastic sheeting on a flat, level surface near the sampling area, if possible, and place equipment to be used on the plastic; place the insulated cooler(s) on separate plastic sheeting. A clean, decontaminated trowel, scoop, or spoon will be used for each sample collected. Other equipment may be used (e.g., shovels) if constructed of stainless steel. Document the sampling events, recording the information in the designated field logbook. Document any and all deviations from SOPs in the field logbook and include rationale for changes. When collecting samples for PFAS analysis, no Teflon®-containing materials or equipment should be used.

2.14 Water Level/NAPL Measurement

Water levels can be measured by several instruments. The two most common are covered here – electric water level meter (measures depth to water only) and the interface probe (measures depth to water and depth to non-aqueous phase liquid (NAPL)).

2.14.1 Procedures for Use of Water Level Meter

Before using a water level meter, standing upwind of the well, open the well head and monitor vapors with a PID as dictated by the site-specific Health and Safety Plan (HASP). Check that the water level meter is functioning correctly (test button, or immerse probe in tap water to test). Next, lower the probe slowly into well until contact with water surface is indicated (tone and/or light). Continue to slowly raise and re-lower probe until a precise, repeatable depth to water can be measured.

Record the depth to water from the measuring point of known elevation, usually marked at the top of the casing. If no mark is present, measure from the highest point of the casing or as otherwise instructed in the site-specific work plan.

2.14.2 Procedures for Use of Interface Probe

The interface meter is used to measure the depth to water and the depth to NAPL (light and/or dense). As with the water level meter, standing upwind of the well, open the well head and monitor vapors with a PID as dictated by the site-specific HASP. Check that the interface level meter is functioning correctly using the test button or immerse the probe in tap water and NAPL to test. Next, lower the probe slowly into the well until contact with water or NAPL surface is indicated. Water is typically indicated by a beeping tone; NAPL is typically indicated by a steady tone; check manufacturer's specifications. Continue to slowly raise and re-lower probe until a precise, repeatable depth to water/NAPL can be measured. Record the depth to water/NAPL from the measuring point of known elevation, usually marked at the top of the casing. If no mark is present, measure from the highest point of the casing or as otherwise instructed in the site specific work plan.

When measuring the interface depth between light non-aqueous phase liquid (LNAPL) and water, the non-aqueous phase is floating on top of the water column, and the probe must be lowered through the NAPL before encountering water. In this case, shake the probe after water is encountered to help dislodge any NAPL droplets stuck to the probe. Then raise the probe slowly until it re-enters the NAPL. Perform this procedure until a repeatable result is obtained. The interface depth should be recorded in the up direction, never the down direction. When the probe is moving down, past the LNAPL, it may still be coated with product and can therefore yield misleading results. Therefore, it must be shaken in the water and raised to the interface for an accurate result. Record depth from measuring point, as noted above.

When measuring the interface depth between dense non-aqueous phase liquid (DNAPL) and water, the non-aqueous phase is at the bottom of the well, below the water column. Lower the probe until NAPL is encountered. Then raise the probe, shake it in the water to dislodge any NAPL droplets, and lower it again. Perform this procedure until a repeatable result is obtained. The interface depth should be recorded in the down direction, never in the up direction. When the probe is moving up from the DNAPL it may still be coated with product and can therefore yield misleading results. Therefore, it must be shaken in the water and lowered to the interface for an accurate result. Record the depth from the measuring point.

2.15 Tap Water Sampling

Tap water sampling may be performed in residential, commercial or industrial areas for several reasons. The most common tap water samples are used to obtain groundwater samples from private wells. Prior to sampling tap water, permission must be obtained to access the property from the resident or owner. The location of the tap should be determined based on its proximity to the water source. It is preferable that the tap water sampling be conducted at a tap located prior to any holding or pressure tanks, filters, water softeners, or other treatment devices that may be present. If possible, obtain well construction details, holding tank volumes etc. to evaluate standing volume of water in the system. If the sample must be collected at a point in the water line beyond a pressurization or holding tank, a sufficient volume of water should be purged to provide a complete exchange of fresh water into the tank and at the location where the sample is collected. If the sample is collected from a tap or spigot located just before a storage tank, spigots located inside the building or structure should be turned on to prevent any backflow from the storage tank to the sample tap or spigot. It is generally advisable to open as many taps as possible during the purge, to ensure a rapid and complete exchange of water in the tanks. Samples collected to determine if system related variables (e.g., transmission pipes, water coolers/heaters, holding/pressurization tanks, etc.) are contributing to the quality of potable water should be collected after a specific time interval (e.g., weekend, holiday, etc.). Sample collection should consist of an initial flush, a sample after several minutes, and another sample after the system has been purged.

Devices such as hoses, filters, or aerators attached to the tap may harbor a bacterial population and therefore should be removed prior to sampling. Sample containers should not be rinsed before use when sampling for bacterial content, and precautions should be taken to avoid splashing drops of water from the ground or sink into either the bottle or cap. Samples of the raw water supply and the treated water after chlorination should be collected when sampling at a water treatment plant and in the logbook, the location and description of the general condition of the tap selected to be sampled should be recorded. The rationale used in selecting the tap sampling location, including any discussions with the property owner, should also be recorded. Provide a sketch of the water supply/distribution system noting the location of any filters or holding tanks and the water supply source (i.e., an onsite groundwater well or surface water intake or a water service line from a public water main). If an onsite water supply is present, observe and record the surrounding site features that may provide potential sources of contamination to the water supply. It's important to don the appropriate personal protective clothing as dictated by the site-specific HASP. Gloves should be changed between sampling locations to avoid possible cross-contamination of the tap water samples.

Prior to sample collection, the supply system should be purged by turning the cold-water tap on. The following general guidelines should be followed to determine when the system is adequately purged (refer to the site-specific sampling plans for any other requirements):

- Onsite Water Supply; A minimum of three standing volumes of water (i.e., the static volume of water in the well and holding tank, if present) should be purged. Obtain water temperature, conductivity, and pH measurements after each volume of water is purged. If the standing volume of water in the supply system is unknown, the tap should be allowed to run for a minimum of 15 minutes and temperature, conductivity, and pH measurements, or other parameters as specified by the project plan, should be collected at approximately three to five minute intervals. (In general, well construction details and holding tank volumes should be obtained prior to conducting the sampling event to estimate the standing volume of the water supply system.) The system is considered adequately purged when the temperature, conductivity, and pH stabilize within 10 percent for three consecutive readings. If these parameters do not stabilize within 15 minutes, then purging should be discontinued and tap water samples may be collected.

- Large Distribution Systems; Because it is impractical to purge the entire volume of standing water in a large distribution network, a tap should be run for a minimum of five minutes, which should be adequate to purge the water service line. Obtain temperature, conductivity, and pH measurements at approximately one minute intervals. The system is considered adequately purged when the temperature, conductivity, and pH readings, or other parameters as specified by the project plan, stabilize within 10 percent for three consecutive readings. If these parameters do not stabilize within five minutes, then purging should be discontinued and tap water samples may be collected. During purging, a five gallon bucket and stopwatch may be used to estimate the flow rate if required by the site specific plans. Dispose of the purged water according to the site specific plans. Record the temperature/conductivity/pH readings, or other parameters as specified by the project plan, the volume of water purged, the flow rate if measured, and the method of disposal in the field logbook.

After purging the supply system, collect the samples directly from the tap (e.g., if a hose was used for purging, the hose should be disconnected prior to sampling). Any fittings on the end of the faucet that might introduce air into the sample (e.g., a fine mesh screen that is commonly screwed onto the faucet) should be removed prior to sample collection also. A smooth-flowing water stream at moderate pressure with no splashing should be obtained.

2.16 Rock Coring

The rock core will be collected by advancing the borehole to the desired depth using auger, rotary, air hammer or other drilling method, as appropriate and collecting the core (using specified core barrel) in accordance with ASTM D2113-06, as appropriate for site conditions. Be sure to record the penetration rate, any fluid loss and depth of loss, rock type, fractures, and other pertinent information. The cores should be placed in sturdy, wooden, core boxes that are clearly labeled with the borehole number and depth. Breaks in the sample should also be marked with 3 parallel lines across the break. Each core sample should be photographed in its box clearly displaying the holes number and depth. Lastly, the Rock Quality Designation for each core run should be determined and should be followed as below.

- Determine Rock Quality Designation (RQD) for each core run:

$$RQD = \frac{\text{the total length of core pieces greater than four inches long}}{\text{total core run}}$$

It should be noted that the core lengths should be measured along the center line of the core. Also, do not count core pieces that are not “hard and sound” as part of the RQD; however, record such lengths separately. Lastly, core breaks known to be induced by drilling or core handling should be fitted together and counted as one piece when determining RQD.

2.17 Packer Testing

Packer testing is performed to obtain groundwater samples from discrete intervals within a larger open borehole in bedrock. A dual straddle packer system or single packer system can be used, as appropriate. The single packer is often used when collecting a groundwater sample from near the bottom of the borehole. Inflatable packers, with a submersible pump between the packers (or below the single packer) are typically used. Geophysical logging can be used prior to packer testing to design the packer interval. If packer testing occurs concurrent with drilling, then a single packer is typically used at progressively deeper depths.

2.18 Aquifer Performance Test

Aquifer performance tests are typically performed to characterize the hydraulic properties of wells and aquifers. Properties evaluated include specific capacity, hydraulic conductivity, transmissivity and storativity.

2.18.1 Continuous Background Monitoring

Baseline groundwater level measurement data will be used to evaluate the effects of outside influences (i.e., influences other than the proposed pump test withdrawal) on groundwater levels. These influences will then be considered when analyzing the pump test data. Typically, groundwater level data will be recorded with an electronic data logger at a selected well approximately every 30 minutes. Precipitation and barometric pressure data are also obtained in order to analyze outside effects other than that of the pump test on the aquifer.

2.18.2 Step Drawdown Test

The step drawdown test (or step test) is required to determine the specific capacity and short term yield of the recovery well and select the pumping rate for the long-term pump test. During the test, continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically. An example of a logarithmic schedule is provided in **Table 2-2** below.

Table 2-2 Step Drawdown Test Logarithmic Schedule

Log Cycle	Elapsed Time	Sample Interval	Points/Cycle
1	0-20 seconds	0.2 second	101
2	20-60 seconds	1 second	40
3	1-10 minutes	10 seconds	54
4	10-100 minutes	2 minutes	45
5	100-480 minutes	10 minutes	38

A variable rate submersible pump capable of operating across various flow ranges should be used to complete testing. A vertical check valve will be placed on the discharge line immediately above the pump. A 1-inch diameter polyvinylchloride line will be placed in the well, with the open, bottom end extending to within one foot of the pump. This 1 inch line will be used as the stilling pipe for the water level transducer.

2.18.3 Long-Term Constant Rate Test

The long-term constant rate test (72-hour pumping test) will be performed at the pumping well on the day after completion of the step test, assuming groundwater levels have recovered to 90 percent of baseline values. The 72-hour pump test will not commence until this condition is met or a minimum of 72 hours have elapsed since the termination of the step testing. The step test results will be reviewed in advance and used to select the pumping rate for this test, which will equate to approximately 50 to 75 percent of the calculated short-term, maximum well yield. During this test, continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically. An example of a logarithmic logging schedule is provided in **Table 2-3** below.

Table 2-3 Long Term Constant Rate Test Logarithmic Schedule

Log Cycle	Elapsed Time	Sample Interval	Points/Cycle
1	0-20 seconds	0.2 second	101
2	20-60 seconds	1 second	40
3	1-10 minutes	10 seconds	54
4	10-100 minutes	2 minutes	45
5	100-480 minutes	10 minutes	38

2.18.4 Recovery Water Level Measurement

Initiate a new log cycle for the transducers immediately upon termination of the constant-rate pumping test. Continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically. Leave the transducers in place to record continuous groundwater level data until the groundwater level at the pumping well has recovered to 90 percent of its baseline value or 72 hours (minimum) have elapsed since termination of pump testing.

2.18.5 Discharge Water Management

The water pumped from the well shall be discharged and managed following the plan specific to the project and in accordance with DER-10 and all applicable local, state and federal regulations.

2.19 Membrane Interface Probe (MIP)

In order to provide a screening-level characterization of VOC contamination in subsurface soil in both the vadose and saturated zones, when practical, CDM Smith will utilize a MIP to obtain qualitative, depth-continuous, relative instrument response data for VOCs and electrical conductivity data in the subsurface soil. The MIP data will be used to establish an instrument response gradient in subsurface soils to identify “hot spots” for sampling during the soil boring investigation. The MIP utilizes a truck-mounted PID, flame-ionization detector (FID), and an electron-capture devise (ECD). The 1.5 inch diameter MIP will be pushed into the subsurface at a penetration rate of approximately 1 foot per minute. The tip of the probe contains a thermister, which provides a heat source to volatilize VOCs. The gases that are produced pass into the probe through a permeable membrane and enter a sampling loop. The gases are then transported to the surface and pass through the PID, FID, and ECD. The MIP will produce a response to all compounds that volatilize sufficiently and diffuse through the MIP probe membrane, are carried to the detector in the carrier gas, and produce a response on one or more of the detectors (PID, FID, and ECD).

The total response for each detector is related to the total contaminant concentration and the relative response of the detector to the compounds in the carrier gas stream. Therefore, the MIP is considered to produce qualitative data.

2.19.1 MIP Procedure

Prior to initiating any field activities, the field team will review and discuss, in detail, the site-specific HASP and any appropriate background documentation. All monitoring and protective equipment will be thoroughly checked at this time. All underground and overhead utilities and structures which may interfere with the progress of the work will be located prior to the commencement of subsurface drilling activities.

2.20 Fish Sampling

Fish samples will be collected from an adequate number of locations in order to characterize and address project objectives, or as directed by the NYSDEC. Samples will be collected using site-specific common fisheries techniques (e.g., seine net, electroshocking, etc.). During each investigation, species representative of the site or individual location (e.g., dominant taxa, high percentage of total biomass, etc.) will be targeted for analysis. The age and/or trophic level of species and other pertinent sampling design information will be decided after consultation with the NYSDEC. Upon capture, sampling crews will taxonomically identify fish retained for analysis, photograph, and record the weight and total length of representative individuals. In order to satisfy analytical requirements, it may be necessary in specific cases (e.g., minnow species) to composite samples consisting of an individual species. When required, the total number of individuals and total weight of the composite will be noted. After processing, individual samples will be wrapped in aluminum foil, placed in re-sealable plastic bags and placed on wet or dry ice. Samples will be shipped via overnight delivery to the subcontracted analytical laboratory for the analyses specified in the site-specific work plan.

2.21 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate (benthos) samples will be collected from an adequate number of locations in order to characterize and address project objectives, or as directed by the NYSDEC. Samples will be collected using site-specific sampling techniques (e.g., kick net, surber sampler, etc.). During each investigation, species representative of the site or individual location (e.g., dominant taxa, high percentage of total biomass, etc.) will be targeted for analysis. Pertinent sampling design information (e.g., sample size, etc.) will be decided after consultation with the NYSDEC.

As samples are collected, they will be placed into a clean sample vessel (e.g., stainless steel bucket, high density polyethylene bucket, etc.) for sorting. Representative species retained for analysis will be taxonomically identified to order. Due to analytical requirements, all samples will consist of a given number of individuals composited together until the proper sample mass is achieved. After processing, individual samples will be placed into the appropriate sample container, placed in re-sealable plastic bags and placed on wet ice or dry ice. Samples will be shipped via overnight delivery to the subcontracted analytical laboratory for the analyses specified in the site-specific work plan.

2.22 Test Pits

All excavation activities will be performed in accordance with the Dig Safely New York *Excavator Manual: A User's Guide to Safe Excavation Practices in New York State.* The location of the test pits will be specified within the site specific plan and will be based off of site conditions and historic site usage. The test pit will predominantly serve as a way to collect soil "grab" samples and to characterize site conditions. All work done in and around the test pit must be compliant with the project HASP.

2.22.1 Procedure

When beginning a test pit, all excavated soil should be stored on an impermeable barrier between the ground surface and should be located at an appropriate distance from excavation to insure slope stability. Before acquiring the soil sample, all visual characterization and PID readings should be recorded in the field logbook. All samples will be forwarded to an approved laboratory and will be labeled, handled, and shipped according to procedures located in the Quality Assurance Project Plan (QAPP).

When samples have been lifted and the site has been observed, test pits should be refilled with the excavated soil. If contamination is severe, fill material will have to be disposed of in proper ways and should not be replaced in the test pit.

2.22.2 Analytical Program

CDM Smith expects to collect one sample from each test pit. However, field observations may dictate that additional samples be collected. Samples may be obtained from the test pit side walls or bases and will be collected from the bucket of the excavator. All samples shall be field screened, photographed and recorded.

Appendix A

Drilling Summary Sheet

DRILLING SUMMARY SHEET

SITE NAME HERE

Date:
Geologist:
Driller:
Borehole Locations:
Drums Generated (ID#s):

1.0 GENERAL CHARGES			**HAS RIG**	**TRIPOD**
1a.	Mobilization and Demobilization	Each		
1b.	Construct Decontamination Pad	Each		
1c.	Steam Cleaning (1 hour/boring maximum)	Hours		
1d.	Drums	Drums		
1e.	Drumming Residuals/Transportation	Drums		
1f.	Standby Time	Hours		
1g.	Baker Tank Rental (20,000 gallons each)	Each		
2.0 BOREHOLE DRILLING				
2a.	4 ¼ inch ID – HSA	Feet		
2b.	Split Spoon Sampling	Spoons		
2c.	Shelby Tubes	Tubes		
2d.	Geoprobe Boreholes	Feet		
2e.	Macro Core and Large Bore Sampling	Feet		
2f.	Soil Boring with Tripod	Feet		
2g.	Borehole Grouting	Feet		
3.0 OVERBURDEN MONITORING WELL INSTALLATION				
3a.	Soil Borings with 6 ¼ inch ID HAS (8 inch borehole)	Feet		
3b.	Split Spoon Sampling	Spoons		
3c.	4-inch Type 304 Stainless Steel Casing	Feet		
3d.	4-inch Type 304 Stainless Steel Screen	Feet		
3e.	Well Completion Materials (Gravel pack, bentonite, grouting installed)	Feet		
3f.	5 foot Carbon Steel Protective Casing (installed), including Well Lock and Key, Concrete Collar, etc.	Each		
3g.	Flush Mount including Well Lock and Key, Concrete Collar, etc.	Each		
3h.	Well Development (3 hours/well)	Wells		
4.0 OVERBURDEN MONITORING WELL INSTALLATION				
4a.	Surcharge for Level "C"	Per Hour		

Drum Tracking Log

DRUM TRACKING LOG

SITE NAME: ____________________________________

Drum #	Boring/MW#	Date Drilled/ Sampled	Related Sample #	Description of Drum Contents	Signature

Low Flow Sampling Sheets

LOW FLOW SAMPLING SHEETS

SITE NAME: ______________________________

DATE:	WELL #:
SAMPLE TIME:	DEPTH OF PUMP:
WEATHER CONDITIONS:	SAMPLERS:

TIME	VOLUME PURGED (GALS)	DEPTH TO WATER (FT TIC)	FLOW RATE (ml/min)	DRAWDOWN (FEET)	TEMP ^{0}C (+/- 10%)	ph (+/- 0.1 SU)	REDOX POTENTIAL mV (+/- 10 mv)	SPECIFIC COND. mS/cm (+/- 3%)	DISSOLVED OXYGEN mg/L (+/- 10%)	TURBIDITY NTUs (+/- 10%)

The well is considered stabilized and ready for sampling when the indicator parameters have stabilized for three consecutive readings by the measurements indicated in parenthesis.

Photo Tracking

PHOTOGRAPH TRACKING LOG

SITE NAME: ________________________________

CAMERA # ____

Photograph #	Description	Date/Time	Photographer

Sample Screening Tracking Log

SAMPLE SCREENING TRACKING LOG

SITE NAME: ____________________________________

SAMPLE ID	SAMPLE DATE	SAMPLE TIME	MATRIX	DUP (Y/N)	COMMENTS

Sample Tracking Log

SAMPLE TRACKING LOG

SITE NAME/SAMPLE EVENT: ______________________________

LDL VOC LAB: ____________________ INORGANIC CLP LAB: ____________________

CLP CASE NO: ____________________ ORGANIC CLP LAB: ____________________ SUBCONTRACT LAB: ____________________

SAMPLE ID	SAMPLE DATE	SAMPLE TIME	MATRIX	DEPTH (feet)	ORGANIC CLP NO.	INORGANIC CLP NO.	SUBCONTRACT ANALYSIS	QA/QC

ANALYSIS SUMMARY: ______________________________

____

REV 5/01

Synoptic Water Level Measurements

SYNOPTIC WATER LEVEL MEASUREMENTS

SITE NAME: ____________________________________

DATE: ________________________

Time	Well	Depth to Water	Total Depth	Product/ Thickness	HNu Headspace Readings	Notes/Well Condition

All readings are from Top of Inner Casing (TIC)

Well Logs

CDM

Consulting, Engineering, Construction & Operations

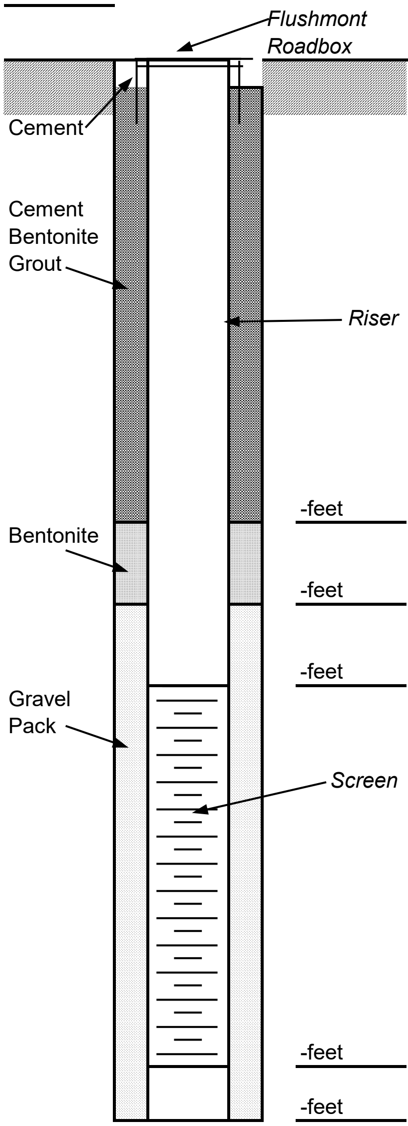
WELL CONSTRUCTION SUMMARY

Project: ____________________ Location: ____________________ Well No.: ____________

Permit No.: ____________

TOC elev.: ________ -

Type: ____________



DRILLING SUMMARY

Drilling Company: ____________ Drillers: ____________

Drill Rig/Model: ____________

Borehole Diameters: ____________ Drilling Fluid: ____________

Bits/Depths: ____________

Total Depth: ________ Depth To Water: ____________

Supervisor Geologist: ____________

WELL DESIGN

Casing Material: ____________ Diameter: ____________

Screen Material: ____________ Diameter: ____________

Slot Size: ____________ Setting: ____________

Filter Material: ____________ Setting: ____________

Seals Material: ____________ Setting: ____________

Grout: ____________ Setting: ____________

Surface Casing Material: ____________ Setting: ____________

TIME LOG

	Started	Completed
Drilling:		
Installation:		
Development:		

WELL DEVELOPMENT

Method: ____________

Static Depth to Water: ____________

Pumping Depth To Water: ____________

Pumping Rate: ________ Spec. Capacity: ________

Volume Pumped: ________

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May 1, 2020

Ms. Lisa Lewis
Contract Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation
Bureau of Program Management
Contracts and Payments Section
625 Broadway, 12th Floor
Albany, New York 12233-7012

Subject: NYSDEC Standby Contract No. D009805
Quality Assurance Project Plan

Dear Ms. Lewis:

Camp Dresser McKee & Smith (CDM Smith) is pleased to submit our Quality Assurance Project Plan (QAPP) for the New York State Department of Environmental Conservation (NYSDEC) Standby Engineering Services Contract D009805.

This document outlines CDM Smith's protocols for field activities, sample collection, analysis, and evaluation of data that will be legally and scientifically defensible for all work performed under Standby Engineering Services Contract D009805. Site-specific procedures will be included in the Field Activities Plan (FAP) as an attachment to the site-specific Work Plan for each work assignment, as needed. The FAP is being submitted as a separate document.

If you have any questions, or need additional information, please call me at 518-782-4526.

Very truly yours,

Amy E. Picunas, P.E.
Environmental Engineer
Camp Dresser McKee & Smith

Attachments: QAPP, April 2020

cc: D. Gardner, NYSDEC
D. Durfee, CDM Smith

QUALITY ASSURANCE PROJECT PLAN

New York State Department of Environmental Conservation

Standby Engineering Services
Contract D009805

Prepared for:
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7017

Prepared by:
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11 British American Boulevard
Suite 200
Latham, NY 12110

April 2020

CDM Smith

Table of Contents

Section 5 Laboratory Procedures

List of Tables

Appendices

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Section 1

Introduction

This generic Quality Assurance Project Plan (QAPP) has been prepared by Camp Dresser McKee & Smith (CDM Smith) for the New York State Department of Environmental Conservation (NYSDEC) to document quality assurance/quality control (QA/QC) under the NYSDEC Standby Contract for Engineering Services D009805. Site-specific procedures will be included in the Field Activities Plan (FAP) as an attachment to the site-specific Work Plan for each work assignment, as needed. The FAP is not included as part of this QA/QC plan.

1.1 Purpose

The principal purpose of this document is to specify QA/QC procedures for the collection, analysis, and evaluation of data that will be legally and scientifically defensible.

1.2 Objectives

The QAPP provides general information and procedures applicable to the field activities and analytical program detailed in each site-specific Work Plan provided by NYSDEC for each work assignment. This information includes definitions and generic goals for data quality and required types and quantities of QA/QC samples. The procedures address field documentation; sample handling, chain of custody, and shipping; instrument calibration and maintenance; auditing; data deliverable and reduction, validation, and reporting; corrective action requirements; and QA reporting specific to the analyses performed by the laboratories subcontracted by CDM Smith.

Section 2

Project Organization and Responsibility

2.1 Overview

The project management organization for each work assignment is to provide a clear delineation of functional responsibility and authority. The project manager for CDM Smith is the primary point of contact with the NYSDEC project manager. He/she is responsible for development and completion of the site-specific investigation, project team organization and supervision of all project tasks. In this role, he/she will communicate directly with the NYSDEC.

For the fieldwork, field teams consisting of CDM Smith personnel and subcontractors will be assembled and will be responsible for implementing all aspects of the fieldwork. Several key activities will be performed as part of the field and analytical work. These activities include:

- Ensuring that sample collection, sample analysis, data validation, and electronic data deliverable procedures are performed according to Division of Environmental Remediation (DER)-10 requirements.
- Ensuring that health and safety procedures, as outlined in CDM Smith Corporate Health and Safety Manual and the site-specific health and safety plan (HASP) for each work assignment, are adhered to.
- Ensuring that field QA/QC procedures are implemented
- Ensuring that laboratory analysis, data validation, data processing, data QC and electronic data deliverables (EDD) activities are performed in accordance with applicable NYSDEC guidelines including DER-10.
- Ensuring that minority business enterprise/women business enterprise (MBE/WBE) goals are achieved.

2.2 Responsibility

The primary responsibilities for program management activities rest with the Program Manager (PGM). The PGM will have ultimate contract responsibility for the project, including responsibility for the technical content of all engineering work. The PGM will direct, review and approve all project deliverables, schedule staff and resources, resolve scheduling conflicts and identify and solve potential program problems. He/she will be directly accountable to NYSDEC's Division of Hazardous Waste Remediation for program execution. He/she has authority to assign staff, negotiate and execute contracts and amendments, as well as execute subcontracts. The PGM will communicate directly with CDM Smith's Project Manager.

The Project Manager will have overall responsibility for the technical and financial aspects of this project.

He/she will assign technical staff, maintain control of the project budget and schedule, prepare monthly progress reports, review and approve project invoices, evaluate the technical quality of the project deliverables as well as the adherence to QA/QC procedures and manage subcontractors. He/she will serve as CDM Smith's point of contact for this project.

The Program Quality Assurance Officer will monitor QC activities of program management and technical staff, as well as identify and report the needs for corrective action to the PGM. He/she will also conduct an internal review of all project deliverables prepared by CDM Smith staff and sign off on the final investigation reports.

The Program Health and Safety Officer will review and make recommendations to the Subcontractors on health and safety plans for compliance with Occupational Safety and Health Administration (OSHA) requirements. He/she will develop a HASP for CDM Smith and NYSDEC employees, handle over-sight activities, evaluate the performance of health and safety officers and maintain required health and safety records. He/she will report to the PGM.

The Health and Safety Site Supervisor/Coordinator will be responsible for ensuring that the HASP is implemented during field activities and that a copy of the site-specific HASP is maintained at the site at all times. He/she will also be responsible for upgrading or downgrading personnel protection based on actual conditions at the time of the investigation. The Coordinator must also present an overview of the HASP to field personnel prior to initiating any field activities and is responsible for assuring that field personnel sign off on this plan. He/she will contact the Program Health and Safety Officer if any questions or issues arise during the field activities that he/she cannot answer.

2.3 Subcontractors

The following subcontractor services may be required as part of the site characterization or site investigation activities and performed by subcontractors under CDM Smith's supervision:

- Geophysical Survey
- Geoprobe Installation (including Membrane Interface Probes (MIPs))
- Drilling (including soil boring and monitoring well installation)
- Vapor, Soil and Groundwater Sampling
- Analytical Services
- Construction Oversight and O&M
- Site Survey
- Investigation Derived Waste Removal
- Data Validation

Section 3

Field Procedures

CDM Smith's point of contact for any field investigation activities is the field team leader and the onsite NYSDEC representative or PM. Any minor changes in sampling activities that are within the proposed scope of the project will be documented each day in the field logbook and signed by both representatives. Any modifications that are inconsistent with the approved work plan are to be approved by the NYSDEC PM prior to implementation.

3.1 Documentation (Field Logbook)

Information recorded in field logbooks include at a minimum, field observations, data, calculations, time, weather, description of the data collection activity, methods, field instruments and calibrations, field screening results and sample identification. Additionally, the logbook may contain descriptions of wastes, biota, geologic material, and site features including sketches, maps or drawings, as appropriate.

3.1.1 Preparation

In addition to this QAPP, site personnel responsible for maintaining logbooks must be familiar withthe site-specific FAP. These should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation.

Prior to use in the field, each logbook should be marked with the specific NYSDEC site number, name and location. The field notebook will then be assigned to an individual responsible for its care and maintenance.

Field logbooks will be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. The following information will be recorded inside the front cover of the logbook:

- Site name, number and location
- Person and organization to whom the book is assigned, office address and phone number(s)
- Start date

3.1.2 Operation

The following is a list of requirements that must be followed when using a logbook:

- Record work, observations, quantity of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are specified by the FAP, this information need not be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.

- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Before an entry has been signed and dated, any changes may be made but care must be taken not to obliterate what was written originally. Indicate any deletion by a single line through the material to be deleted.
- Do not remove any pages from the book.
- Record as much information as possible.
- Specific requirements for field logbook entries include:
  - Initial and date each page.
  - Initial and date all changes.
  - Multiple authors must sign out the logbook by inserting the following:
- Above notes authored by:
  - (Sign name)
  - (Print name)
  - (Date)
- A new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
  - Date and time.
  - Description of activity being conducted, including station (i.e., well, boring, sampling location number) if appropriate.
  - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data.
  - Level of personnel protection to be used.
  - Subcontractors on site.

Entries into the field logbook will be preceded with the time (written in military units) of the observation. The time should be recorded at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form. In these cases, the logbook must reference the automatic data record or form.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also, record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personnel protection equipment.
- Visitors to the site.

3.1.3 Post-Operation

To guard against loss of data due to damage or disappearance of logbooks, completed pages will be scanned periodically (weekly, at a minimum) and submitted to the project manager. Documents that are separate from the logbook will be scanned and submitted regularly to the project manager. This includes all automatic data recording media (printouts, logs, disks or tapes) and activity-specific data collection forms required by other FAP.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will confirm all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook will be submitted to the records file.

3.2 Sample Collection, Documentation and Identification

The following procedures describe proper sample collection and documentation to be included in field logbooks. Documentation includes describing data collection activities, logging sample locations, sample IDs, container labeling and chain of custody (COC) forms. Procedures for sample classification to assure proper labeling of samples are also included.

3.2.1 Responsibilities

The field task manager or field engineer is responsible for overseeing field operations such as, soil vapor intrusion, soil borings, Geoprobe, well drilling, collection of vapor, soil or groundwater samples, field logbooks, sample documentation, COC forms and labeling of any Investigative Derived Waste (IDW) drums, if required. Additionally, the field manager and/or field engineer is responsible for ensuring that all field activities adhere to the site-specific HASP and that samples are sent to the laboratory as soon as practicable. Generally, samples should be received by the laboratory within 48 hours of sampling.

3.2.2 Sample Collection

3.2.2.1 Water Samples

- Volatile Organic Compounds (VOCs), if analyzed, are to be sampled first. Pour water slowly into the 40-ml vial, tipping the vial and allowing water to run down the side to prevent aeration. Fill until a meniscus forms and tightly seal the vial. Invert the vial and check for bubbles. If bubbles are present, add water and repeat. It may be necessary to discard the vial and use another if bubbles continue to appear.

- Remaining bottles should then be filled, again preventing aeration.
- If filtering is required (filtering is sometimes requested when samples are to be analyzed for metals and turbidity is high), use a dedicated 0.45 micron filter for each sample and filter prior to preservation.
- Label bottles with sample designation, project, date, time, preservative and required analysis. Clear tape may be used to cover the completed label.
- Place sample in a cooler with ice to maintain temperature at 4°C +/- 2°C. Samples will be maintained at this temperature throughout the sampling and transportation period. COC and shipping procedures are discussed in Section 3.3 and field logbook procedures in Section 3.1.

3.2.2.2 Soil/Sediment/Sludge Samples

- VOCs, if analyzed, are to be sampled first. Fill the jar completely such that there is no air space. VOCs must not be homogenized. En Core® samplers or similar may be used to collect undisturbed soil samples. In such case, the appropriate sample collection volume and preservation methods should be followed.
- For the remaining parameters, homogenize the samples with a decontaminated stainless bowl (Section 3.12) and trowel prior to filling the remaining bottles. Use of dedicated disposable trowels is permitted.
- Label bottles with sample designation, project, date, time, preservative and required analysis. Clear tape may be used to cover the completed label.
- Place sample in a cooler with ice to maintain temperature at 4°C +/- 2°C. Samples will be maintained at this temperature throughout the sampling and transportation period. COC and shipping procedures are discussed in Section 3.3 and field logbook procedures in Section 3.1.

3.2.2.3 Soil Vapor/Ambient Air Samples

- Soil vapor samples will be collected with either a 1.4-liter or 6-liter Summa canister, a 2-hour or 24-hour flow controller (regulators) and particulate filters (if required). Flow rate shall not exceed 200 ml/min. The size of Summa canister and duration of sample are dependent on the type of soil vapor sample.
- Sub slab soil vapor samples will be collected with 6-liter Summa canisters, with 24-hour (unless otherwise specified in project-specific work plan) flow controllers (regulators) and particulate filters (if required). Sample flow rate shall not exceed 200 ml/minute.
- Indoor and outdoor ambient air samples will be collected with 6-liter Summa canisters, with 24-hour (unless otherwise specified in project-specific work plan) flow controllers

(regulators) and particulate filters (if required). Sample flow rate shall not exceed 200 ml/minute.

- Instantaneous grab samples may also be collected, as permitted by NYSDEC.
- Record vacuum prior to and at conclusion of sampling. Prior to sampling, vacuum should read 25-30 inches of mercury (Hg).
- At conclusion of sampling, vacuum should be 5 inches Hg +/- 1 inch Hg.
- Label Summa canister and prepare for shipping. Summa canisters are not chilled or otherwise preserved.

3.2.3 Field Logbooks

Complete and thorough notes of all field events are essential to a timely and accurate completion of each project. The field task manager and/or field engineer is responsible for accounting for actions of the subcontractor and the times for said actions while in the field. Include identification (numbers and description) of field samples, duplicates samples, and field or trip blank samples in the field logbook. For a given workday, the field logbook should contain the following:

- Names of field personnel, names of subcontractors (if any), number of persons in crew, equipment used and any calibrations completed, weather, date, time, and location at start of day (boring number).
- Sample identification number, depth, amount of sample recovery, PID readings, odors, and soil descriptions.
- Description of any unusual surface or subsurface soil conditions
- Record of Health and Safety monitoring; time, equipment and results
- Record of site accidents or incidents
- Record of any visitors
- Any field work delays and the cause of the delay, i.e. subcontractor equipment breakdown
- Materials and equipment used during borehole installation
- Final daily summary of work completed, including a list of samples obtained
- Completion of daily QA/QC log sheet
- Contractor downtime, decontamination time, equipment breakdowns, movement tracking throughout the day, etc.
- Any other data that may be construed as relevant information in the future.

The field logbooks should confirm the subcontractor's data. Field notes should be scanned weekly and submitted to the project manager.

If a borehole is completed (regardless of whether a monitoring well is installed), field personnel shall record the lithography, PID measurements, and any samples collected in the field logbook. Additionally, a soil boring log shall be completed, an example is provided in **Appendix A**. The field task manager should review field forms at the end of each day.

Monitoring well logs are required if the borehole is completed as a monitoring well. These are to be completed in the field after a monitoring well is installed. They should include data such as screen length, riser length, materials used, etc. An xxample monitoring well construction log is provided in **Appendix A**. The completed monitoring well logs should be reviewed by the field task manager.

3.2.4 Drum Labeling

Labeling of drums is essential for tracking hazardous materials. The subcontractor is responsible for collecting, handling, and transporting the drums for disposal, but field personnel are responsible for labeling drums appropriately. There is a significant cost implication if drums are not property labeled. Unknown material must be disposed of as hazardous waste if any hazardous waste is found on-site.

The following drum labeling procedures are to be adhered to:

- Field staff shall secure packing list envelopes to the side of the drum(s) at the completion of a boring.
- Field staff shall print with an indelible marker on information cards all information pertaining to the contents of the drum(s). If more than one drum is collected from the same borehole, each information card shall be numbered sequentially in parenthesis starting with the number one after the boring number. The information shall include:
    - Program Area
    - Boring No.(s)
    - Date collected
    - Description of contents (i.e., soil cuttings, well water, etc.)
    - Amount of contents (specify in inches)
    - Fullness of drum (not including free liquid, specify in fractional form)
- Field staff shall insert information card into packing list envelope. The packing list envelope shall be sealed at this time.
- Field staff shall record in field logbook all information pertaining to the contents of the drum that was printed on the information card.

- Project manager, upon receipt of the analytical data for the drums, shall prepare a summary table of the analytical results on a weekly basis, and provide to the designated coordinator.
- Based on the tabulated information, the designated coordinator will determine and prepare the appropriate storage labels required:
  - Hazardous waste label
  - Non-hazardous label
- The designated coordinator will fill out these labels.
- Field staff shall attach these labels to the appropriate drums. If the information cards inside the packing list envelopes are damaged, they shall be reprinted at this time.

It is noted that waste material is expected to be transported off-site once testing is completed and disposal requirements are obtained.

3.2.5 Sample Identification

Each sample collected will be designated by an alphanumeric code that will identify the type of sampling location, matrix sampled, and the specific sample designation (identifier). The sample identification for all samples will begin with the Site ID for the site.

The following terminology shall be used for the **soil** sample identification:

SITE ID - BORING/SAMPLE LOCATION ID – DEPTH- DATE

The sample ID for the soil vapor and groundwater samples will then include the sample type designation, followed by the sample number. The following terminology shall be used for the **soil vapor** sample identification:

SITE ID – SV – # - DATE

Where there are shallow and deep samples at a location, the shallow samples will be designated "S" and the deep samples designated "D".

The following terminology shall be used for the **groundwater** sample identification:

SITE ID-GW-MW # - DEPTH- DATE (if necessary) for monitoring well samples
SITE ID-GW-TP# - DEPTH- DATE (for temporary well point or hydro-punch samples)

For sub-slab and indoor/outdoor air samples, the site ID will be followed by the sample type designation, the sample number and then the date. The following terminology shall be used for the **structure** sample identification:

SITE ID-SS-xx-DATE (for sub-slab locations)
SITE ID-IA-xx-DATE (for indoor ambient air)
SITE ID-A-xx-DATE (for outdoor ambient air)

Field blank and **trip blank** samples will be designated as follows:

SITE ID-FB-DATE (for field blanks)
SITE ID-TB-DATE (for trip blanks)

Field **duplicates** will be designated by using the next consecutive sample number for the site.

3.3 Chain of Custody Procedures

This section describes the procedures used to ensure that sample integrity and COCs are maintained throughout the sampling and analysis program.

COC procedures provide documentation of sample handling from the time of collection until its disposal by a licensed waste hauler. This documentation is essential in assuring that each sample collected is of known and ascertainable quality.

The COC begins at the time of sample collection. Sample collection is documented in the field logbooks in accordance with the specified Standard Operating Procedure (SOP). At the same time, the sampler fills out the label on the sample container with the following information:

Sample ID code

- Required analyses
- Sampler initials
- Date and time of sample collection

3.3.1 Chain of Custody Forms

The COC forms are a paper trail system that follows the samples collected and indicates which laboratory analyses are to be performed on which samples. Each sample should be clearly labeled and listed on the COC. The laboratory will only perform analyses on samples indicated and all other samples should be indicated with a "HOLD" designation. By labeling a sample "HOLD", the laboratory will store the sample until further instruction is given. Do not check the request for analysis blocks on the COC for samples designated with "HOLD" Status. Never indicate duplicate or blank samples on a COC.

It is the responsibility of the field manager to coordinate COC forms and supply copies of all COC to the project manager for data management use.

A COC form is filled out for each sample type at each sampling location. Each time the samples are transferred to another custodian or to the laboratory, the signatures of the people relinquishing the sample and receiving the sample, as well as the time and date, are documented. Labels will be filled out with an indelible, waterproof, marking pen.

3.3.2 Chain of Custody Records

The COC record is a three-part form. The laboratory retains the original form and the person relinquishing the samples keeps a copy of the form at the time of sample submittal. This form is then returned to the project manager or person in charge of data coordination.

The COC record will be placed in a Ziplock bag and placed inside of all shipping and transport containers. All samples will be hand delivered or shipped by Federal Express to the laboratory identified for the project . Samples should be packed so that no breakage or leakage will occur (e.g. placed upright in the cooler surrounded by packing materials). Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

3.4 Field Quality Control Samples

In order to maintain QA/QC in both the field and the laboratory, additional samples such as trip blanks, duplicates, field blanks, performance evaluation samples and background samples will be collected. Each type of QA/QC sample is described below. Details of the QA/QC samples collected will be provided to the project data validator for use in their evaluation.

3.4.1 Quality Control for Soil Sampling

At a minimum, five percent of all soil samples analyzed should be QA/QC samples. These samples act as a verification of appropriate field and laboratory procedures. These samples should be recorded in the field book but should not be identified on the COC form other than with an MD (Miscellaneous Discrete). All QA/QC samples should be numbered sequentially with other field samples on the soil log form. The following is a breakdown of types of QA/QC samples that are to be taken:

3.4.1.1 Duplicate Samples

At minimum, field duplicate samples should be collected at a frequency of one per twenty soil samples analyzed. Soil duplicates shall be field-homogenized samples, excluding VOCs. To ensure laboratory "blind" analyses, duplicate samples will be identified with the next sequential sample number on sample containers and the COC forms. The actual identification of the duplicate samples shall be recorded in the field logbook. Duplicate samples are collected from the same split spoon sampler, homogenized in the field and analyzed for the same compounds.

3.4.1.2 Field Blanks

Approximately five percent of all soil samples analyzed should be field blanks. Rinsate blanks are collected after a sample is taken and the equipment used (i.e., split spoon sampler) has been decontaminated. Distilled water is then poured over the decontaminated sampling equipment and collected in sample jars for analysis. It should be documented in the field logbook which soil sample preceded the field blank and which soil sample followed the field blank for the equipment used.

3.4.2 Quality Control for Soil Vapor and Air Sampling

Approximately five percent of all soil vapor (including sub-slab soil vapor) samples analyzed should be duplicate samples. Soil vapor duplicates will be collected in a manner so that the sample and duplicate are being collected simultaneously from the same sample location. One duplicate indoor air sample will be collected per site where indoor air sampling is being conducted. Duplicate outdoor air samples will be collected only at the sites where indoor air sampling is also being conducted. Duplicate samples are analyzed for the same compounds. All Summa canisters must be certified to be free of contaminants in accordance with QA/QC protocol.

3.4.3 Quality Control for Groundwater Sampling

Approximately five percent of all groundwater samples analyzed should be QA/QC samples. These samples act as a verification of appropriate field and laboratory procedures. These samples should be recorded in the field book but should not be identified on the COC form as a QA/QC sample. All QA/QC samples should be numbered sequentially with other field samples. The following is a breakdown of types of QA/QC samples that are to be taken:

3.4.3.1 Duplicate Samples

Approximately five percent of all groundwater samples analyzed should be duplicate samples.

To ensure laboratory "blind" analysis, duplicate samples will be recorded with the well I.D. number and the next sequential sample number on sample containers and the COC forms. Duplicate samples should be collected using the same method as the parent sample and analyzed for the same compounds.

3.4.3.2 Trip Blanks

Each cooler packed and shipped for aqueous VOC analysis should also contain a trip blank. Trip blanks are VOC vials filled with distilled water. These pre-filled vials are to be carried with the sample bottles and samples and should remain sealed the entire time. It should be documented in the field book which aqueous samples were collected and transported with the trip blank.

3.4.3.3 Field Blanks

One field blank sample will be collected per day of sampling. Field blanks are collected after a sample is taken and the equipment used (i.e., bailer) has been decontaminated. Distilled water is then poured over the decontaminated sampling equipment and collected in sample jars for analysis. It should be documented in the field logbook which groundwater sample preceded the field blank and which sample followed the field blank for the equipment used.

3.5 Pre-Mobilization

Prior to initiating fieldwork, the following preparatory activities will be completed:

- Utility clearance and permitting. The drilling subcontractor is responsible for contacting the appropriate local utility or "one-call" service to locate subsurface and aboveground utilities in the vicinity of the soil gas survey area.
- Site-specific issues resolved.
- Site-specific HASP completed and approved.
- Geophysical survey completed, as necessary.
- Sample analysis will be scheduled with the laboratory.
- Appropriate sample containers and preservatives for the various sample parameters will be obtained. Extra containers will be obtained to account for possible breakage.

- Field blank water will be obtained from the laboratory performing the analysis. This water shall be specified as VOC free water.

- Necessary field sampling and monitoring equipment will be obtained. Prior to use, the equipment will be checked to confirm that it is in good working condition, properly calibrated, and decontaminated. The suggested field equipment for the procedures detailed in Sections 3.6 through 3.34is listed in Table 3-1.

- Materials necessary for personal protection and decontamination will be obtained.

- Coordinate with subcontractors and all Task Orders completed and signed.

3.6 Direct Push Groundwater Sampling

3.6.1 Macro Core Sampling

Direct push methods will be used to collect 48 or 60 inch macro-core samples continuously at each of the groundwater sample locations. The samples will be used by the CDM Smith engineer, geologist, or field scientist to determine the depth to groundwater at each location. Once saturated soil is verified, a screen point groundwater sampler will be set approximately 5 feet into the water table. The depth to water will be used to determine the depth of the soil vapor probes.

3.6.2 Purge and Sampling

Standard purge techniques will be utilized to purge and sample groundwater. Standard purge and sampling techniques consist of using a check valve and tubing to purge the well at a low flow rate. The check valve intake is set approximately in the middle of the screen. The well is purged at the low rate until the water flows clear or the turbidity is reduced to 50 nephelometric turbidity units (NTUs) or less, or to a level deemed acceptable by NYSDEC. The sample is then collected directly from the tubing or bailer.

3.6.3 Direct Push Groundwater Sampling Procedure

Personal protective equipment will be donned in accordance with the requirements of the site-specific HASP.

- Assemble the screen point groundwater sampler.

- Attach the mill-slotted screen point groundwater sampler, onto the leading probe rod.

- Thread the drive cap onto the top of the probe rod and advance the sampler using either the hydraulic hammer or hydraulic probe mechanism. Replace the 30 centimeter (cm) rod with the 90 cm rod as soon as the top of the sampler is driven to within 15 cm of the ground surface.

- Advance the sampler to the interval to be sampled using the hydraulic hammer. Add additional probe rods as necessary to reach the specified sampling depth.

- Move the probe unit back from the top of the probe rods and remove the drive cap.
- Attach the pull cap to the top probe rod, retract the probe rods, push the screen into the formation, remove extension rods from the probe rods, and measure and record the water level, allowing time for the water level to reach equilibrium.
- Purge the groundwater until the water flows clear or the turbidity has been reduced to 50 NTUs or less. If the well is purged dry, the sample may be collected after the well recharges.
- Collect the samples using a check valve and flexible tubing system.
- Label and store samples. Samples will be preserved, labeled, and placed immediately into a cooler and maintained at 4°C throughout the sampling and transportation period.

  Samples should be labeled, recorded on the COC and shipped according to the proper procedures. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

3.7 Soil Vapor Sampling

Soil vapor sampling will be conducted in accordance with the New York State Department of Health (NYSDOH) "*Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006,"* including the May 2017 Updates to Soil Vapor/Indoor Air Decision Matrices, and the NYSDEC "*DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010".*

3.7.1 Soil Vapor Probe Installation

A soil vapor probe installation at all locations will be performed according to the following procedures:

- At each location, a Geoprobe will be used to drive stainless steel rods equipped with detachable stainless steel drive points to the desired depth (approximately 8 feet bgs).
- Once the probe is in place, retract the drive rod slightly to expose a 6 inch sampling screen and sampling port. Insert Teflon®-lined tubing through the rods and attach it to the soil gas probe just above the tip.
- Seal the probe at the surface using electrical conduit putty or non-shrink bentonite grout.
- The borehole will then be backfilled with sand to a minimum depth of 6 inches above the screen interval.
- Bentonite slurry will then be placed from approximately 6 inches above the screen to the ground surface and immediately hydrated. The bentonite will be allowed to set-up for a minimum of 24 hrs.
- Repeat steps 1 through 4 at a second co-located borehole to the second depth (~2 feet above the water table).

3.7.2 Tracer Testing

Tracer tests will be conducted at fifty percent of soil vapor locations to verify the integrity of the soil vapor probe seal. Tracer tests will be conducted according to the following procedures:

- Set up the tracer test apparatus by first sealing the open area around the Teflon®-lined tubing with wax or bentonite.
- A bucket is then placed upside down over the borehole with the tubing coming out through a hole at the top.
- Helium will then be injected through a hole near the bottom of the bucket to enrich the atmosphere to at least 80 percent helium. The concentration of helium inside the bucket will be monitored by a helium detector located at a second hole near the bottom of the bucket.

  Once the atmosphere is enriched to the appropriate concentration, the helium detector will then be used to monitor the concentration coming out of the tubing from the borehole located at the top of the bucket. If the reading is below 10 percent tracer gas, the probe seal is sufficient; proceed with sampling, as described in the following sections. If the reading is above 10 percent tracer gas, the probe seal is insufficient; reseal the probe surface with bentonite and repeat the tracer test until the reading is below 10 percent tracer gas.

3.7.3 Soil Vapor Sampling Procedures for Laboratory Analysis

Once the soil gas probe is installed and a tracer test is conducted, soil gas samples for laboratory analysis will be collected according to the following procedures:

- The soil vapor samples will be collected using a laboratory-certified clean Summa canister with a regulator ensuring that the sample flow rate less than 200 milliliters per minute (ml/min) to minimize outdoor air infiltration during sampling. The Summa canisters will have a vacuum of 28 inches mercury (in Hg) ± 2 inches prior to the collection of the soil vapor sample.
- Calculate the volume of the tubing including the screen interval as part of the volume. The tubing has an inside diameter of ¼ inch and a volume of 9.65 ml/foot.
- Attach the vacuum pump and purge at least 3 tube volumes from the Teflon®-lined tubing.
- A Tedlar™ bag will be filled toward the end of the purge volume to be screened using the PID meter. The PID readings will be observed and recorded on the appropriate field form.
- After purging is complete, the tubing will be connected to the Summa canister.
- Record the initial pressure in the stainless steel Summa canister to be used for the sample prior to connecting the tubing. The samples will be collected using laboratory-certified clean Summa canisters with flow regulators and a vacuum of 28 inches Hg, ± 2 inches. Vacuum readings in the canister should be approximately 25-30 inches of Hg. If no vacuum reading is obtained, use a different canister as this indicates the canister was not properly evacuated.

- Connect the end of the tubing directly to the Summa canister intake valve.
- Collect the sample into the Summa canister, which will be provided by CDM Smith's subcontract laboratory. An additional canister and regulator will be ordered as backup. Sample flow rate will not exceed 200 ml/min.
- When the vacuum gauge reads 5 inches Hg, close the valve. Sampling is complete. A vacuum of 5 inches Hg ± 1 inch must be present when sample collection is terminated to prevent contamination during transit. Record the final pressure reading in the Summa canister.
- Field personnel will label, pack and ship the samples to an NYSDOH Environmental Laboratory Approval Program (ELAP) approved laboratory.

  The serial numbers for the Summa canisters and the regulators as well as the initial and ending pressures of each canister will be recorded on the COC and in the logbook. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.
- The field sampling team will maintain a sample log sheet summarizing the following:
  - Sample identification;
  - Date and time of sample collection;
  - Sampling depth;
  - Serial numbers for Summa canisters and regulators;
  - Sampling methods and devices;
  - Purge volumes;
  - Volume of soil vapor extracted;
  - Vacuum of Summa canisters before and after sample collection;
  - Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and
  - COC protocols and records used to track samples from sampling point to analysis

It is critical to ensure that moisture does not enter the Summa canister which can compromise the analytical results.

3.8 Temporary Sub-Slab Soil Vapor Sampling Procedures

Sub-slab soil gas samples for laboratory analysis will be collected according to the following procedures:

- Prior to installation of the sub-slab vapor point, the building floor should be inspected and any penetrations (cracks, floor drains, utility, sumps, etc.) should be recorded. Sub-slab points should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.
- After the slab has been inspected and the location of any subsurface utilities determined, the ambient air surrounding the proposed sampling location will be screened with a PID.
- A hammer drill, equipped with a 1.25-inch diameter drill bit, will be used to advance a hole to a depth of approximately three to 6 inches beneath the slab. When drilling is complete, clean around drilled area.
- Insert tubing constructed with 3/8-inch outer diameter poly, ¼-inch inner diameter Teflon® tubing. The tubing should not extend further than 2 inches into the sub-slab material.
- The annular space between the borehole and the sample tubing will be filled and sealed with electrical conduit putty (or equivalent) at the surface.
- Conduct tracer testing in accordance with the procedures detailed in Section 3.7.2 above.
- The tubing will be connected to a low-flow sample pump. A three-way valve will be used to allow purging of all the lines. Flow rates for both purging and collection must not exceed 200 ml/min to minimize the ambient air infiltration during sampling.
- Approximately 1 liter of gas will be purged from the subsurface point and captured in a Tedlar™ bag using the low-flow pump. PID readings will be observed from this sample and the highest reading shall be recorded on the appropriate field form.
- Record the initial pressure in the stainless steel Summa canister to be used for the sample prior to connecting the tubing. The samples will be collected using laboratory-certified clean Summa canisters with flow regulators and an initial vacuum of 28 inches Hg ± 2 inches. If no vacuum reading is obtained, close the valve and try a new regulator. If no vacuum reading is observed a second time, use a different canister as this indicates the canister was not properly evacuated.
- The end of the tubing will be connected directly to the Summa canister's regulator intake valve via the three-way valve. Flexible silicone tubing will be used at a minimum and as a tubing adapter only. The sample shall be collected with a 6 liter laboratory-certified Summa canister with dedicated regulator lab calibrated for a 24-hour sample collection.
- When the vacuum gauge reads 5 inches of Hg, close the valve. Sampling is complete. A vacuum of 5 inches Hg ± 1 inch must be present when sample collection is terminated to prevent contamination during transit. Record the final pressure reading in the Summa canister.
- CDM Smith personnel will label, pack and ship the samples to an NYSDOH ELAP approved laboratory. The serial numbers for the Summa canisters and the regulators as well as the

initial and ending pressure of each canister will be recorded on the COC and in the field logbook. Custody seals will be placed on all packages containing laboratory samples during shipment.

- Remove the sample port and patch the floor with concrete.

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:

- Historic and current storage and uses of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance).
- 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 sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, Heating, Ventilation, and Air Conditioning (HVAC) system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported.
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, Jerome Mercury Vapor Analyzer, etc.), should be recorded.
- Photograph documentation should be taken of all sample locations and materials stored at each sample location.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should 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, vacuum of canisters before and after samples collected;
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and
- COC protocols and records used to track samples from sampling point to analysis.

3.9 Permanent Port Sub-Slab Soil Vapor Sampling Procedures for Vapor Intrusion

Sub-slab soil vapor samples for laboratory analysis will be collected from permanent sub-slab ports according to the following procedures:

- 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.
- After the slab has been inspected and the location of any subsurface utilities determined, the ambient air surrounding the proposed sampling location will be screened with a PID.
- A hammer drill with a 3/8 inch diameter drill bit will be used to drill an inner pilot hole into the concrete slab to a depth of approximately 2 inches.
- Using the pilot hole as the center, drill 1 inch diameter outer hole to an approximate depth of 1 3/8 inch.
- Clean any cuttings out of the hole.
- Using the 3/8-inch drill bit, continue to drill the pilot hole through the slab and several inches into the sub-slab material.
- Assemble the stainless steel permanent point:
    - Determine the length of stainless steel tubing required to reach from the bottom of the outer hole, through the slab, and into the open cavity below the slab. To avoid obstruction of the probe tube, insure that it does not contact the sub-slab material.
    - Attach the measured length of ¼ inch OD stainless tubing to the female connector with the swagelock™ nut and tighten the nut.
    - Insert the ¼ inch hex socket plug into the female connector. Tighten the plug. Do not over tighten.

- Place the completed probe into the outer hole. The probe tubing should not contact the sub-slab material and the top of the female connector should be flush with the surface of the slab and centered in the outer hole.

- Fill the space between the probe and the inside of the outer hole with anchoring cement and allow to cure.

- Wrap one layer of Teflon thread tape onto the NPT end of the male connector.

- Remove the ¼ inch hex socket plug from the female connector.

- Screw and tighten the male connector into the female connector.

- A length of Teflon®-lined tubing is attached to the probe assembly and connected to the sample system for purging and sample collection.

- A three-way valve will be used to allow purging of all the lines. Flow rates for both purging and collection must not exceed 100 ml/min to minimize the ambient air infiltration during sampling.

- Purge at least 3 volumes from the subsurface probe and captured in a Tedlar™ bag using a 60 cc syringe. PID readings will be observed from this sample and the highest reading shall be recorded on the appropriate field form.

- Record the initial pressure in the stainless steel Summa canister to be used for the sample prior to connecting the tubing. The samples will be collected using laboratory certified clean Summa canisters with flow regulators and a vacuum of 28 inches Hg ± 2 inches. Vacuum readings in the canister should be approximately 25-30 in Hg. If no vacuum reading is obtained, use a different canister as this indicates the canister was not properly evacuated.

- The end of the tubing will be connected directly to the Summa canister's regulator intake valve via the three-way valve. Flexible silicone tubing will be used at a minimum and as a tubing adapter only. The sample shall be collected with a 6 liter laboratory certified Summa canister with dedicated regulator lab calibrated for a 24 hour (unless otherwise specified in the project-specific work plan) sample collection.

- Collect the sample into the Summa canister, which will be provided by the subcontracted laboratory.

- When the vacuum gauge reads 5 inches Hg, close the valve. Sampling is complete. A vacuum of 5 inches Hg ± 1 inch must be present when sample collection is terminated to prevent contamination during transit. Record the final pressure reading in the Summa canister.

- CDM Smith personnel will label, pack and ship the samples to an NYSDOH ELAP-approved laboratory. The serial numbers for the Summa canisters and the regulators as well as the initial and end pressure of each canister will be recorded on the COC. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

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:

- Historic and current storage and uses of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance).
- 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 sampling 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), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported.
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should 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 are used, vacuum of canisters before and after samples collected;
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and
- COC protocols and records used to track samples from sampling point to analysis.

3.10 Indoor (Ambient) Air Sampling Procedures Vapor Intrusion

All indoor air samples will be collected with a 6 liter laboratory certified Summa canister regulated for a 24 hour sample collection. Sample collection will be similar to outdoor ambient air sample collection. The Summa canister will be placed in an appropriate location as to collect a representative sample from the breathing zone at 4 or 6 feet above the floor. Personnel should avoid lingering in the immediate area of the sampling device while samples are being collected.

The NYSDOH *Indoor Air Quality Questionnaire and Building Inventory* shall be completed for each structure where indoor air testing is being conducted. The following actions should be taken to document conditions during indoor air sampling and ultimately to aid in the interpretation of the sampling results:

- Historic and current uses and storage of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance).
- A product inventory survey documenting sources of volatile chemicals present in the building during the indoor air sampling that could potentially influence the sample results should be completed.
- 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 sampling 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), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported.
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should 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;
- Volume of air sampled;
- Vacuum of canisters before and after samples collected; and
- COC protocols and records used to track samples from sampling point to analysis.

3.11 Outdoor (Ambient) Air Sampling Procedures for Vapor Intrusion

All outdoor air samples will be collected with a laboratory certified Summa canister regulated for a 24 hour sample collection using a 6 liter Summa canister. The Summa canister will be placed in an appropriate location as to collect a representative sample from the breathing zone at 4 or 6 feet above the ground.

Personnel will avoid lingering in the immediate area of the sampling device while samples are being collected. Ambient air samples will be collected in a location that will not be impacted by any boring or dust generating activities.

The following actions will be taken to document conditions during ambient air sampling:

- Outdoor plot sketches will be drawn that include the building site, area streets, ambient air sample locations, the location of potential interferences, compass orientation, and paved areas.
- Weather conditions (e.g. precipitation, temperature, wind direction and barometric pressure)
- Any pertinent observations, such as odors, reading from field instruments, and significant activities in the vicinity (e.g. operation of heavy equipment) will be recorded.

The field sampling team will 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;
- Volume of air sampled;
- Vacuum of canisters before and after samples collected; and
- COC protocols and records used to track samples from sampling point to analysis.

3.12 Decontamination

All non-dedicated, non-disposable sampling equipment and tools used to collect samples for chemical analysis will be decontaminated prior to and between each sample interval using an Alconox rinse and potable water rinse prior to reuse. Unless disposable sampling equipment is used, the equipment will be decontaminated by the following procedure:

- Wash with a non-phosphate detergent
- Tap water rinse
- Deionized water rinse
- Air dry and wrap in aluminum foil, shiny side out

Additional cleaning of the drilling equipment with steam may be needed under some circumstances if elevated levels of contamination appear to be present using field monitoring equipment or if there are visible stained soils. Decontamination fluids will be discharged to the ground surface unless visible sheen or odor is detected either on the equipment or the fluids, at which point the decontamination water will be contained in a 55 gallon drum, staged, labeled and properly disposed of.

3.13 Investigative Derived Waste

All IDW such as drill cuttings and other soil generated during investigation activities, shall be handled in accordance with DER-10 Section 3.3 (e). Transport, storage and disposal of IDW are generally subject to one or more solid or hazardous waste regulations (e.g. 6 New York Codes, Rules, and Regulations (NYCRR) Parts 360,364 and 370 series). All material from onsite activities, with the exception of test pits, is considered hazardous and must be containerized and properly stored onsite for offsite disposal.

Test pit material may be placed back into the hole if the material is from the same general strata from which it was removed and there is no non-aqueous phase liquid (NAPL) or free product present.

Investigation derived water/fluid resulting from well development or well purging before sampling must be collected, handled and discharged/disposed of pursuant to applicable guidance and regulations. It shall be properly labeled and stored onsite. If the water/fluid meets any of the following criteria, it must be properly disposed of offsite:

- Visual evidence of contamination, consisting of discoloration, sheens, free product or NAPL.
- Olfactory evidence of contamination.
- Concentrations of contaminants of above groundwater standards at levels of concern that are known to be present in the monitoring wells based on previous sampling of groundwater.

If none of the conditions above apply, the containerized water/fluid may be discharged to an unpaved ground into the same groundwater unit, within or adjacent to a source area in a manner which does not result in surface water runoff, with DER approval.

3.13.1 Waste Sampling

Waste classification sampling will occur before the completion of site investigation activities. Representative soil samples will be collected from waste containers with a decontaminated stainless steel or disposable trowel.

The samples will be homogenized (except for VOC samples) in a stainless steel bowl and transferred to the sample container(s) for subsequent analysis. Grab samples will be collected from each container containing aqueous wastes.

The requirements for waste characterization will be determined by the disposal facility. The containers of waste will be stored in an area designated by NYSDEC until the analytical results are received and the waste can be characterized for disposal.

3.13.2 Waste Sampling Procedure

3.13.2.1 Soil Waste

- Scan the sample with the PID and record readings.
- Collect a sample of the soil from the container using a decontaminated stainless steel or disposable trowel and place the sample in a stainless steel bowl (for VOC samples, place sample directly in the sample container). Homogenize the soil using the trowel. Samples will be collected and homogenized in the steel bowl to represent each drum.
- Remove the cap from the container.
- Fill the sample container as completely as possible by transferring the sample to the container immediately after collected the sample with a stainless steel trowel, and screening the sample with the PID.
- Close the sample container tightly.
- Label the container and place it in a cooler with bagged ice sufficient to cool the samples to 4°C.

- Maintain COC forms for samples.
- Log the description of IDW sampled in the field book, i.e. number of drums and locations from which IDW originated.

3.13.2.2 Aqueous Waste

- Remove the cap from the drum containing the aqueous waste.
- Fill a sample container(s) as completely as possible by transferring liquid sample from the waste container to the sample container and screening the sample with a PID.
- Close the sample container(s) tightly.
- Place sample container(s) in cooler with bagged ice sufficient to cool the samples to 4°C.
- Maintain COC forms.

3.14 Soil Boring Logs/Geoprobe

Geological logging includes keeping a detailed record of drilling (or excavating) and a geological description of materials on a prepared form.

Geological logs are used for all types of drilling and exploratory excavations and include descriptions of both soil and rock. Accurate and consistent descriptions are imperative.

3.14.1 Log Form

When drilling in soils or unconsolidated deposits, the log should be kept on a standard Soil Boring Log Form (Appendix A). The following basic information should be entered on the heading of each log sheet:

- Project name and number
- Boring or well number
- Locations (approximate in relation to an identifiable landmark; will be surveyed)
- Elevations (approximate at the time; will be surveyed)
- Name of drilling contractor
- Drilling method and equipment
- Water level
- Start and finish (times and date)

The following technical information is recorded on the logs:

- Depth of sample below surface
- Sample interval

- Sample type and number
- Length of sample recovered
- Standard penetration test (American Society of Testing Materials (ASTM-D1586)) results, if applicable
- Soil description and classification
- Graphic soil symbols
- PID readings

In addition to the items listed above, all pertinent observations about drilling rate, equipment operation, or unusual conditions should be noted. Such information might include the following:

- Size of casing used and method of installation
- Rig reactions such as chatter, rod drops, and bouncing
- Drilling rate changes
- Material changes
- Zones of caving or heaving

3.14.2 Soil Classification

The soil description should be concise and should stress major constituents and characteristics. Soil descriptions should be given in a consistent order and format. The following order is as given in ASTM D2488:

- Soil name. The basic name of the predominant constituent and a single-word modifier indicating the major subordinate constituent.
- Gradation or plasticity. Granular soil (sand or gravel) should be described as well graded, poorly graded, uniform, or gap-graded, depending on the gradation of the minus 3 inch fraction. Cohesive soil (silts or clays) should be described as non-plastic, slightly plastic, moderately plastic, or highly plastic, depending on the results of the manual evaluation for plasticity as described in ASTM D2488.
- Particle size distribution. An estimate of the percentage and grain-size range of each of the soil's subordinate constituents with emphasis on clay-particle constituents. This description may also include a description of angularity. This parameter is critical for assessing hydrogeology of the site and should be carefully and fully documented.
- Color. The color of the soil using Munsell notation.
- Moisture content. The amount of soil moisture, described as dry, moist, or wet.

- Relative density or consistency. An estimate of density of a granular soil or consistency of a cohesive soil, usually based on standard penetration test results (see **Table 3-2** and **Table 3-3).**

- Local geologic name. Any specific local name or a generic name (i.e., alluvium, loess). Also use of Unified Soil Classification System of symbols.

The soil logs should also include a complete description of any tests run in the borehole; placement and construction details of piezometers, wells, and other monitoring equipment; abandonment records; geophysical logging techniques used; and notes on readings obtained by air monitoring instruments.

- Additional data in sedimentary rocks includes:
  - Sorting
  - Cementation
  - Density or compaction
  - Rounding

The core should be logged as quickly as possible after removal from the hole. Some materials may degrade rapidly upon exposure.

Check each core end carefully and try to determine if the fracture is natural or mechanical in origin. Mechanical fractures often can be identified by their orientation, the absence of secondary coatings or filling and slicken sides, and its fit with the adjacent core piece. If doubt exists, consider it a natural fracture. If it is determined that the fracture is mechanical, consider the two pieces of core as a single piece.

Table 3-2
Relative Density of Non-Cohesive Soil

Blows/Ft	Relative Density	Field Test
0-4	Very Loose	Easily penetrated w/ ½-inch steel rod pushed by hand
5-10	Loose	Easily penetrated w/ ½-inch steel rod pushed by hand
11-30	Medium	Easily penetrated w/ ½-inch steel driven with a 5- lb hammer
31-50	Dense	Penetrated one foot with a ½-inch steel road driven with 5-lb hammer
>50	Very Dense	Penetrated only a few inches with a ½-inch steel rod driven with a 5-lb hammer

Blows/Ft= Blows per foot
lb = pound

Table 3-3
Relative Consistency of Cohesive Soil

Blows/Ft	Consistency	Pocket Penetrometer (TSF)	Torvance (TSF)	Field Test
<2	Very Soft	<0.25	<0.12	Easily penetrated several inches by fist
2-4	Soft	0.25-0.8	0.12-0.25	Easily penetrated several inches by thumb
5-8	Firm	0.50-1.0	0.25-0.5	Can be penetrated several inches by thumb with moderate effort
9-15	Stiff	1.0-2.0	0.5-1.0	Readily indented by thumb but penetrated only with great effort
16-30	Very Stiff	2.0-4.0	1.0-2.0	Readily indented by thumbnail
>30	Hard	>4.0	>2.0	Indented with difficulty by thumbnail

TSF= Tons per square foot

3.15 Monitoring Well Installation

This section provides procedures for well design and well construction to aid in the development of drilling subcontracts. Drilling operation and well development guidelines are presented to aid the reader in the oversight of the installation of monitoring wells.

The principal reason that monitoring wells are constructed is to collect groundwater samples that, upon analysis, can be used to delineate a contaminant plume and track movement of specific chemical or biological constituents.

A secondary consideration is the determination of the physical characteristics of the groundwater flow system to establish flow direction, transmissivity, quantity, etc. The spatial and vertical locations of monitoring wells is important. Of equal importance are the design and construction of monitoring wells that will provide easily obtainable samples and yield reliable, defensible, and meaningful information. In general, monitoring well design and construction follows production well design and construction techniques. However, emphasis is placed on the effect these practices may have on the chemistry of the water samples being collected rather than on maximizing well efficiency.

From this emphasis, it follows that an understanding of the chemistry of the suspected pollutants and of the geologic setting in which the monitoring wells are constructed plays a major role in determining the drilling technique and materials used.

3.15.1 Well Siting

The following procedures should be followed:

- Review pertinent proposal sections, specifications, and subcontractor's contracts. Review any regulations governing how, where or when the well is drilled. Review data (supplied by the Client, or any other data available) used for program planning.

- Identify well site on a topographic map or other suitable project base map. Contact landowner at the beginning of well siting. Inquire whether the proposed drill locations will interfere with the landowner's established land use. Unless the property is owned by the client, the landowner is always contacted before entering the property, even if he/she is leasing back the property from the client.

- Check route to confirm a drill rig can access the proposed well site. Plan routes that require the least disturbance of natural vegetation or natural conditions and which would not require grading or other types of work using mechanical equipment.
- The well site should be reasonably level and absent of large boulders or other hazardous obstructions.
- Check to insure absence of buried high-pressure gas, oil or water lines. If any lines are present relocate the well site a safe distance away from them. Be sure to check with the subcontractor to insure his/her agreement.
- Check to insure absence of overhead power transmission lines. If any overhead power lines are present, relocate the well site a safe distance away from them. Be sure to check with the subcontractor to insure his/her agreement.
- Consult landowner about water source and access, and then notify the driller of these decisions.
- Explain to the driller the need for care and accurate retrieval of drill cuttings and, if necessary, placement and accounting of materials during well completion.
- If necessary, request access agreement to the well site.

3.15.2 Well Design

The following procedures should be followed:

- Examine the geophysical log and determine the exact interval(s) and depth(s) of the completion zone(s). Calculate the quantity of slotted casing or screen, blank casing, sealing materials, gravel pack and cement necessary to complete the well.
- Calculate the quantities of gravel pack, sealing materials and cement figuring the volume of the bore hole [borehole radius squared time the length of the borehole (rB2 x L)] minus the volume of the casing [radius of the casing squared times the length of the casing (rC2 x L)] which will yield the volume per linear foot.
  - A cubic foot of silica sand weighs 100 pounds. Frequently silica sand is packaged in 100 pound sacks but should be purchased and delivered in bulk quantities. A 5-gallon bucket is equal to 0.67 cubic feet. Dividing the determined or calculated volume between the well bore and the outside of the casing(s) into 0.67 cubic feet per bucket will yield approximately the number of feet per bucket of silica sand. Dividing the total interval of the intended gravel pack by the number of feet per bucket of gravel pack will yield approximately how many buckets of gravel will be required. This same method can be used if the silica sand arrives in 1 cubic foot sacks (100 pounds) except the final value is approximately the number of feet per sack of silica sand.

- Cement typically comes in 94 pound sacks and can be mixed in the field to obtain volumes between 0.88 cubic feet per sack to 1.50 cubic foot per sack. See **Table 3-4** for the most common cement slurry mixtures.

- Clay seals are routinely placed in a well completion above the gravel or filter pack and below the cement or grout cap or plug. The clay seals are generally a bentonite clay and, before swelling (in the borehole), has the form of ¼ inch to ½ inch pellets. The pellets generally come in plastic containers of 20 and 50 pounds, but can also arrive in boxes or cloth sacks.

Table 3-4
Monitoring Well Grout

Water Cement Ratio (gallons water per sack)	Weight per Gallon of Slurry (pounds)	Volume of Mixture per Sack (cubic feet)
7 1/2	14.1	1.50
7	14.4	1.43
6 ½	14.7	1.35
6	15.0	1.28
5 ½	15.4	1.21
5	15.8	1.14
4 ½	16.25	1.08
4	16.50	1.00
3 ½	17.35	0.95
3	18.1	0.88

The volume of the bentonite pellets needed for a specific seal thickness is calculated in the same manner as was done for the gravel pack and cement requirements.

Measure all materials twice during the well construction. First, when estimating the quantity of supplies needed for the completion, second, during well construction. Keep the first estimate in the daily log book. Record the following; the actual (second measurement) intervals top and bottom), as well as the quantity and type of materials placed in the well. recorded

3.15.3 Well Construction

The following procedures should be followed:

3.15.3.1 Final Design of Casing - Screen/Slotted Casing String(s)

- If there is any doubt about the final design of the casing string, based on data from the pilot hole or the individual drill holes scheduled for completion, verify the design with the hydrogeologist in charge.

- It is the hydrogeologist's responsibility to insure adequate supplies are maintained at each well site even though it may be the contractor's responsibility for supplying the materials.

3.15.3.2 Installing Casing (Slotted/Screen Casing String(s))

- Plastic or Polyvinylchloride (PVC) Casing - Join all 5 or 10 foot lengths of casing (solid and slotted screen) by flush-joint threading. All pipe is cut with a cutting tool which leaves a smooth, square end.

- Both the hydrogeologist and the contractor keep a complete casing-slotted/screen string tally. Seal the bottom of the casing or slotted/screen casing string with a cap screwed permanently in place.

3.15.3.3 Installing Filter Material (Gravel Pack)

- Place the filter material downhole by gravity feed.

- The filter material shall be installed to levels pre-determined by the hydrogeologist. The exact depth for each well is determined from the final well design. However, generally the top of the filter material will be 5 feet above the top of the highest slotted screen interval.

- Following placement of the filter material "sound" or "tag" this depth with the tremie pipe to insure it is at the prescribed level.

3.15.3.4 Installing Bentonite Pellet Seals (Blanket)

Following the installation of the filter material, place a Bentonite pellet blanket seal on top of the filter material to prevent contamination of the filter pack by the grout.

The actual amount of the annulus that is filled with Bentonite pellets may vary from completion to completion but a minimum of 12 inches of the annulus should be filled with Bentonite by gravity feed from the surface. The tremie pipe remains in the bore hold during gravity feed of the Bentonite pellets. Calculate the exact volume of pellets needing placement.

3.15.3.5 Grouting

- Grout the annular space above the Bentonite pellets as directed by the hydrogeologist.

- The grouted volume of annular space will vary from well to well, and sometimes within the same completion. Generally, if the annular space exceeds approximately 20 feet then the grouting is done in more than one stage. Take care that the grout does not displace the Bentonite seal or exceed (in weight) the collapse strength of the casing.

- The methods for mixing grout in the field vary. The first concern is that the slurry mixture is fluid enough for placement by tremie pipe and heavy enough to give the desired strength and sealing properties required. Reference the table from Halliburton Cementing Tables, 1979 or other suitable source for the amount of water per sack, and then measure accurately into a large tub (water trough) or steel pit. Mix the correct number of bags of cement with the water at a rate which prevents, clotting or settling out of dry, unmixed cement. Usually this procedure is accomplished with a portable pump that sucks the water or cements mixtures in and then expels it under pressure through a hose that is used in a jetting fashion at the opposite end of the tank, pit or trough.

   - Grout also can be mixed using a shovel or hoe. Generally, the grout is placed on the side of the tub, the bag is ruptured, and the cement is slowly added to the water. If the cement has hard spots place on a screen of approximately ¼ inch mesh attached to some type of frame that is placed across the mixing tub. The cement is then "filtered" for the larger; hard pieces or blocks.

- Pumping or Pouring Grout

   - Place the mixed grout above the Bentonite pellets. The time between placement of the Bentonite pellets and the grout should not be less than 15 to 20 minutes. This allows the pellets to settle to the top of the gravel pack and to begin to swell, while not allowing the grout to harden.

   - The grout can either be pumped down the tremie pipe by the same pump used for jetting or it can be poured by buckets through a funnel into the tremie pipe. Displacement of the bore hole fluid is almost certain because the grout slurry weighs more than the residual borehole fluid (10 or 11 pounds per gallon for the mud versus 14 to 18 pounds per gallon for the grout).

   - Except under rare circumstances, grout is never poured from the surface nor is it ever poured into standing water.

   - Grout the remainder of the hole by gravity feed from the surface, as directed by the hydrogeologist. The quantity of grout placed from the surface should not exceed the collapse strength of the casing and should not be initiated prior to the curing of the grout seal above the Bentonite pellets.

3.16 Monitoring Well Development

All completed wells, whether the production or monitoring type, must be developed in order to facilitate unobstructed and continuous groundwater flow into the well. Well development is the process of cleaning the fines from the face of the borehole and the formation near the well screen. During any drilling process the side of the borehole becomes smeared with drilling mud, clays or other fines. This plugging action substantially reduces the permeability and retards the movement of water into the well screen. If these fines are not removed, especially in formations having low permeability, it then becomes difficult and time consuming to remove sufficient water from the well before obtaining a fresh groundwater sample because the water cannot flow easily into the well.

The development process is best accomplished for monitoring wells by causing the natural formation water inside the well screen to move vigorously in and out through the screen in order to agitate the clay and silt, and move these fines into the screen. The use of water other than the natural formation water is not permitted.

3.16.1 Development Methods

The following well development methods may be used including:

- Surge Block - A surge block is a round plunger with pliable edges such as belting that will not catch on the well screen. Moving the surge block forcefully up and down inside the well screen causes the water to surge in and out through the screen accomplishing the desired cleaning action. Surge blocks are commonly used with cable-tool drilling rigs, but are not easily used by other types of drilling rigs.

- Bailer - A bailer sufficiently weighted that will sink rapidly through the water and can be raised and lowered through the well screen. The resulting agitating action of the water is similar to that caused by a surge block. The bailer, however, has the added advantage of removing the fines each time it is brought to the surface and dumped. Bailers can be custom-made for small diameter wells, and can be hand-operated in shallow wells.

- Surging and pumping - Starting and stopping a pump so that the water is alternately pulled into the well through the screen and backflushed through the screen is an effective development method. Periodically pumping to the surface will remove the fines from the well and permit checking the progress to assure that development is complete.

Well development should continue until the water becomes free of sediment or contains sediment in a lesser amount than was initially present. Conductivity, pH, temperature and turbidity (as measured by a YSI meter or equivalent) of the development water must all have stabilized prior to ceasing development. Disposal of development water shall be in accordance with Section 3.13.

3.17 Low Flow Groundwater Sampling

Low-flow purge and sampling is appropriate at locations where disturbance of the media around the well screen needs to be minimized. A common concern is turbidity in the monitoring wells and the consequent undesirable effects on metals sampling results.

The low-flow purge and sample method creates less disturbance and agitation in the well, and therefore excess turbidity is not generated during the purging and sampling process. The result is a more rapid stabilization of turbidity and other parameters (pH, temperature, specific conductivity, oxidation reduction potential (ORP), and dissolved oxygen), and a sample more representative of conditions in the formation is collected.

The low flow purge and sample method consists of using a submersible, peristatic or bladder pump to purge the well at a very low flow rate (0.5 to 1.5 liter/minute). The pump intake is set approximately in the middle of the well screen, with a stagnant water column over the top of the pump. The well is purged at the low rate until the field parameters (temperature, pH, specific conductivity, turbidity, dissolved oxygen, and ORP) have stabilized. The sample is then collected directly from the pump discharge at a low flow rate. Procedures for collecting groundwater sampling using low flow methods are as follows:

- Check and record the condition of the well for any damage or evidence of tampering.

- Remove the well cap.

- Measure well headspace with a PID and record the reading in the field logbook. For wells installed on a landfill, also measure the headspace with a combustible gas indicator.

- Measure and record the depth to water with an electronic water level device and record the measurement in the field logbook. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated). Obtain depth to bottom information from installation information in the field logbook or drilling logs. Calculate volume of the water column by depth of water column times the cross-sectional area of the well.

- Lower pump to desired sampling depth. During purging, monitor the water level and field parameters (temperature, pH, turbidity, specific conductance, ORP and dissolved oxygen) approximately every 3 to 5 minutes or using a flow through cell such as a YSI. Continue monitoring until the water level stabilizes and field parameters have stabilized to within 10 percent (plus or minus 5 percent) over a minimum of three readings. Turbidity and dissolved oxygen are typically the last parameters to stabilize. Note: once turbidity readings get below 10 NTUs, then the stabilization range can be amended to 20 percent (plus or minus 10 percent) over a minimum of three readings.

  - If a flow through cell is not used, readings should be taken in a clean container and the monitoring instrument allowed to stabilize before collection of the next sample. The Horiba instrument takes the readings consecutively and therefore the process to record all the measurements may take longer than five minutes. If so, measurements should be taken as often as practicable.

- Once the water level and field parameters have stabilized, collect the samples from the pump. Collect samples per Section 3.2.2.1.

- Decontaminate equipment in accordance with Section 3.12.

3.18 Monitoring Well Purging

Well purging can be performed on a volume basis or on a field parameter stabilization basis. In both cases, field parameters are recorded; however, for the former case purging is concluded after a target number of well volumes (typically 3 to 5) regardless of whether parameters have stabilized. In the latter case, purging continues until field parameters stabilize within 10 percent.

3.18.1 Volumetric Method of Well Purging

The following steps should be followed when purging a well by the volumetric method:

- Don personal protective clothing and equipment as specified in the site-specific HASP.

- Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.

- Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.

- Calibrate the required field parameter meters according to manufacturer's specifications.
- Determine the depth to static water level and depth to bottom of well casing. Calculate the volume of water within the well bore based on the following well volumes.

Table 3-5
Well Volumes

Well Diameter (inches)	Gallons (per foot)
2	0.16
4	0.65
6	1.5
8	2.6
10	4.1
12	5.9

Note: Record all data and calculations in the field logbook.

- Set up field parameter probes at the discharge orifice or dedicated probe port of the pump assembly or within the flow-through chamber.
- Prepare the pump and tubing, or bailer, and lower it into the casing.
- Remove the number of well volumes specified in the site-specific plans. Generally, three to five well volumes will be required. Field parameters should be measured and recorded, if required by site-specific plans. In low recharge aquifers, the well commonly will be pumped or bailed to dryness before three well volumes of water are removed. If this is the case, there is no need to continue with purging operations. Record pertinent data in the field logbook.
- Remove the pump assembly or bailer from the well, decontaminate it (if required), and clean up the site. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plan.

3.18.2 Indicator Parameter Method of Well Purging

- Don personal protective clothing and equipment as specified in the site-specific HASP.
- Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
- Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.
- Calibrate the required field parameter meters according to manufacturer's specifications.
- Determine the depth to static water level and depth to bottom.
- Set up field parameter probes at the discharge orifice or dedicated probe port of the pump assembly or within the flow-through chamber.

- Assemble the pump and tubing, or bailer, and lower into the casing.
- Begin pumping or bailing the well. Record indicator parameter readings for every purge volume. Maintain a record of the approximate volumes of water produced.
- Continue pumping or bailing until indicator parameter readings remain stable within ±10 percent for three consecutive recording intervals, or in accordance with site-specific plans. Purging should continue until the discharge stream is clear or turbidity becomes asymptotic-low or meets project requirements. In a low recharge aquifer, the well may pump or bail to dryness before indicator parameters stabilize. In this case, there is no need to continue purging. Record pertinent data in the field logbook.
- Remove the pump assembly or bailer from the well, decontaminate (if required), and clean up the site. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plans.

3.19 Groundwater Sampling by Bailer

Groundwater is typically sampled by bailer after purging 3 to 5 well volumes per Section 3.18.

- Don personal protective clothing as specified in the site-specific HASP.
- Prepare the area for sample acquisition. If required, cover ground surface around well head with plastic sheeting.
- Open well head and immediately check for organic vapors with PID or flame ionization detector as appropriate.
- Determine static water level and calculate water volume in well.
- Purge well in accordance with Section 3.18.
- Allow water level to recover to a depth at least sufficient for complete submergence of the bailer without contacting well bottom. Ideally, the water level should recharge to 75 percent of static level. Samples shall be collected within 3 hours of purging if recharge is sufficient. Wells with a low recharge rate must be collected within 24 hours of purging.
- Securely attach the bailer to the line and test the knot. The opposite end of the line should be secured to prevent loss of bailer into well.
- Lower bailer slowly into the water to prevent aeration, particularly when VOC samples are collected.
- Retrieve filled bailer and fill sample bottles in accordance with Section 3.2.2.1.
- Collect required field parameters and depth to water.
- Decontaminate non-disposable sampling equipment in accordance with Section 3.12.
- Secure well, clean up area.

3.20 Well Abandonment

Once it is deemed that the temporary or permanent monitoring well is no longer needed, the well will be abandoned by a New York State certified well driller as follows:

- The well will be sounded (its depth measured with a weighted line or appropriate method) immediately before it is destroyed to make sure that it contains no obstructions that could interfere with filling and sealing. If an obstruction is present over drilling the well to its original depth to remove obstruction(s) may be required.
- Where possible, remove all material within the original borehole – including the well casing, filter pack and annular seal. If the casing, filter pack and annular seal materials cannot be removed, they may be left in place.
- The casing left in place may require perforation or puncturing to allow proper placement of sealing materials. Where the casing is left in the hole, the casing may be cut at the surface.
- Fill well screen with sand per NYSDEC specifications.
- The monitoring well should be filled to the surface with cement grout, or within 20 feet of the surface with Bentonite grout. After the placement of the Bentonite grout (if used), the remaining portion of the well then should be sealed with a Portland Type I, II or Type I/II cement with 2 percent to 5 percent Bentonite.

3.21 Surface Water Sampling

Four surface water sampling scenarios are provided below. These include 1) shallow surface water samples for VOC analysis (preserved and unpreserved), 2) shallow surface water samples for non-VOC or inorganic compound analysis (preserved and unpreserved), 3) deep surface water samples using a weighted bottle sampler and 4) deep surface water samples using a peristaltic pump.

The following steps should be taken when preparing for sampling surface water:

- Don the appropriate personal protective clothing as dictated by the site-specific HASP.
- Identify stream/river sampling locations as directed in work plan.
- Prepare sampling site by laying out clean plastic sheeting on the ground or any flat, level surfaces near the sampling area and place equipment to be used on the plastic.
- Make field measurements as required by the project plans in physical, chemical, and biological characteristics of the water (e.g., temperature, turbidity, dissolved oxygen, conductivity, ORP, pH).
- The samples shall be collected from areas of least to greatest contamination (when known) and, when collecting several samples in 1 day, always collect from downstream to upstream.
- The sampler should be facing upstream when sampling.

- Document the sampling events, recording all information in the designated field logbook and take photographs if required or if possible. Document all deviations from this SOP and include rationale for changes.

3.21.1 Collecting Shallow Surface Water Samples

The following steps must be taken when collecting shallow surface water samples:

- Approach the sample location from downstream; do not enter the sample area. Slowly submerge VOC vials completely into an area of gently flowing water and fill. Do not disturb bottom sediments. The sampler and open end of the vials should be pointed upstream. If wading is necessary, approach the sample location from downstream; do not enter the actual sample area. When using gasoline-powered vessels, make sure the engine is turned off.

- Collect samples per Section 3.2.2.1; if preserved bottles are used, collect sample in a dedicated non-preserved bottle and transfer to the preserved bottle.

Note: When collecting samples for VOC analysis, avoid collecting from a surface water point where water is cascading and aerating. Cap the VOC vial while it is under water. After the vial is capped, check the vial to see if there are any air bubbles trapped in it. If air bubbles are present discard the sample and re-collect.

3.21.2 Collecting Deep Surface Water Samples at Specified Depth Using a Weighted Bottle Sampler

The following steps must be followed when collecting surface water samples at specific depths using a weighted bottle sampler:

- Lower the weighted bottle sampler to the depth specified in the site-specific plan.

- Remove the stopper by pulling on the sampler line; allow the sampler to fill with water.

- Release the sampler line to reseat the stopper and retrieve the sampler to the surface.

- Wipe the weighted bottle sampler dry with a Kimwipe or clean paper towel.

- Remove the stopper slowly. Collect samples per Section 3.2.2.1.

- Decontaminate equipment according to the Section 3.12.

3.21.3 Collecting Deep Surface Water Sample Collection Using a Peristaltic Pump

The following steps must be followed when collecting deep surface water samples using a peristaltic pump:

- Install clean silicon or Teflon®-lined tubing on the pump head. Leave sufficient tubing on the discharge side for convenient dispensing of liquid directly into sample containers.

- Select the appropriate length of Teflon®-lined intake tubing necessary to reach the specified sampling depth. Attach the intake sampling tube to the intake pump tube.
- Lower the intake tube into the surface water at the specified sampling location to the specified depth; make sure the end of the intake tube does not touch underlying sediments.
- Start the pump and allow at least three tubing volumes of liquid to flow through and rinse the system before collecting any samples. Do not immediately dispense the purged liquid back to the surface water body. Instead, collect the purged liquid and return it to the source after sample collection is complete.
- Fill the specified number of sample containers directly from the discharge line, in accordance with Section 3.2.2.1.
- Drain the pump system, rinse it with deionized water, and wipe it dry. Replace all tubing with new tubing before sampling at another sampling location. Place all used tubing in plastic bags to be discarded or decontaminated according to the Section 3.12.

3.22 Sediment/Sludge Sampling

The following steps should be taken when preparing for sampling sediment/sludge:

- Don the appropriate personal protective clothing as dictated by the site-specific HASP.
- Identify stream/river sampling locations in accordance with the site-specific work plan.
- Prepare sampling site by laying out clean plastic sheeting on the ground or any flat, level surfaces near the sampling area and place equipment to be used on the plastic.
- The samples shall be collected from areas of least to greatest contamination (when known) and, when collecting several samples in 1 day, always collect from downstream to upstream.
- When sampling sediment and surface water from the same surface water body, collect surface water samples prior to sediment samples.

3.22.1 Sediment/Sludge Sample Collection from Shallow Waters

- Use a decontaminated stainless steel or Teflon, long-handled scoop, corer, push tube, or dredge to collect the entire sample in one grab. If wading is necessary, approach the sample location from downstream. Do not enter the actual sample area.
- Retrieve the sampling device and slowly decant off any liquid phase.
- Collect samples in accordance with Section 3.2.2.2.

3.22.2 Subsurface Sediment/Sludge Sample Collection Using a Corer or Auger from Shallow Waters

- At the specified sampling location, force or drive the corer to the specified depth.

- Twist and withdraw the corer in a smooth motion.
- Retrieve the sampling device, remove the corer nosepiece (if possible), and extrude the sample into the specified sampling container(s). Use a clean stainless steel or Teflon spoon or spatula to completely fill the container(s), ensuring no headspace.
- Collect samples in accordance with Section 3.2.2.2.

3.22.3 Sediment/Sludge Sample Collection Using a Dredge from Deep Waters

- Attach a clean piece of 12 to 19 mm (½ to ¾ inch) braided nylon line or Teflon-coated wire rope to the top of the sampler. The line must be of sufficient length to reach sediment or sludge and have enough slack to release the mechanism. Mark the distance to the bottom on the line.
- Attach the free end of the sampling line to a fixed support to prevent loss of the sampler.
- At the specified sampling location, open the sampler jaws and slowly lower the sampler until contact with the bottom (sediments/sludge) is felt.
- Release tension on the line; allow sufficient slack for the mechanism (latch) to release. Slowly raise the sampler.
- Once the sampler is above the water surface, place the sampler in a stainless steel or Teflon lined tray or pan. Open the sampler.
- Collect samples in accordance with Section 3.2.2.2.

3.22.4 Restrictions/Limitations

Core sampling devices may not be usable if cobbles exist in the sediment/sludge. Bumping of core sampling devices and Ponar dredge samplers may result in the loss of some of the sample.

For VOC analysis or for analysis of any other compound(s) that may be degraded by aeration, grab sampling is necessary to minimize sample disturbance and, hence, analyte loss. The representativeness of this sample, however, is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

3.23 Subsurface Soil Sampling

Subsurface soil samples may be collected using a hand auger at depths of up to 10 feet (typical). In such cases, CDM Smith typically performs the boring and collects the samples for analysis. For deeper depths, a drilling subcontractor is typically used to perform a boring and collect subsurface soil samples by split spoon or Shelby tube via rotary drilling methods, or by direct push methods. In such cases, the driller provides the soil samples to CDM Smith, and CDM Smith then collects the laboratory samples.

The following steps should be taken when preparing for subsurface soil sampling:

- Don the appropriate personal protective clothing as dictated by the site-specific HASP.

- Locate sampling location(s) in accordance with project documents (e.g., work plan) and document pertinent information in the appropriate field logbook. When possible, reference locations back to existing site features such as buildings, roads, intersections, etc.

- Processes for verifying depth of sampling must be specified in the site-specific plans.

- Clear away vegetation and debris from the ground surface at the boring location.

- Prepare an area next to the sample collection location for laying out cuttings by placing plastic sheeting on the ground to cover the immediate area surrounding the borehole.

The following general steps must be followed when collecting all subsurface soil samples:

- VOC samples or samples that may be degraded by aeration shall be collected first and with the least disturbance possible.

- Sampling information shall be recorded in the field logbook and on any associated forms.

- Describe lithology, including color, grains size, moisture, odor and other observations.

3.23.1 Manual (Hand) Auger Sampling

The following steps must be followed when collecting hand-auger samples:

- Auger to the depth required for sampling. Place cuttings on plastic sheeting or as specified in the site-specific plans. If possible, lay out the cuttings in stratigraphic order.

- Throughout the sampling, make detailed notes concerning the geologic features of the soil or sediments in the field logbook.

- Cease augering when the top of the specified sampling depth has been reached. If required, remove the auger from the hole and decontaminate the auger or use a separate decontaminated auger, then obtain the sample.

- Scan sample with PID, as appropriate.

- Collect samples in accordance with Section 3.2.2.2. Collect VOCs quickly to minimize loss of volatiles.

- When all sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.

- Decontaminate all equipment in accordance with Section 3.12

3.23.2 Split-Spoon/ Split Barrel Sampling

Note: the first 15 bullets describe activities to be performed by a licensed drilling contractor, not CDM Smith personnel.

The following steps must be followed when collecting split-spoon samples:

- Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
- The drilling rig will be decontaminated at a separate location prior to drilling.
- Attach the hollow-stem auger with the cutting head, plug, and center rod(s) to the drill rig.
- Begin drilling and proceed to the first designated sample depth, adding auger(s) as necessary.
- Upon reaching the designated sample depth, slightly raise the auger(s) to disengage the cutting head and rotate the auger without advancement to clean cuttings from the bottom of the hole.
- Remove the plug and center rods.
- If required by the site-specific sampling plan, install decontaminated liners in the split-spoon/split barrel sampler.
- Install a decontaminated split-spoon on the center rod(s) and insert it into the hollow-stem auger. Connect the hammer assembly and lightly tap the rods to seat the drive shoe at the top of undisturbed soil or sediment.
- Mark the center rod in 15 cm (6 inch) increments from the top of the auger(s).
- Drive the split-spoon using the hammer. Use a full 76 cm (30 inch) drop as specified by the ASTM Method D-1586. Record the number of blows required to drive the spoon or tube through each 15 cm (6 inch) increment.
- Cease driving when the full length of the spoon has been driven or upon refusal. Refusal occurs when little or no progress is made for 50 blows of the hammer. ASTM D1586-99 § 7.2.1 and 7.2.2 defines "refusal" as greater than 50 blows per 6 inch advance or a total of 100 blows.
- Pull the split-spoon free by using upswings of the hammer to loosen the sampler. Pull out the center rod and split-spoon.
- Unscrew the split-spoon assembly from the center rod and place it on the plastic sheeting.
- Remove the drive shoe and head assembly. If necessary, tap the split-spoon assembly with a hammer to loosen threaded couplings.
- With the drive shoe and head assembly off, open (split) the split-spoon, being careful not to disturb the sample.
- Scan sample with PID, as appropriate.
- Collect samples in accordance with Section 3.2.2.2. Collect VOCs quickly to minimize loss of volatiles.

- When all sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.
- Decontaminate all equipment in accordance with Section 3.12.

3.23.3 Direct Push Drilling

Note: The first six bullets describe activities to be performed by a licensed drilling contractor, not CDM Smith personnel.

- Decontaminate equipment, if required.
- Install acetate sleeve in direct push sampler (no acetate sleeve required for split-spoon).
- Drive samples from the surface to the desired depth, using either 4 foot or 5 foot long direct push samplers, or 2 foot split-spoons.
- Use discrete interval sampling (sampler end is plugged while driving to top of desired sample interval to exclude soil from non-desired depths) when appropriate (for example, deeper than 8 feet or below the water table).
- At top of sampling interval, release plug (if used) and drive sampler across desired sample interval.
- Retrieve sample and provide to CDM Smith.
- Cut open acetate sleeve with two parallel slices, scan with PID as appropriate.
- Collect samples in accordance with Section 3.2.2.2.
- At the conclusion of the boring, grout the borehole and decontaminate equipment in accordance with Section 3.12.

3.23.4 Restrictions/Limitations

- Basket or spring retainers may be needed for split-spoon sampling in loose, sandy soils.

3.24 Surface Soil Sampling

The following steps must be followed when preparing for sample collection:

- Don the appropriate personal protective clothing as dictated by the site-specific HASP.
- Locate sampling location(s) in accordance with project documents (e.g., work plan) and document pertinent information in the appropriate field logbook. When possible, reference locations back to existing site features such as buildings, roads, intersections, etc.
- Processes for verifying depth of sampling must be specified in the site-specific plans.
- Carefully remove vegetation, stones etc. from the ground surface to expose soil.

- Place clean plastic sheeting on a flat, level surface near the sampling area, if possible, and place equipment to be used on the plastic; place the insulated cooler(s) on separate plastic sheeting.
- A clean, decontaminated trowel, scoop, or spoon will be used for each sample collected. Other equipment may be used (e.g., shovels) if constructed of stainless steel.
- Surface soil samples are normally collected from the least contaminated to the most contaminated areas, if known.
- Document the sampling events, recording the information in the designated field logbook. Document any and all deviations from SOPs in the field logbook and include rationale for changes.
- Collect samples in accordance with Section 3.2.2.2.
- Decontaminate sampling equipment in accordance with Section 3.12.

3.25 Water Level/NAPL Measurement

Water levels can be measured by several instruments. The three most common are covered here – electric water level meter (measures depth to water only), interface probe (measures depth to water and depth to non-aqueous phase liquid NAPL and pressure transducer (typically used to measure depth to water for long term monitoring or aquifer testing).

3.25.1 Procedures for Use of Water Level Meter

- Standing upwind of the well, open the well head and monitor with PID as dictated by the site-specific HASP.
- Check that water level meter is functioning correctly (test button, or immerse probe in tap water to test).
- Lower probe slowly into well until contact with water surface is indicated (tone and/or light).
- Slowly raise and re-lower probe until a precise, repeatable depth to water can be measured.
- Record the depth to water from the measuring point of known elevation, usually marked at the top of the casing. If no mark is present, measure from the highest point of the casing or as otherwise instructed in the site-specific work plan.
- Remove and decontaminate probe, secure well.

3.25.2 Procedures for Use of Interface Probe

The interface meter is used to measure the depth to water and the depth to non-aqueous phase liquid (light and/or dense).

- Standing upwind of the well, open the well head and monitor with PID as dictated by the site-specific HASP.

- Check that the interface level meter is functioning correctly (test button, or immerse probe in tap water and NAPL to test).

- Lower probe slowly into well until contact with water or NAPL surface is indicated. Water is typically indicated by a beeping tone; NAPL is typically indicated by a steady tone – check manufacturer's specifications.

- Slowly raise and re-lower probe until a precise, repeatable depth to water/NAPL can be measured.

- Record the depth to water/NAPL from the measuring point of known elevation, usually marked at the top of the casing. If no mark is present, measure from the highest point of the casing or as otherwise instructed in the site-specific work plan.

- Measurement of interface depth between Light Non-Aqueous Phase Liquid (LNAPL) and water: For LNAPL, the non-aqueous phase is floating on top of the water column, and the probe must be lowered through the NAPL before encountering water. In this case, shake the probe after water is encountered to help dislodge any NAPL droplets stuck to the probe. Then raise the probe slowly until it re-enters the NAPL. Perform this procedure until a repeatable result is obtained. The interface depth should be recorded in the up direction, never the down direction. When the probe is moving down, past the LNAPL, it may still be coated with product and can therefore yield misleading results. Therefore, it must be shaken in the water and raised to the interface for an accurate result. Record depth from measuring point, as noted above.

- Measurement of interface depth between Dense Non-Aqueous Phase Liquid (DNAPL) and water: For DNAPL, the non-aqueous phase is at the bottom of the well, below the water column. Lower the probe until NAPL is encountered. Then raise the probe, shake it in the water to dislodge any NAPL droplets, and lower it again. Perform this procedure until a repeatable result is obtained. The interface depth should be recorded in the down direction, never in the up direction. When the probe is moving up from the DNAPL it may still be coated with product and can therefore yield misleading results. Therefore, it must be shaken in the water and lowered to the interface for an accurate result. Record depth from measuring point, per item 5 above.

- Remove and decontaminate probe, secure well.

3.26 Tap Water Sampling

Tap water sampling may be performed in residential, commercial or industrial areas for several reasons. The most common tap water samples are used to obtain groundwater samples from private wells.

- Obtain permission to access the property and collect samples.

- Obtain the name(s) of the resident(s) or water supply owner/operator, the exact mailing address, and telephone numbers. This information is required to obtain access to the property to be sampled and to submit a letter of introduction to the owner/representative.

- Determine the location of the tap to be sampled based on its proximity to the water source. It is preferable that the tap water sampling be conducted at a tap located prior to any holding or pressure tanks, filters, water softeners, or other treatment devices that may be present.

- If possible, obtain well construction details, holding tank volumes etc. to evaluate standing volume of water in the system.

- If the sample must be collected at a point in the water line beyond a pressurization or holding tank, a sufficient volume of water should be purged to provide a complete exchange of fresh water into the tank and at the location where the sample is collected.

  If the sample is collected from a tap or spigot located just before a storage tank, spigots located inside the building or structure should be turned on to prevent any backflow from the storage tank to the sample tap or spigot. It is generally advisable to open as many taps as possible during the purge, to ensure a rapid and complete exchange of water in the tanks.

- Samples collected to determine if system related variables (e.g., transmission pipes, water coolers/heaters, holding/pressurization tanks, etc.) are contributing to the quality of potable water should be collected after a specific time interval (e.g., weekend, holiday, etc.). Sample collection should consist of an initial flush, a sample after several minutes, and another sample after the system has been purged.

- Devices such as hoses, filters, or aerators attached to the tap may harbor a bacterial population and therefore should be removed prior to sampling.

- Sample containers should not be rinsed before use when sampling for bacterial content, and precautions should be taken to avoid splashing drops of water from the ground or sink into either the bottle or cap.

- Samples of the raw water supply and the treated water after chlorination should be collected when sampling at a water treatment plant.

- In the logbook, record the location and describe the general condition of the tap selected for sampling. The rationale used in selecting the tap sampling location, including any discussions with the property owner, should also be recorded. Provide a sketch of the water supply/distribution system noting the location of any filters or holding tanks and the water supply source (i.e., an onsite groundwater well or surface water intake or a water service line from a public water main). If an onsite water supply is present, observe and record the surrounding site features that may provide potential sources of contamination to the water supply.

- Don the appropriate personal protective clothing as dictated by the site-specific HASP. Gloves should be changed between sampling locations to avoid possible cross-contamination of the tap water samples.

- Prior to sample collection, the supply system should be purged by turning the cold-water tap on. The following general guidelines should be followed to determine when the system is adequately purged (refer to the site-specific sampling plans for any other requirements):

- Onsite Water Supply; A minimum of three standing volumes of water (i.e., the static volume of water in the well and holding tank, if present) should be purged. Obtain water temperature, conductivity, and pH measurements after each volume of water is purged. If the standing volume of water in the supply system is unknown, the tap should be allowed to run for a minimum of 15 minutes and temperature, conductivity, and pH measurements, or other parameters as specified by the project plan, should be collected at approximately 3- to 5-minute intervals. (In general, well construction details and holding tank volumes should be obtained prior to conducting the sampling event to estimate the standing volume of the water supply system.) The system is considered adequately purged when the temperature, conductivity, and pH stabilize within 10 percent for three consecutive readings. If these parameters do not stabilize within 15 minutes, then purging should be discontinued and tap water samples may be collected.

- Large Distribution Systems; Because it is impractical to purge the entire volume of standing water in a large distribution network, a tap should be run for a minimum of 5 minutes, which should be adequate to purge the water service line. Obtain temperature, conductivity, and pH measurements at approximately 1-minute intervals. The system is considered adequately purged when the temperature, conductivity, and pH readings, or other parameters as specified by the project plan, stabilize within 10 percent for three consecutive readings. If these parameters do not stabilize within 5 minutes, then purging should be discontinued and tap water samples may be collected. During purging, a 5 gallon bucket and stopwatch may be used to estimate the flow rate if required by the site-specific plans. Dispose of the purged water according to the site-specific plans.

  Record the temperature/conductivity/pH readings, or other parameters as specified by the project plan, the volume of water purged, the flow rate if measured, and the method of disposal in the field logbook.

- After purging the supply system, collect the samples directly from the tap (i.e., if a hose was used for purging, the hose should be disconnected prior to sampling). Any fittings on the end of the faucet that might introduce air into the sample (i.e., a fine mesh screen that is commonly screwed onto the faucet) should be removed prior to sample collection also.

- Obtain a smooth-flowing water stream at moderate pressure with no splashing. Collect samples in accordance with Section 3.2.2.1 COC forms.

3.26.1 Restrictions/Limitations

To protect the sample from contamination on the exterior of a tap, a tap should not be chosen for sampling if any of the following conditions exist:

- A leaky tap allowing water to flow out from around the stem of the valve handle and down the outside of the faucet.

- A tap located too close to the bottom of the sink or the ground surface.
- A tap that allows water to run up on the outside of the lip.
- A tap that does not deliver a steady stream of water. A temporary fluctuation in line pressure may cause sheets of microbial growth, lodged in some pipe sections or faucet connections, to break loose.

Careful sampling for VOC analysis, or for any other compound(s) that may be degraded by aeration, is necessary to minimize sample disturbance and, hence, analyte loss.

3.27 Sample Handling, Packaging, and Shipping

The shipping containers (coolers or shuttles) will be provided by the laboratory providing the analysis. These containers, once filled, will be secured with fiber tape, wrapped entirely around the container and will either be shipped or delivered directly to the laboratory by the field crew or picked up by a laboratory provided courier. Consequently, the strict packaging, labeling and shipping of hazardous wastes and substances requirements set forth by the U.S. Department of Transportation (DOT) under Code of Federal Regulations (CFR) 49 will not be necessary. However, the following sample packaging procedures will be followed to guard against sample breakage and to maintain COC.

- Check to ensure that the sample is properly filled; tighten cap securely.
- Enclose and seal sample containers in a clear plastic bag.
- Place freezer packages of ice in large ziplock plastic bags and place the bags in a sample cooler so that ice is not in direct contact with sample bottles. Sufficient ice will be added to cool the samples to 4°C.
- Use appropriate packing material such as bubble wrap to protect sample bottles from breaking during shipping.
- Complete COC records and other shipping/sample documentation including air bill numbers for each shipment of samples using a ballpoint pen. Seal documentation in a waterproof plastic bag and tape the bag inside the shipping container under the container lid. Include a return address for the cooler.
- Close the container and seal it with fiber tape and custody seals in such a manner that the custody seals would be broken if the cooler were opened.

3.28 Rock Coring

Rock core will be collected as follows:

- Decontaminate all equipment in accordance with Section 3.12.
- Advance borehole to the desired depth using auger, rotary, air hammer or other drilling method, as appropriate.

- Collect core (using specified core barrel) in accordance with ASTM D2113-06, as appropriate for site conditions.
- Record penetration rate.
- Record any fluid loss and depth of loss.
- Place core in new, sturdy, wooden, core boxes.
- Clearly label boxes with borehole number and depth.
- Drilling/coring induced breaks should be marked with 3 parallel lines across the break.
- Photograph full core box, with hole's number and depths clearly visible in the photo.
- Record core data including rock type, fractures and other pertinent information.
- Determine Rock Quality Designation (RQD) for each core run:

$$RQD = \frac{\text{the total length of core pieces greater than four inches long}}{\text{total core run}}$$

  - Measure core lengths along the center line of the core.
  - Do not count core pieces that are not "hard and sound" as part of the RQD; however, record such lengths separately.
  - Core breaks known to be induced by drilling or core handling should be fitted together and counted as one piece when determining RQD.

3.29 Packer Testing

Packer testing is performed to obtain groundwater samples from discrete intervals within a larger open borehole in bedrock. A dual straddle packer system or single packer system can be used, as appropriate. The single packer is often used when collecting a groundwater sample from near the bottom of the borehole. Inflatable packers, with a submersible pump between the packers (or below the single packer) are typically used. Geophysical logging can be used prior to packer testing to design the packer interval. If packer testing occurs concurrent with drilling, then a single packer is typically used at progressively deeper depths.

Packer testing will be conducted as follows:

- Decontaminate all down hole equipment as needed in accordance with Section 3.12.
- Assemble packer(s) lift pipe and pump. If a straddle packer system will be used, assemble packers at desired spacing.
- Lower packer assembly to desired depth.
- Measure static water level using a water level indicator.

- Inflate packers with nitrogen, with sufficient pressure to seal against borehole wall.
- Calculate volume of water in packer zone and lift pipe using Table 3-5.
- Begin purging with submersible pump; record totalizer readings and flow rates. Contain and dispose of water in accordance with Section 3.13 above and DER-10 Section 3.3 (e).
- Monitor water quality parameters, if appropriate.
- Collect water sample based upon volume of water pumped and/or water quality parameters.
- Deflate packers.
- Move system to next test zone or remove from borehole, as appropriate.
- Decontaminate all down hole equipment prior to demobilization from the site.

3.30 Aquifer Performance Test

Aquifer performance tests are typically performed to characterize the hydraulic properties of wells and aquifers. Properties evaluated include specific capacity, hydraulic conductivity, transmissivity and storativity.

3.30.1 Continuous Background Monitoring

- Baseline groundwater level measurement data will be used to evaluate the effects of outside influences (i.e., influences other than the proposed pump test withdrawal) on groundwater levels. These influences will then be considered when analyzing the pump test data.
- Groundwater level data will be recorded with electronic data loggers at selected well, at 30 minute intervals.
- The loggers will be synchronized to record water levels at the same time.
- A synoptic round of water levels will be made at the wells prior to installing the transducers. After the transducers have been installed and recording has been started, a second round of synoptic water levels will be collected on the day of transducer installation to confirm proper data recording.
- A third round of manual groundwater level measurements will be collected from continuous monitoring points and any other existing wells just prior to beginning pump testing to:
    - Confirm proper data recording by transducers.
    - Obtain a broader baseline groundwater level data set.
- Groundwater level data will also be downloaded from data loggers at this time, saved to electronic media, and reviewed to confirm that groundwater levels have stabilized.

- Precipitation and barometric pressure data will be obtained for the aquifer performance test period from the local weather station (within approximately 5 miles of the project).

3.30.2 Step Drawdown Test

The step drawdown test (or step test) is required to determine the specific capacity and short-term yield of the recovery well and select the pumping rate for the long-term pump test.

- During the test, continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically. An example of a logarithmic schedule is provided on **Table 3-6**.

Table 3-6
Step Drawdown Test Logarithmic Schedule

Log Cycle	Elapsed Time	Sample Interval	Points/Cycle
1	0-20 seconds	0.2 second	101
2	20-60 seconds	1 second	40
3	1-10 minutes	10 seconds	54
4	10-100 minutes	2 minutes	45
5	100-480 minutes	10 minutes	38

- The drawdown versus time data shall be plotted semi-logarithmically.
- The drawdown (y-axis) shall be plotted on a linear scale and time (x-axis) shall be plotted on a logarithmic scale.

  The drawdown curves shall be extrapolated to the specified time of the proposed long-term test. The rate that results in the maximum drawdown without dropping the water level below the design pumping level within the time period of the long-term test shall be considered the flow rate to be used for the long-term test.

- The specific capacity versus pumping rate should also be plotted to determine if excessive well losses occur at the selected rate.
- A variable rate submersible pump capable of operating across the above flow range will be used to complete testing. A vertical check valve will be placed on the discharge line immediately above the pump. A 1 inch diameter polyvinylchloride line will be placed in the well, with the open, bottom end extending to within one foot of the pump. This 1 inch line will be used as the stilling pipe for the water level transducer.

After the pumping equipment is installed, the following testing steps will be followed:

- Step 1 - Connect a flow meter, valve, and sample port to the pump discharge line. Extend the pump discharge line from the pumping well to the existing groundwater treatment system influent sump using flexible, chemical-resistant pipe/hose (e.g., garden hose, polyethylene pipe).

- Step 2 - Measure and record the static groundwater level reading in the pumping well.
- Step 3 – Start log cycle for select transducers, and initiate pumping. Set to initial flow rate (Step 1) using the valve (or variable-speed controller). Record the stabilized flow rate and start time for pumping. Confirm proper operation of the pumping well transducer. Confirm that significant leaks are not present along the above-ground hose/pipeline extending between the pumping well and the influent sump.
- Step 4 - Monitor the groundwater level in the pumping well using the transducer and collect manual groundwater level measurements at monitoring points at ± 20 minute intervals.
- Step 5 - After approximately two hours, calculate the specific capacity of the well (flow/drawdown [gpm/ft]), estimate the maximum well yield based upon the calculated capacity and pump depth, and increase the pumping rate to approximately 50 percent (%) of the calculated maximum yield.
- (Step 2). If 50% of the yield has already been exceeded, adjust the rate to approximately 75% of the yield. Record the flow rate and adjustment time. Confirm proper operation of the pumping well transducer.
- Step 6 – Monitor the groundwater level in the pumping well using the transducer, and collect manual groundwater level measurements at monitoring points at ± 20 minute intervals.
- Step 7 – Repeat Steps 5 and 6 for up to two additional steps at approximately 75% and 95% of the maximum well yield (Steps 3 and 4). Be careful not to drop the water level below the top of the pump.
- Step 8 - Shut off the pump at the end of the last step test (after 4 tests and 8 hours, maximum), and download the groundwater level data from all transducers. Also collect manual groundwater level measurements at approximately 20 minutes and 40 minutes after terminating pump operation. Leave the transducers in place.

3.30.3 Long-Term Constant Rate Test

The long-term constant rate test (72-hour pumping test) will be performed at the pumping well on the day after completion of the step test, assuming groundwater levels have recovered to 90% of baseline values. The 72-hour pump test will not commence until this condition is met or a minimum of 72 hours have elapsed since the termination of the step testing. The step test results will be reviewed in advance and used to select the pumping rate for this test, which will equate to approximately 50 to 75% of the calculated short-term, maximum well yield.

- During this test, continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically. An example of a logarithmic logging schedule is provided in **Table 3-7**.

Table 3-7
Long Term Constant Rate Test Logarithmic Schedule

Log Cycle	Elapsed Time	Sample Interval	Points/Cycle
1	0-20 seconds	0.2 second	101
2	20-60 seconds	1 second	40
3	1-10 minutes	10 seconds	54
4	10-100 minutes	2 minutes	45
5	100-480 minutes	10 minutes	38

The following testing steps will be followed:

- Step 1 – Manually measure groundwater levels in recovery well and all observation points prior to initiating pumping.
- Step 2 – Start log cycle for transducers, and initiated pumping at the pre-determined rate by adjusting the valve (or variable-speed controller). Record flow rate and start time. Also check proper data recording at the pumping well transducer.
- Step 3 - Collect manual groundwater level measurements at 20 minute intervals until drawdown begins to stabilize. Also check pump flow rate and adjust valve as necessary to maintain a constant pumping rate until stabilization (difference between consecutive measurements less than 10%).
- Step 4 - Perform manual groundwater level measurements and flow rate checks/adjustments at one-hour intervals after the system has approached stabilization. Download and review pressure transducer data at 6-hour intervals to confirm proper data recording and observe data trends.
- Step 5 - Stop pumping after 72 hours have elapsed, and record time. Leave the transducers in place. Download and review pressure transducer data at 6-hour intervals to confirm proper data recording and observe data trends.

3.30.4 Recovery Water Level Measurement

- Initiate a new log cycle for the transducers immediately upon termination of the constant-rate pumping test.
- Continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically.
- Leave the transducers in place to record continuous groundwater level data until:
  - The groundwater level at the pumping well has recovered to 90% of its baseline value or
  - 72 hours (minimum) have elapsed since termination of pump testing.

3.30.5 Discharge Water Management

The water pumped from the well shall be discharged and managed following the plan specific to the project and in accordance with DER-10 and all applicable local, state and federal regulations.

3.31 Pre-Packed Direct Push Well Installation

A drilling subcontractor will perform the well installation and CDM Smith will oversee the fieldwork.

- Wells will be constructed of a pre-packed 2.5 inch OD (1 inch ID) slotted PVC well screen (pre-packed with sand and stainless steel mesh) and 1 inch ID, schedule 40 PVC riser casings. The pre-packed well screens are manufactured prior to mobilization.
- Thread the drive cap onto the top of the 3.25 inch OD probe rod and advance the drive rod using either the hydraulic hammer or hydraulic probe mechanism.
- Advance the drive rod to the target depth using the hydraulic hammer. Add additional probe rods as necessary to reach the specified sampling depth.
- Lower the well assembly into the probe rod string with threaded PVC riser pipe to the bottom of the probe rod string.
- Install a sand filter around the well screen to directly above the screen. Grain size of the sand will be appropriate for the slot size of the screen (normally 0.01-inch). Retract the probe rods to a point above the screen.
- Install 2 foot grout penetration seal using “00” gravel or bankrun sand.
- Insert a tremie pipe and backfill the remainder of the hole with bentonite-cement grout until it flows at the surface.
- Square cut the well pipe below grade.
- Install protective flushmount or stick-up casing around new well.

3.32 Membrane Interface Probe (MIP)

In order to provide a screening-level characterization of VOC contamination in subsurface soil in both the vadose and saturated zones, CDM Smith may utilize a MIP to obtain qualitative, depth-continuous, relative instrument response data for VOCs and electrical conductivity data in the subsurface soil. The MIP data will be used to establish an instrument response gradient in subsurface soils to identify “hot spots” for sampling during the soil boring investigation.

- The MIP utilizes a truck-mounted PID, flame-ionization detector (FID), and an electron-capture devise (ECD).
- The 1.5 inch diameter MIP will be pushed into the subsurface at a penetration rate of approximately 1 foot per minute. The tip of the probe contains a thermister, which provides a heat source to volatilize VOCs. The gases that are produced pass into the probe

through a permeable membrane and enter a sampling loop. The gases are then transported to the surface and pass through the PID, FID, and ECD. The MIP will produce a response to all compounds that:

- Volatilize sufficiently to diffuse through the MIP probe membrane,
- Are carried to the detector in the carrier gas, and
- Produce a response on one or more of the detectors (PID, FID, and ECD).

The total response for each detector is related to the total contaminant concentration and the relative response of the detector to the compounds in the carrier gas stream. Therefore, the MIP is considered to produce qualitative data.

Several "performance checks" have been incorporated into the MIP screening program to provide a basis for evaluating MIP performance during subsurface soil screening activities. The following performance checks will be used during the MIP screening activities:

- Ex-situ response check - This performance check will be used to test the response of the probe to a known concentration of a target contaminant in a test cell. This check will be performed in accordance with Geoprobe® Systems Technical Bulletin MK3010 (Geoprobe® 2003).
- Reproducibility check - This performance check includes performance of a replicate push within 5 to 10 feet of a selected push. The MIP profiles for the replicate locations will be compared to assess the reproducibility of the data. As a guideline, MIP responses that are within one order of magnitude will be considered to be reasonable evidence of reproducibility.
- Ex situ response checks will be run at the following times:
  - At the start of each day.
  - If more than 3 hours elapses between the last response check and the next logging run.
  - If the MIP probe, membrane, trunk line, dryer, probe rod, or any major components of the MIP system are repaired or replaced.
- Replicate MIP profiles will be run on approximately 1 in 20 samples.

Performance check results will be reviewed for each sample lot to evaluate MIP performance. If MIP performance issues are identified, the MIP subcontractor will take corrective actions to remedy the issues.

3.32.1 MIP Procedure

Prior to initiating any field activities, the field team will review and discuss, in detail, the site-specific HASP and any appropriate background documentation. All monitoring and protective equipment will be thoroughly checked at this time. All underground and overhead utilities and structures which may interfere with the progress of the work will be located prior to the commencement of subsurface drilling activities.

- The MIP soil screening will be conducted using a Geoprobe® rig or equivalent direct push rig (as discussed above) and will follow the general drilling procedures outlined in Section 3.23.3.
- At each location the direct push rig will continuously collect data on the lithology and the VOC contamination.
- The MIP technology will provide a continuous depth qualitative readout of VOC concentrations. This probe will be used until the final depth is reached.
- The MIP subcontractor will provide CDM Smith with an electronic data file of each push containing qualitative VOC readings and electrical conductivity readings.
- The screening point boreholes will be tremie-grouted with a cement-bentonite mixture after all sampling has been completed and the boring locations will be restored to pre-existing conditions.

3.33 Fish Sampling

Fish samples will be collected from an adequate number of locations in order to characterize and address project objectives, or as directed by the NYSDEC.

- Samples will be collected using site-specific common fisheries techniques (e.g., seine net, electroshocking, etc.). Electroshocking and other techniques may require that sampling personnel obtain required training.
- During each investigation, species representative of the site or individual location (i.e., dominant taxa, high percentage of total biomass, etc.) will be targeted for analysis.
- The age and/or trophic level of species and other pertinent sampling design information will be decided after consultation with the NYSDEC.
- Upon capture, sampling crews will taxonomically identify fish retained for analysis, photograph and record the weight and total length of representative individuals.
- In order to satisfy analytical requirements, it may be necessary in specific cases (e.g., minnow species) to composite samples consisting of an individual species. When required, the total number of individuals and total weight of the composite will be noted.
- After processing, individual samples will be wrapped in aluminum foil, placed in re-sealable plastic bags and placed on wet or dry ice.
- Samples will be shipped via overnight delivery (see Section 3.27) to the subcontracted analytical laboratory for the analyses specified in the site-specific work plan.

3.34 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate (benthos) samples will be collected from an adequate number of locations in order to characterize and address project objectives, or as directed by the NYSDEC.

- Samples will be collected using site-specific sampling techniques (e.g., kick net, surber sampler, etc.).
- During each investigation, species representative of the site or individual location (i.e., dominant taxa, high percentage of total biomass, etc.) will be targeted for analysis. Pertinent sampling design information (e.g., sample size, etc.) will be decided after consultation with the NYSDEC.
- As samples are collected they will be placed into a clean sample vessel (e.g., stainless steal bucket, high density polyethylene bucket, etc.) for sorting.
- Representative species retained for analysis will be taxonomically identified to order.
- Due to analytical requirements, all samples will consist of a given number of individuals composited together until the proper sample mass is achieved.
- After processing, individual samples will be placed into the appropriate sample container, placed in re-sealable plastic bags and placed on wet ice or dry ice.
- Samples will be shipped via overnight delivery (see Section 3.27) to the subcontracted analytical laboratory for the analyses specified in the site-specific work plan.

3.35 Test Pits

All excavation activities will be performed in accordance with the Dig Safely New York *Excavator's Manual: A User's Guide to Safe Excavation Practices in New York State.* Test pits will be performed as described below.

3.35.1 Equipment

- Rubber tired backhoe with extension or larger track mounted excavator (provided by subcontractor)
- Survey stakes to mark corners of the test pits
- Digital camera
- Indelible black ink pen or marker
- Field logbook
- Decontamination equipment (provided by subcontractor)
- Steel or cloth 100-foot tape
- Personal protective equipment (refer to Site-specific HASP)

- Sample containers
- Stainless steel or disposable sample bowls and trowels
- Ice and cooler
- COC forms and custody seals
- Distilled and deionized water
- Alconox
- Paper towels
- Garbage bags
- Water jugs
- Spray paint
- Hand auger

3.35.2 Procedures

A test pit will be conducted as follows:

- Prior to mobilizing to the site or beginning excavation, the subcontractor will contact Dig Safe NY for utility mark outs.
- Decontaminate all equipment as necessary in accordance with Section 3.12 of the generic QAPP.
- Advance excavation to the desired length, width and depth using appropriate equipment.
- Make visual observations of soil conditions including staining and odors and collect samples for headspace readings as needed.
- Take photograph documentation of any staining and at all sample locations.
- Samples will be collected from the bucket of the backhoe and no personnel will enter the excavation. One sample from each test pit will be submitted for laboratory analyses. Sample collection and documentation will be conducted in accordance with Section 3.2 of the Generic QAPP.
- Record the depths of any visual observations made and take digital photos.
- Excavated material shall be placed at an appropriate distance from the test pit to ensure proper slope stability.
- Upon completing the test pit, backfill and compact the excavation to grade.

- Providing that no visual staining, odors or product are observed, the test pit material can be used as backfill. If any of the above is observed the test pit material must be properly disposed of and clean material shall be used for backfilling.
- Mark the corners of the excavation so the location can be surveyed at a later date.
- Decontaminate the backhoe bucket prior to starting the next test pit.

3.35.3 Analytical Program

CDM Smith expects to collect one sample from each test pit. However, field observations may dictate that additional samples be collected. Samples may be obtained from the test pit side walls or bases and will be collected from the bucket of the excavator. All samples shall be field screened, photographed and recorded.

3.36 Per- and Polyfluoroalkyl Substances (PFAS)

Samples collected using this protocol are intended to be analyzed for per- and polyfluoroalkyl substances (PFAS) by Modified (Low Level) Test Method 537. Sampling and analytical methods for PFAS may change based on technological advancement. Any changes will be submitted as an amendment for approval by NYSDEC. The list of PFAS is shown on **Table 3-8**.

3.36.1 Monitoring Wells and Surface Water Sample Protocol

The Modified (Low Level) Test Method 537.1 provides PFAS results with reporting limits of approximately 2 nanograms per liter.

Table 3-8
Full PFAS Target Analyte List

Class	PFAS Name	Abbreviation	Cas No.
Perfluoroalkyl sulfonates	**Perfluorobutanesulfonic acid**	**PFBS**	**375-73-5**
	Perfluorohexanesulfonic acid	**PFHxS**	**355-46-4**
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	**PFOS**	**1763-23-1**
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	**PFHpA**	**375-85-9**
	Perfluorooctanoic acid	**PFOA**	**335-67-1**
	Perfluorononanoic acid	**PFNA**	**375-95-1**
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2

Fluorinated Telomer	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Bold entries depict the 6 original UCMR3 chemicals
Current acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Additional materials may be acceptable if proven not to contain PFAS. Grundfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grundfos pumps and low-density polyethylene (LDPE) bladders for bladder pumps). Selection of sampling devices must be carefully researched. All sampling equipment components and sample containers should not come in contact with aluminum foil, LDPE, glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with polyfluorinated materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with polyfluorinated materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFAS.

All clothing worn by sampling personnel must have been laundered multiple times and dried without using dryer sheets of any type. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Equipment blanks should be collected each day that sampling is conducted and at a minimum frequency of 1 per 20 samples. Collect one field duplicate for every sample batch, not to exceed 20 samples. Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category B) and an electronic data deliverable.

Prohibited Materials and Equipment

1. Teflon®-containing materials, when possible, should be avoided (e.g., tubing, bailers, tape, and plumbing paste). In cases where Teflon® -containing materials are unavoidable, ensure adequate purging is performed prior to sampling (e.g., in-well pumps) and/or rinse blanks are collected prior to sampling.
2. LDPE or polypropylene containing materials (e.g., bags or containers used to transport samples)
3. Paper products such as waterproof field books, plastic clipboards, binders, spiral hard cover notebooks, sticky notes or glue materials
4. Markers
5. Chemical (blue) ice packs
6. Decontamination soaps containing fluoro-surfactants such as Decon 90
7. Water that is not verified to be "PFAS-free" to be used for trip and decontamination blanks and decontamination processes
8. Water resistant, waterproof, stain-treated clothing or shoes including Gore-Tex™ and Tyvek® materials

Recommended Materials and Equipment

1. HDPE and silicon
2. Materials include: tubing, bailers, tape, plumbing paste
3. Acetate liners for direct push technologies
4. Nitrile gloves – change often
5. Loose paper with Masonite or aluminum clipboards
6. Pens
7. Bags of ice
8. Alconox® or Liquinox®
9. Laboratory supplied and verified "PFAS-free" water to be used for trip and decontamination blanks and decontamination processes
10. Cotton construction is recommended for field clothing and should be laundered a minimum of 6 times from time of purchase due to possible PFAS related treatments. Fabric softener and dryer sheets must be avoided. Rain gear should be made from polyurethane and wax-coated materials.

3.36.2 Shallow Soil Sample Protocol

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS by liquid chromatography-tandem mass spectrometry (LCMSMS) (modified method 537.1). Laboratory reporting limits should be less than or equal to 0.5 micrograms per kilogram. One 8-ounce HDPE container is required for each sample. Pre-cleaned sample containers, coolers, sample labels and a chain of custody form will be provided by the laboratory.

Sampling Location and Survey

Shallow soil sampling will generally be confined to surface or near-surface soils and/or sediments with hand equipment. For screening purposes, sampling of this type should be conducted in depositional areas. Sample locations and depths shall be located and recorded.

Equipment

At this time acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate and polypropylene. Additional materials may be acceptable if proven not to contain PFAS. All sampling equipment components and sample containers **should not** come in contact with aluminum foil, LDPE, glass or PTFE, Teflon™ materials including sample bottle cap liners with a PTFE layer. A list of acceptable equipment is provided below, but other equipment may be considered appropriate at a later date.

1. stainless steel spoon
2. stainless steel bowl
3. carbon steel hand auger without any coatings

Equipment Decontamination

Standard two step decontamination using detergent and clean, PFAS-free water rinse should be considered for equipment that does come in contact with PFAS materials.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a clean stainless steel spoon should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) shall then be collected using a pre-cleaned, stainless steel spoon.

Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the soil sample is obtained, it should be deposited into a stainless-steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized.

Sample Identification and Logging

A label shall be attached to each sample container with an identification consistent with the format indicated below. Each sample shall be included on the COC and labelled in the formats discussed in Section 3.2.5.

Quality Assurance/Quality Control

1. Immediately place samples in cooler maintained at 4 ± 2º Celsius.
2. Collect one field duplicate for every sample batch, not to exceed 20 samples. The duplicate shall consist of an additional sample at a given location.

3. Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC.
4. Request appropriate data deliverable (Category B) and an electronic data deliverable.
5. Collect an equipment blank each day sampling is conducted to ensure the equipment does not come in contact with PFAS.

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, duplicate sample, visual description of the material and any other observations or notes determined to be appropriate.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler must wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. All clothing worn by sampling personnel must have been laundered multiple times.

3.37 Sampling for 1, 4-Dioxane

All groundwater samples from DER remediation sites that have chlorinated solvents as a contaminant of concern must be analyzed for 1,4-dioxane. 1,4-Dioxane was added as a stabilizer in 1,1,1-trichloroethane (TCA) at percent levels. The detection limit for 1,4-dioxane should be no higher than 0.2 µg/L (ppb).

The only current analytical method that Environmental Laboratory Accreditation Program (ELAP) offers certification for is EPA method 8260C. In order to get the detection limits needed, the laboratory will need to use the mass spectrometer in “selective ion monitoring” (SIM) mode. In addition to EPA 8260C SIM, other analytical methods that can achieve the required detection limits include EPA 8270 SIM and EPA 522. The analytical method accepted by the state currently is 8270SIM, the use of 8260 may be accepted when justified by site conditions. EPA Method 8270 SIM provides a more robust extraction procedure and is the preferred method . EPA 522 is reportedly the lowest cost alternative and has the lowest detection limit (in drinking/potable water).

At sites where solvents are not a contaminant of concern, and where 1,4-dioxane is not otherwise a contaminant of concern, 1,4-dioxane should be included in the analyte list for EPA Method 8260C, but the use of SIM mode is not required.

Samples analyzed by EPA 8260C SIM should be collected in three 40 ml vials. Samples analyzed by EPA Method 8270 SIM should be collected in two 1 Liter amber glass jars. Samples analyzed by EPA Method 522 should be collected in bottles fitted with screw caps.

Clothing that contains 1,4-dioxane materials must be avoided. Avoid laundry detergents, dish soap, shampoos, and other cleaning products that contain 1,4-dioxane when sampling. An example list of detergent products reported to be free of 1,4-dioxane are listed below:

1. Honest Company
2. Seventh Generation Free & Clear laundry detergent
3. Dreft powdered detergent
4. Sun Burst
5. Planet Ultra Liquid laundry detergent
6. Clorox Green Works Natural laundry detergent
7. Ecos laundry detergent (Earth Friendly Products)
8. Life Tree Laundry Liquid
9. Method Squeaky Green Laundry detergent

The list is referenced from https://www.honest.com/about-us/honestly-free-guarantee and https://www.naturalnews.com/028846_laundry_detergents_dioxane.html.

The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill pre-cleaned bottle with the sample.

2. Cap the bottles with an acceptable cap and liner closure system.

3. Label the sample bottles.

4. Fill out the chain of custody.

5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples. Collect one field duplicate for every sample batch, not to exceed 20 samples.

Sampling and analytical methods for 1,4-dioxane may change based on technological advancement. Any changes will be submitted as an amendment for approval by NYSDEC.

Section 4

Instrument Procedures

4.1 Photoionization Detector (PID)

4.1.1 Introduction

This Standard Operating Procedure (SOP) is specific to the MiniRAE 2000 and 3000 PIDs. These portable instruments are designed to measure the concentration of trace gases in ambient atmospheres at industrial and hazardous waste sites, and are intrinsically safe. The analyzers employ PIDs.

The PID sensor consists of a sealed ultraviolet light source that emits photons which are energetic enough to ionize many trace species (particularly organics), but do not ionize the major compounds of air such as O_2, N_2, CO, CO_2, or H_2O. An ionization chamber adjacent to the ultraviolet lamp source contains a pair of electrodes. When a positive potential is applied to one electrode, the field created drives any ions, formed by absorption of UV light, to the collector electrode where the currents (proportional to concentration) are measured. One major difference between a flame ionization detector (FID) and a PID is that the latter responds to inorganic compounds as well as non-methane type organic compounds.

To assess whether the instrument will respond to a particular species, the ionization potential (IP) should be checked. If the IP is less than the lamp energy, or in some cases, up to 0.2-0.3 electron volts (ev) higher than the lamp energy, instrument response should occur. For example, hydrogen sulfide (IP = 10.5 ev) may be detected with a 10.2 ev lamp, but butane (IP 10.6 ev) will not be detected.

4.1.2 Calibration

Qualified personnel trained in calibration techniques for all field items perform calibration of all CDM Smith field equipment. When a field instrument that requires calibration is obtained from the rental facility, the unit will display a calibration tag denoting the date when the instrument was last calibrated and/or maintained. All field instruments are calibrated each time they leave the equipment facility. A maintenance file is kept for each calibrated field item.

PID and FID detector type instruments come with field calibration kits. A field calibration kit would be used if the instrument is to be kept out at the site for extended periods of time, or if the instrument endures prolonged environmental extremes. In either case, a calibration check standard could be introduced in the instrument to verify its accuracy. If an instrument will not calibrate or shows improper field operation, it should be sent back to the office, and another instrument reissued.

Field personnel should not try to maintain the instruments in the field. If long sampling program is required, be prepared to take more equipment for backup in case of instrument failure. Records and procedures of all calibration techniques are on file at the CDM Smith equipment management facility at 153 South Street, Somerville, Massachusetts.

With the instrument fully calibrated, it is now ready for use. Any results obtained should be reported in parts per million (ppm). If you need to convert these numbers based on a benzene standard, HNu offers a conversion table which is available from CDM Smith. Important instrument specifications for each PID detector are listed as follows.

MiniRAE 2000 Performance	MiniRAE 3000
Range - 0.1 to 9999	0 - 9999
Detection limit 0.1 PPM	0.1 PPM

MiniRAE 2000 Power Requirements	MiniRAE3000
Continuous use, battery >10 hours	8 hours
Recharge time, max >14 hours, 3 hours +	8 hours
Alkaline Pack	Alkaline Pack

Unit can be operated on battery charger.

Both units provide protection circuitry for the battery. This prevents deep discharging of the battery and considerably extends the battery life.

4.1.3 MiniRAE 2000

4.1.3.1 Procedure

- To turn on the unit, press and hold the Mode button and allow the unit to run 5-10 minutes in a clean air environment.
- After the warm-up, press and hold the Mode and N/- buttons simultaneously until the unit displays “Calibrate/select gas?”
- Press Y/+ “Fresh Air Cal?” is displayed
- Press N/- “Span cal?” is displayed
- Press N/- “Select Cal Memory?” is displayed
- Press N/- “Change Span Value?” is displayed
- Press Y/+, the unit will display span value. If no Charge is needed. Press and hold the MODE button and “modify cal memory?” is displayed press N/-
- If you wish to change the span value, press the MODE button until SAVE? Is displayed press Y/+, “Modify cal memory?” is displayed press N/-
- “Change Correction Factor?” is displayed. If you desired correction factor is not 1.00 (default setting) press Y/+. Use the same steps as change span value to change the correction factor. If no change is required, Press N/- to continue.

- "Fresh Air Cal?" is displayed (Ensure that you are in a clean ambient air environment.) press Y/+.
- "Zero in process" will be displayed, followed by countdown. The zero reading will now be displayed. The unit will move to "Span Gas Cal?"
- Fill a 3L Tedlar bag with Span gas.
- From "Span Gas Cal?" Press the Y/+ button "Apply Gas Now" is displayed. Apply Gas to the unit. The unit will countdown and then display "Update Data"" the unit is Updating the calibration =… (Span value). Followed by "Calibration Done". Remove the Tedlar Bag from the unit.
- Press MODE twice to return to the run mode.
- Unit is now calibrated and ready to use.

Note: After the span calibration is completed and the unit is running, it is recommended to perform a function "bump test" to verify the accuracy of the calibration. To perform this test, simply reconnect the span gas to the unit and verify the displayed reading coincide with the actual concentrations of span gas used for calibration. (Manufactures specification is +/- 5% of the value)

4.1.3.2 Limitations

- Environmental factors such as humidity, rain and extreme cold can limit the instrument performance. MiniRAE2000 should be kept out of the rain as much as possible or covered. This will insure longer operating times with less false positive readings.

4.1.4 MiniRAE 3000

4.1.4.1 Procedures

- With the unit being fully calibrated before receiving it, you are ready for operation. Located on the face of the unit is a panel. On the panel is a MODE key. Press and hold the MODE key. When the display turns on, release the MODE key. The instrument is now operating and performs self tests. If any tests (including sensor and memory tests fail), refer to the Troubleshooting sector of the User's Guide. NOTE: if Basic User/Hygiene Mode (the default setting), the instrument stops after self-testing, and asks whether to perform a zero air (fresh air) calibration. You can start this calibration, quit, or abort the calibration. When the zero calibration is done, you see screen telling you that the zero calibration is complete, along with its value. After calibration (or after you abort the calibration), the instrument then shows a numerical reading screen with icons. This indicates that the instrument is fully functional and ready to use.
- To turn off the instrument press and hold the Mode key for 3 seconds. A 5-second countdown to shut off begins. Once the countdown stops, the instrument is off. Release the Mode key. When you see "Unit off…" release your finger from the Mode key. The instrument is now off.

NOTE: You must hold your finger on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the instrument continues normal operation.

- The instrument has a built-in flashlight that helps you point the probe in dark places. Press the flashlight key to turn it on. Press it again to turn it off. NOTE: Using the flashlight for extended periods shortens the battery's operating time before it needs recharging.

4.2 pH Meter

4.2.1 Introduction

pH is the negative logarithm of the effective hydrogen ion concentration (or activity) in gram equivalents per liter used. This expresses both acidity, and alkalinity on a scale whose valves run from 0 to 14. Number 7 represents neutrality, and numbers greater than 7 indicate increasing alkalinity while numbers less than 7 indicate increasing acidity. pH is one of the most commonly analyzed parameters. Water supply treatments such as neutralization, softening, disinfection and corrosion control are all pH dependent. CDM Smith has a variety of pH monitoring instruments in the equipment warehouse.

4.2.2 Orion SA 250 pH Procedures

With the instrument fully calibrated, it is now ready for use. Follow the check out procedures:

- Slide power switch to on position. Attach BNC shorting plug to BNC connector on top of meter.
- If LO BAT indicator on LCD remains on, the battery must be replaced.
- Slide mode switch to mV. Display should read 0 + .3.
- Slide mode switch to TEMP. Display should read 25.0. If 25.0 is not displayed, scroll using, and X10 keys, until 25.0 is displayed and press enter.
- Slide mode switch to pH .01. Press iso. Display should read the letters ISO, then a value of 7.000. If 7.000 is not displayed, scroll until 7.00 is displayed and press enter.
- Press slope. Display should read the letters SLP, then a value of 100.0. If 100.0 is not displayed, scroll until 100.0 is displayed and press enter.
- Press sample. Observe the letters pH, then a steady reading of 7.00, +0.02 should be obtained. If not, press CAL and scroll until 200 is displayed and press enter. Press sample and observe a reading of 7.00.
- Remove the shorting plug. After completing these steps, the meter is ready to use with an electrode.
- Attach electrodes with BNC connectors to sensor input by sliding the connector onto the input, pushing down and turning clockwise to lock into position. Connect reference electrodes with pin tip connectors by pushing connector straight into reference input.

- Put the temperature probe in the sample and let it stabilize.
- Once temperature is stable, set the unit to read pH (by 0.1 or 0.01) and take a reading in the aqueous sample (remembering first to remove the cap on the end of the pH probe).

4.2.3 Model Tripar Analyzer Procedures

With the instrument fully calibrated, it is now ready for use:

- Connect the pH probe's BNC input connector to the front of the Tripar.
- Put the pH/mV switch on the pH position.
- Turn the parameter display selection switch to TEMP.
- Plug in the gray temperature plug jack in the input temperature sensor connector.
- Put end of temperature probe in the sample.
- Allow the temperature to stabilize.
- Turn the temperature compensation knob to the temperature shown.
- Turn the parameter display selection switch to pH.
- Put pH probe in the aqueous sample (remembering first to remove the cap on the end of the probe). Let it stabilize and record the reading.

4.3 Conductivity Meter

4.3.1 Introduction

Conductivity is a numerical expression of the ability of an aqueous solution to carry an electrical current. This ability depends on the presence of ions in the solution, and their total concentration. Factors such as mobility valence, relative concentration, and temperature also combine to create this occurrence. Solutions of most inorganic acids, bases and salts are relatively good conductors. Organic compounds in aqueous solutions are not good conductors. For example, freshly distilled water has conductivity reading of 0.5 to 2 mhos/cm and increases with time. This increase is caused by absorption of atmospheric carbon dioxide, and to a lesser extent ammonia. While industrial type wastes have conductivity readings of ±10,000 mhos/cm.

4.3.2 Model SCT Procedures

The model 33 SCT has 3 conductivity scales of 0-500, 0-5000, and 0-50,000 mhos/cm. Salinity is scaled 0-40 parts per thousand in a temperature range of -2 to +45^{B}C. Temperature is scaled -2^{B} to +5^{B}C.

With the instrument calibration verified, the unit is now ready for use. The model 33 S-C-T meter face is scaled and calibrated to give an accurate reading of the conductivity of a water sample by measuring the amount of current flow between two fixed electrodes in the probe.

The unit also measures salinity in a special range conductivity circuit, which includes a user-adjusted temperature compensator. A precision thermistor in the probe measures temperature by changing its resistance in relation to the temperature of the water.

The start-up procedure is as follows:

- Plug the probe plug receptacle in the side of the meter.
- With the mode select in the OFF position, check to see that the meter needle is centered at the zero mark on the conductivity scale and adjust if necessary.
- Turn the mode control switch to Red Line position.
- Adjust the Red Line control knob so the meter needle lines up with the red line on the meter face. If this cannot be accomplished, replace the batteries. If battery replacement is necessary, use only alkaline "D" cells, as regular carbon zinc batteries will cause errors.
- Place the probe into the solution to be measured.
- Set the mode control to TEMPERATURE. Read the temperature on the bottom scale of the meter in Degrees C. Allow time for the probe temperature to come to equilibrium before taking a reading.
- With the probe in the solution to be tested, adjust the conductivity scale until the meter reading is on scale. Multiply the reading by the correction on the calibration sticker on the instrument.
- When using the X10 and X100 scales, depress the CELL TEST button. If the reading on the dial moves +2%, the electrode is fouled and needs to be cleaned. Repeat the measurement on another instrument.
- Store the probe in distilled water when not in use.

4.4 Photovac Portable Gas Chromatograph

4.4.1 Introduction

The Photovac portable gas chromatograph (GC) can provide for accurate and specific identification of volatile organic compounds in a field control laboratory.

4.4.2 Equipment Preparation

- The Photovac portable GC should be set up in a sheltered area and, if possible, within a climate controlled area to minimize temperature changes. Do not place the GC near any equipment that causes vibration. A flat table, large enough to accommodate the GC, the printer, a laboratory size oven, and electrical power packs for the GC should be utilized during operation.
- Fill the GC with carrier gas being sure not to pressurize the GC with more than 1500 pounds per square inch (psi) of carrier gas. Check to ensure the pressure of the air feed to the GC column is 40 psi.

The carrier gas should contain no more than 2.0 parts per million by volume (ppmV) of total hydrocarbons and not less than 0.1 ppmv of total hydrocarbons. The lower the hydrocarbon concentration the lower the baseline of the GC. A lower baseline minimizes interference of compound identification.

- Install new Teflon septa in the injection port being utilized. The septa should be replaced at the start of each day and after every twenty injections.

4.4.3 Calibration Procedures and Frequency

The Photovac portable GC will be calibrated at the beginning of each day prior to sample analysis.

4.4.3.1 Gas Standards

Gas standards used to calibrate the GC will be obtained from certified compressed gas cylinders of known concentration. CDM Smith stocks two compressed gas standard cylinders containing the following gases and concentrations:

Cylinder 1

Benzene - 10 ppmv

Toluene - 10 ppmv

Ethyl Benzene - 10 ppmv

M-xylene - 10 ppmv

O-xylene - 10 ppmv

P-xylene - 10 ppmv

Cylinder 2

Trans 1,2 Dichloroethylene - 1.05 ppmv

1,1,1 Trichloroethane - 19.3 ppmv

Trichloroethylene - 1.13 ppmv

These gas cylinders were purchased from Scott Specialty Gas Corporation and are certified by Scott to be traceable to NBS standards.

The calibration procedure using these cylinders is as follows:

- A two stage pressure regulator (CGA 350) is attached to the standard gas cylinder to be used.
- A 250 ml glass sampling bulb, determined clean by injecting a volume of air obtained from the bulb onto the GC (described later), is labeled and attached to the effluent port of the second stage of the gas regulator. The Teflon stopcocks of the sampling bulb are opened.

- The sample cylinder valve is opened and the first stage of the regulator is pressurized.
- Slowly the diaphragm valve controlling the gas flow entering the second stage is opened until the pressure reads 2 psig.
- The valve allowing the gas to exit the second stage of the regulator is opened until the gas can be heard escaping from the regulator and passing through the glass sample bulb. Purge the bulb for approximately ten seconds. Close the Teflon stopcock located at the discharge end of the sampling bulb, then, the stopcock closest to the regulator. In this way the calibration gas is collected at the same pressure as the delivery pressure of the second stage of the regulator.
- Using a gas tight 1 ml syringe, extract approximately 500 microliters (µl) of the calibration gas from the glass bulb and purge the volume of gas into the atmosphere. Repeat this step.
- Place the syringe needle in the glass bulb. Pull the syringe plunger back approximately 500 µl of calibration gas enters the syringe barrel. Without removing the syringe from the glass bulb depress the plunger. Pump the syringe in this manner several times.
- Extract the syringe from the glass bulb with approximately 500 µl of calibration gas present. Carefully depress the plunger until 300 µl of calibration gas is present in the syringe barrel. Immediately inject this gas volume into the Photovac GC.
- A response factor for each analyte is obtained as the ratio of the known gas concentration injected and the area under the peak produced by that injection. This integration is performed automatically by the internal Photovac data processor and stored in the library.
- The procedure to obtain a calibration gas sample is repeated and the gas volume is injected into the GC. The GC will identify the compounds in the sample stream that have retention times within +/- 20% of the retention times of the compounds in the library. The area of these identified peaks will be compared to the response factor of the compounds stored in the library and integrate a corresponding concentration.
- If the calibration check concentration does not equal +/- 15% of the library concentration, a new calibration check is performed. If this check fails, a new library is created.

4.4.4 Sample Analyses

The following procedure will be followed when performing analysis of samples.

- The Photovac portable GC is set as described above. The GC function and application file is loaded into memory. This includes all previously established calibration data and retention time information.
- 300 µl of sample are obtained from the sample source and injected into the GC. Samples will be injected as soon as possible after it is collected.
- Immediately after injection the GC is started.

- Each chromatograph run will run for a minimum of 5 minutes. At this time the run will be stopped and the results obtained.
- Following completion of the run, the Photovac GC will produce a hard copy printout of the results. This printout will include the sample identification, time of analysis, and appropriate operating parameters.

This procedure will be followed for all sample runs.

4.4.5 Method Blanks and Duplicates

Prior to any calibration or sample injections, the integrity and level of contamination of each syringe used for injections will be verified.

- Plungers will be removed from the barrel of the syringe and placed into a laboratory oven for 5 minutes. The temperature of the oven should not be above 150 degrees Fahrenheit (F) or below 120 degrees F.
- The syringes will be removed from the oven, cooled, and reassembled.
- Pump the syringe plunger several times, purging the syringe with ambient air.
- Collect approximately 500 µl of ambient air in the syringe and carefully depress the plunger to 300 µl. Immediately inject the gas volume into the GC.
- Detection of the target compounds above the detection limit (50 ppbv for most compounds) will require another decontamination procedure before additional analyses.
- Blanks will be performed after every sample and calibration injection. Blanks will not be performed between duplicate sample injections.
- Duplicate samples will be performed at a minimum of 1 every 10 sample injections.

4.5 X-Ray Fluorescence Meter

4.5.1 Introduction

An X-Ray Fluorescence Meter or XRF meter is used to detect metals in soils or solid objects. It works on wavelength-dispersive spectroscopic principles that are similar to an electron microprobe. Several companies have developed portable XRF meters suitable for screening metals in soils for field applications.

4.5.2 Calibration

Since there are different models of XRF meters on the market, the user's manual should be consulted to determine the required calibration procedures for a specific model. The XRF meter will generally be calibrated by the rental company. Additionally, once or twice per day before performing tests or after the meter's software is restarted, it is necessary to standardize the instrument. A standard metal clip is generally included with the meter, which is placed over the analyzer window as prompted by the software.

4.5.3 Operating Procedures

The user's manual for each individual model of XRF meter should be consulted for operating instructions specific to that model. XRF meters use a "point and shoot" system where the analyzer window is held against the sample while squeezing the trigger. When analyzing soil samples, the sample must be dry, this may require oven drying. The soil sample should also be homogenized before testing by mixing the sample and removing objects such as rocks and sticks. For soil testing, use of a test stand is recommended. The test stand allows for longer analysis times, which may be required to obtain desired detection limits for the metals of interest. The accuracy of the results obtained using an XRF meter may vary and are not considered to be as accurate as laboratory analysis. End point samples should be confirmed with laboratory analysis.

4.5.4 Safety Concerns

4.5.4.1 Safe Operation Procedures

XRF meters produce ionizing radiation. The instruction manual for the specific model should be consulted for safe operating information. In general, for all models the following recommendations are provided:

- The meter should not be pointed at anyone or any body part, energized or de-energized.
- A control area should be established during use. The area at least three paces beyond the target should be unoccupied.
- The target should not be hand held and the instrument should be shot into high density materials whenever possible.
- A radiation exposure badge is recommended for the operator for personal exposure monitoring. Some rental companies include a radiation badge with the rental of an XRF meter.

4.5.4.2 Department of Health Permit Requirements

Because XRF meters contain an x-ray tube, the NYSDOH requires that XRF instruments be registered with their agency by the owner. In addition, when an XRF meter is rented, the company renting the meter must apply for a usage permit from NYSDOH at least three weeks prior to the date of intended usage. When done using the meter, NYSDOH must again be notified. These permits may require a fee and NYSDOH will want to know where the meter will be used.

4.5.4.3 Shipping Requirements

Some XRF meter models have a radioactive source, which must be shipped ground as a hazardous material by an employee trained in hazardous materials shipping. Other models of XRF meters do not have a radioactive source and may be shipped by standard shipping methods. It may be necessary to contact the manufacturer of the specific model to obtain shipping instructions.

Section 5

Laboratory Procedures

5.1 Introduction

Laboratory analysis must be conducted by a laboratory that is accredited pursuant to the NYSDOH ELAP for the category of parameters analyzed. Samples shall be analyzed using the analytical method included in the most current NYSDEC Analytical Services Protocol (ASP) available on the NYSDEC website. Unless otherwise approved by NYSDEC, laboratory data deliverables must be Category B as defined in the ASP.

The term "data quality" refers to the level of uncertainty associated with a particular data set. The data quality associated with environmental measurement data is a function of the sampling plan rationale and procedures used to collect the samples as well as the analytical methods and instrumentation used in making the measurements. Each component has its own potential sources of error and biases that can affect the overall measurement process.

Sources of error that can be traced to the sampling component of environmental data collection are:

- Poor sampling plan design,
- Inconsistent use of standard operating procedures,
- Sample handling and transportation.

The most common sources of error that can be traced to the analytical component of the total measurement system are calibration and contamination problems. It is recognized that, by far, the largest component of the total uncertainty associated with environmental data collection originates from the sampling process. All sampling programs initiated in support of this project will stress forward planning and be well conceived and reviewed prior to the collection of any samples as a way to minimize this major source of potential error.

Uncertainty cannot be eliminated from environmental measurement data. The amount of uncertainty that can be tolerated depends on the objective of the sampling program and the intended use of the data collected. The purpose of the project's quality assurance program is to assure that the quality of all data collected be of known and ascertainable value.

5.2 Data Quality Criteria

Data quality can be assessed in terms of its precision, accuracy, representativeness, completeness, and comparability. Analytical method detection limits will also be discussed in this section.

5.2.1 Precision

Precision is a measure of the reproducibility of analyses under a given set of conditions. The overall precision of a sampling event is a mixture of sampling and analytical factors. The precision of data collected in support of this project will be assessed on two different levels:

- By calculating the relative percent difference (RPD) of laboratory matrix spike duplicates and/or laboratory replicate samples (a measure of analytical precision).
- By calculating the RPD of field duplicates samples submitted to laboratory "blind" (a measure of the precision of the entire measurement system, including sampling).

Relative percent difference will be calculated according to the following equation:

$$\mathrm{RPD} = \frac{|A - B|}{(A + B)/2} \times 100\%$$

Where:	A	=	Sample Result
	B	=	Replicate Sample Result

5.2.2 Accuracy

Accuracy is a measurement of the amount of bias that exists in a measurement system. This can be thought of as the degree that the reported value agrees with the supposed "true value". The accuracy of data collected in support of this project will be assessed in the following ways:

- By calculating the percent recovery (%R) of laboratory matrix spikes and/or laboratory control standards.
- By documenting the level of contamination that exists (if any) in laboratory method blanks.
- By documenting the level of contamination that exists (if any) in field and/or trip blanks submitted to the laboratory "blind" for analysis.
- Percent recovery will be calculated according to the following equation:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

Where:	SSR	=	Spiked Sample Result
	SR	=	Sample Result
	SA	=	Spike Concentration

5.2.3 Representativeness

Unlike the previous two criteria which can be expressed in quantitative terms, representativeness is a qualitative parameter. However, in terms of overall data quality, representativeness may be the most important parameter of all.

The representativeness criterion is concerned with the degree to which a sample reflects (represents) a characteristic of a population, parameter variations at a specific location, or an environmental condition. Sample representativeness will be addressed in support of this project through a detailed sampling plan design and rationale and through the proper use of the appropriate sampling standard operating procedures, depending on sample matrix and the parameters to be analyzed.

Composite samples will be collected in situations conducive to compositing techniques (particularly samples collected along the vertical extent of a borehole). The use of composite samples tends to maximize the representativeness of a sampling round because more information is provided about a much broader area than a single grab sample. This is especially true in situations where the objective of sampling is to determine where gross contamination exists on site and the location of any "hot spots". In these cases, broad coverage of the area to be sampled is more important than obtaining the lowest possible detection limits.

5.2.4 Completeness

Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Usability will be determined by evaluation of the precision, accuracy, representativeness, and comparability parameters. The data that is validated as correct, or are qualified as estimated or non-detect, are considered usable. Rejected data is not considered usable. A completeness goal of 90% is projected. If this goal is not met, the effect of not meeting this goal will be discussed by the CDM Smith project manager and the NYSDEC site manager. Completeness is calculated using the following equation:

$$Percent\,Completeness = \frac{DO}{DP} \times 100$$

Where: DO = Data obtained and usable
DP = Data planned to be obtained

There also may be incomplete data while still meeting the 90%goal if a critical sample location cannot be sampled.

5.2.5 Comparability

The comparability criterion is a quality characteristic which is an expression of the confidence with which one data set can be compared with another. Comparability issues are of importance at two different levels of a sampling program. The primary comparability issues are concerned with whether the field sampling techniques, analytical procedures, and concentration units of one data set can be compared with another.

The comparability criterion also applies to the environmental conditions/considerations present at the time of the sampling. Temporal and/or seasonal variations may make data collected from the same location at different times of the year incomparable, or comparable in a relative sense only, for example.

Comparability is judged by comparing results to other similar data sets. Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Data developed under this investigation will be collected and analyzed using Soil Vapor Intrusion Guidance for soil vapor collection and NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010 to ensure comparability of results with other analyses performed in a similar manner.

5.2.6 Method Detection Limits

Whenever environmental measurement data is to be used in comparison with predetermined "action levels" or other regulatory requirements, the reported method detection limits of the analytical data is of prime importance. Analytical methods specified in support of this project should have a reported detection limit at least 50% below the required action level to assure that measurements made in the vicinity of the action level are of high quality. In circumstances concerning extremely low action levels or regulatory requirements where analytical techniques will have to be pushed to their limits, every effort will be made to select the most appropriate analytical procedures. It is recognized that analytical detection limits are sample specific and are affected by sample volumes as well as the need for sample concentration or dilution. These circumstances will be accounted for in the review and interpretation of the analytical results.

5.3 Quality Control

Two separate levels of quality control exist for all samples collected in support of this project, internal laboratory quality control and program generated quality control.

5.3.1 Internal Laboratory Quality Control

Internal laboratory quality control is a function of the individual laboratory's QA/QC plan. A laboratory's QA/QC plan contains specific criteria governing the manner in which analyses are conducted and provides information on the laboratory's performance and control of the sources of error that exist within the lab. Included in the plan are requirements for the type and frequency of quality control check samples that are to be analyzed on a routine basis.

All laboratory analysis conducted in support of this project must include the following quality control check samples:

- Surrogate spikes (where appropriate)
- Matrix spike/matrix spike duplicate (MS/MSD) or laboratory duplicates and laboratory control samples (where appropriate)
- Method blanks

The laboratory may adhere to the analysis frequency specified in their QA/QC plan for these check samples, provided that the specified frequency is equal-to or greater-than the frequency specified in **Table 5-1** or as modified/specified by the QAPP.

5.3.2 Program Generated Quality Control

Program generated quality control consists of quality control check samples that are submitted to the laboratory for analysis "blind" along with actual environmental samples. These samples provide quality control information for the entire sampling event, from the actual sampling and handling through laboratory analysis. As such, they can provide the best overall estimate of the total uncertainty associated with the sampling round.

Table 5-1
Laboratory Sample Frequency

QC Check Sample	Frequency of Analysis
Method Blanks	One per analytical batch or one per every twenty samples
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per analytical batch or one per every twenty samples
Surrogate Spikes	One per every trace organic analysis

The combination of laboratory duplicates and laboratory control samples may be substituted for MS/MSD analysis for parameters where they are more appropriate.

Program generated quality control samples collected in support of this project are:

- Duplicate samples
- Field and equipment blanks
- Trip blanks

Each report should have a cover page that references the CDM Smith task number.

The cover page also provides an opportunity to describe, in a narrative format, any unusual problems or interferences encountered during analysis. In addition, all results should be reported on a dry weight basis for soils and at dilution-corrected concentrations for all samples.

5.3.3 QC Deliverables Package

The following quality control data is required to be reported. For "priority pollutant" type analysis, the following quality control data is required per sample batch:

- Method Blanks associated with each analytical procedure.
- Surrogate Spike Recoveries for volatile organics, PCBs, semi-volatiles and polynuclear aromatic hydrocarbons.
- MS/MSDs for all priority pollutant parameters. One MS/MSD should be run for every 20 samples.

For non-priority pollutant parameters, the following quality control data is required per sample batch:

- Method Blanks

- Laboratory Duplicates - One duplicate analysis should be performed at a frequency of one per 20 samples.

No specific acceptance criteria for blanks and spike recoveries will be set forth here, however, all laboratories are expected to conform to standard EPA quality control specifications. CDM Smith expects laboratories to reanalyze samples if quality control samples fail to meet EPA specifications.

The quality control data may be presented as a quality control section within the report or it may be integrated with the results.

5.4 Data Quality Requirements

Taking into consideration a project's overall objective and intended use of the data, it should be considered that the analyses be conducted in accordance with SW-846, Test Methods for Evaluating Solid Waste, Third Edition procedures. In cases where additional procedures are required, other EPA approved laboratory methods will be used.

5.5 Data Deliverable

NYSDEC requires the use of electronic submissions to the greatest degree appropriate for the site-specific remedial program. All data generated will be submitted in an electronic data deliverable (EDD) that complies with the NYSDEC Electronic Document Standards (EDWS) or as otherwise directed by NYSDEC.

5.6 Analytical Data Validation

If a work assignment requires the validation of data, validation is performed to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use.

Laboratory results shall be supported by sufficient back-up data and QA/QC results to enable the reviewer to conclusively determine the quality of the data. The laboratory will review data prior to its release from the laboratory. Objectives for review are in accordance with the QA/QC objectives stated in each site-specific Work Plan. The laboratory is required to evaluate their ability to meet these objectives. Outlying data will be flagged in accordance with laboratory standard operating procedures, and corrective action will be taken to rectify the problem.

A NYSDEC-approved qualified independent third party data validator will review the data package to determine completeness and compliance in accordance with Standby Contract D009805. A narrative describing how the data did or did not meet the validation criteria is part of the data validation procedure. The validation assessment will describe the overall quality of the data and the data validation report will provide a written statement upon completion of the validation indicating whether or not the data is valid and usable, and will include a percent completeness value of usable data.

5.7 Data Usability Summary Report

A Data Usability Summary Report (DUSR) provides a thorough evaluation of analytical data without the third party data validation.

The primary objective of a DUSR is to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use. If a work assignment requires a DUSR, the DUSR will be developed by a NYSDEC approved qualified environmental scientist in accordance with Standby Contract D009805.

Table 3-1
Equipment List

Equipment List \ Field Procedure	Soil Vapor Sampling	Temporary Port Sub-Slab Soil Vapor Sampling	Permanent Port Sub-Slab Soil Vapor Sampling	Indoor (Ambient) Air Sampling	Outdoor (Ambient) Air Sampling	Direct Push Groundwater Sampling	Low Flow Groundwater Sampling	Monitoring Well Purging	Groundwater Sampling by Bailer	Tap Water Sampling	Surface Water Sampling	Sediment/Sludge Sampling	Subsurface Soil Sampling	Surface Soil Sampling	Investigative Derived Waste	Water Level/NAPL Measurement	Rock Coring	Packer Testing	Aquifer Performance Test	Membrane Interface Probe	Fish Sampling	Benthic Macroinvertibrate Sampling
¼-inch flush mount hex socket plug, Teflon coated			x																			
¼-inch OD Teflon tubing	x	x	x				x															
¼-inch outside diameter (OD) stainless steel tubing			x																			
¼-inch Swagelock™ female and male connector			x																			
½- to ¾-inch braided nylon line or Teflon-coated wire rope									x		x	x										
1.4 or 6 Liter summa canisters	x	x	x	x	x																	
1-gallon buckets with foam along the rim	x	x																				
5-gallon bucket							x	x	x	x											x	x
60 cm^3 syringe	x	x	x																			
6-ft Engineers Scale																	x					
Aluminum foil												x									x	
Anchoring cement			x																			
Auger, rotary, air hammer or other drilling method (provided by subcontractor)																	x	x				
Bailer (sampler) and rope or wire line								x	x		x											
Boat (as needed for deep water)												x										
Bricks (or equivalent)	x																					
Camera	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cement (to patch floor)		x																				
Check valve																			x			
Clear waterproof tape												x										
Composite Liquid Waste Sampler (COLIWASA) or sample thief for liquid sampling in a container															x							
Coolers/Sample shipping containers with ice packs						x	x		x	x	x	x	x	x	x			x			x	x
Core Barrel (provided by subcontractor)																	x					
Data logger and laptop																x			x			
Decontamination supplies						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Direct-push drill rig or rotary drill rig (for split-spoon/split barrel or direct push sampling)													x									
Discharge Hosing/piping								x											x			
Electrical conduit putty or modeling clay		x	x																			
Field parameters meters (Temperature, conductivity, pH, dissolved oxygen, Redox, turbidity)							x		x	x	x							x				
Flow meter with totalizer																		x	x			
Generator/electric supply source							x	x											x			
Hammer Drill with 1.25-inch bit		x																				
Hammer Drill with 3/8,1-inch bit			x																			
Hand auger and extension rods (for manual sampling)												x	x									

Table 3-1
Equipment List

Equipment List / Field Procedure	Soil Vapor Sampling	Temporary Port Sub-Slab Soil Vapor Sampling	Permanent Port Sub-Slab Soil Vapor Sampling	Indoor (Ambient) Air Sampling	Outdoor (Ambient) Air Sampling	Direct Push Groundwater Sampling	Low Flow Groundwater Sampling	Monitoring Well Purging	Groundwater Sampling by Bailer	Tap Water Sampling	Surface Water Sampling	Sediment/Sludge Sampling	Subsurface Soil Sampling	Surface Soil Sampling	Investigative Derived Waste	Water Level/NAPL Measurement	Rock Coring	Packer Testing	Aquifer Performance Test	Membrane Interface Probe	Fish Sampling	Benthic Macroinvertibrate Sampling
Helium, regulator and detector	x	x																				
Indelible black ink pen or marker	x	x	x	x	x	x	x		x	x	x	x	x	x	x		x	x				
Inflatable Packers (provided by subcontractor)																		x				
Kimwipe or paper towels						x	x	x	x		x	x	x	x	x	x					x	x
Labels and shipping products	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		x			x	x
Large, wide-mouth breakers for measuring field parameters							x		x	x	x							x				
Lift pipe (provided by subcontractor)																		x				
Logbook	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
low-flow air pump	x	x	x																			
low-flow groundwater pump							x															
Nitrogen																		x				
Personal protective equipment per Health and Safety Plan	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Photoionization detector (PID)	x	x	x			x	x		x	x		x	x	x	x			x				
Plastic Zip-top bag									x	x		x	x	x							x	x
Polyethylene or plastic sheeting						x	x	x	x		x	x	x	x	x			x		x	x	x
Ponar sampler/ Eckman grab												x										
Pond sampler											x											
Pressure Gauges																		x				
Sample containers and preservatives (supplied by laboratory)						x	x		x	x	x	x	x	x	x			x				
Sampling port/valve																		x	x			
Scale																					x	x
Slide Hammer with extension rods (for manual sampling)													x									
Stainless steel push tubes (as needed)												x										
Stainless steel trowels, spoons, pan, tray, or bowls												x	x	x	x							
Stop watch										x									x			
Submersible pump								x										x	x			
Surveyor’s stand (or equivalent to place canister on)				x																		
Tap and deionized water						x			x		x	x	x	x	x	x	x	x				
Tape Measure (100+ ft)	x	x	x	x	x	x	x				x	x	x	x				x	x		x	x
Locating device (GPS)	x	x	x	x	x	x	x		x		x	x	x	x			x	x		x		
Tedlar™ sample bags	x	x	x																			
Teflon thread tape			x																			
T-handle (extension rod) and hand auger													x									
three-way valve	x	x	x																			
trowel or putty knife			x																			
Tubing cutter	x	x	x				x	x														
Water level indicator						x	x	x	x							x		x	x			
Water spray bottle						x	x				x	x	x	x	x							
Water storage container (if necessary)					x	x	x											x	x			
Wrenches and pliers	x	x	x	x	x		x	x	x				x									

Appendix A

Field Form

CDM Smith

PHOTOGRAPH TRACKING LOG

SITE NAME: ________________________________

CAMERA # ____

Photograph #	Description	Date/Time	Photographer

LOW FLOW SAMPLING SHEETS

SITE NAME: ______________________________

DATE:	**WELL #:**

DATE:	**WELL #:**
SAMPLE TIME:	**DEPTH OF PUMP:**
WEATHER CONDITIONS:	**SAMPLERS:**

TIME	VOLUME PURGED (GALS)	DEPTH TO WATER (FT TIC)	FLOW RATE (ml/min)	DRAWDOWN (FEET)	TEMP ^{0}C (+/- 10%)	ph (+/- 0.1 SU)	REDOX POTENTIAL mV (+/- 10 mv)	SPECIFIC COND. mS/cm (+/- 3%)	DISSOLVED OXYGEN mg/L (+/- 10%)	TURBIDITY NTUs (+/- 10%)

The well is considered stabilized and ready for sampling when the indicator parameters have stabilized for three consecutive readings by the measurements indicated in parenthesis.

SAMPLE SCREENING TRACKING LOG

SITE NAME: ____________________________________

SAMPLE ID	SAMPLE DATE	SAMPLE TIME	MATRIX	DUP (Y/N)	COMMENTS

SYNOPTIC WATER LEVEL MEASUREMENTS

SITE NAME: ____________________________________

DATE: ________________________

Time	Well	Depth to Water	Total Depth	Product/ Thickness	HNu Headspace Readings	Notes/Well Condition

All readings are from Top of Inner Casing (TIC)

DRUM TRACKING LOG

SITE NAME: ______________________________

Drum #	Boring/MW#	Date Drilled/ Sampled	Related Sample #	Description of Drum Contents	Signature

SAMPLE TRACKING LOG

SITE NAME/SAMPLE EVENT:____

LDL VOC LAB: ______________________________ **INORGANIC CLP LAB:** ________________________

CLP CASE NO:___________________________ **ORGANIC CLP LAB:**____________________________ **SUBCONTRACT LAB:** ________________________

SAMPLE ID	SAMPLE DATE	SAMPLE TIME	MATRIX	DEPTH (feet)	ORGANIC CLP NO.	INORGANIC CLP NO.	SUBCONTRACT ANALYSIS	QA/QC

ANALYSIS SUMMARY: ____

____

DRILLING SUMMARY SHEET

SITE NAME HERE

Date:
Geologist:
Driller:
Borehole Locations:
Drums Generated (ID#s):

1.0 GENERAL CHARGES			**HAS RIG**	**TRIPOD**
1a.	Mobilization and Demobilization	Each		
1b.	Construct Decontamination Pad	Each		
1c.	Steam Cleaning (1 hour/boring maximum)	Hours		
1d.	Drums	Drums		
1e.	Drumming Residuals/Transportation	Drums		
1f.	Standby Time	Hours		
1g.	Baker Tank Rental (20,000 gallons each)	Each		
2.0 BOREHOLE DRILLING				
2a.	4 ¼ inch ID – HSA	Feet		
2b.	Split Spoon Sampling	Spoons		
2c.	Shelby Tubes	Tubes		
2d.	Geoprobe Boreholes	Feet		
2e.	Macro Core and Large Bore Sampling	Feet		
2f.	Soil Boring with Tripod	Feet		
2g.	Borehole Grouting	Feet		
3.0 OVERBURDEN MONITORING WELL INSTALLATION				
3a.	Soil Borings with 6 ¼ inch ID HAS (8 inch borehole)	Feet		
3b.	Split Spoon Sampling	Spoons		
3c.	4-inch Type 304 Stainless Steel Casing	Feet		
3d.	4-inch Type 304 Stainless Steel Screen	Feet		
3e.	Well Completion Materials (Gravel pack, bentonite, grouting installed)	Feet		
3f.	5 foot Carbon Steel Protective Casing (installed), including Well Lock and Key, Concrete Collar, etc.	Each		
3g.	Flush Mount including Well Lock and Key, Concrete Collar, etc.	Each		
3h.	Well Development (3 hours/well)	Wells		
4.0 OVERBURDEN MONITORING WELL INSTALLATION				
4a.	Surcharge for Level "C"	Per Hour		

Boring Name:

Client:
Project Location:

Project Name:
Project Number:

Drilling Contractor:
Drilling Method:
Sample Method:
Drilling Date:
North:
East:

Surface Elevation (ft amsl):
Total Depth:
Depth to Initial Water Level (ft bgs):
Field Screening Instrument:
Logged by:

Depth (ft. bgs)	Sample Number	Blows per 6 inches	Sample Interval (ft)	Recovery (ft)	OVM Reading (ppm)	Graphic Log	Material Description

Remarks:

Boring Completion Depth ft bgs __________

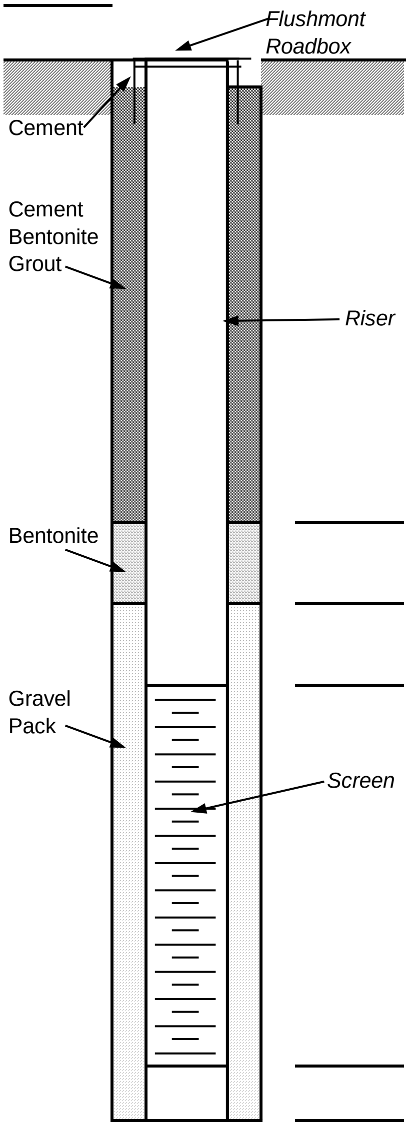
WELL CONSTRUCTION SUMMARY

Project: ____________ Location: ____________ Well No.: ____________

Permit No.: ____________

TOC elev.: ________ -

Type: ____________



DRILLING SUMMARY

Drilling Company: ____________ Drillers: ____________

Drill Rig/Model: ____________

Borehole Diameters: ____________ Drilling Fluid: ____________

Bits/Depths: ____________

Total Depth: ________ Depth To Water: ____________

Supervisor Geologist: ____________

WELL DESIGN

Casing Material: ____________ Diameter: ____________

Screen Material: ____________ Diameter: ____________

Slot Size: ____________ Setting: ____________

Filter Material: ____________ Setting: ____________

Seals Material: ____________ Setting: ____________

Grout: ____________ Setting: ____________

Surface Casing Material: ____________ Setting: ____________

TIME LOG

	Started	Completed
Drilling:		
Installation:		
Development:		

WELL DEVELOPMENT

Method: ____________

Static Depth to Water: ____________

Pumping Depth To Water: ____________

Pumping Rate: ________ Spec. Capacity: ________

Volume Pumped: ________

Appendix B

Health and Safety Plan

HEALTH AND SAFETY PLAN FORM

CDM Smith Health and Safety Program

This document is for the exclusive use of CDM Smith and its subcontractors

PROJECT NAME	New Process Cleaners Site No. 518024	**PROJECT#**	D009805-15
REGION	ESG-NY		
SITE ADDRESS	115 North Market Street Johnstown, NY 12095	**CLIENT ORGANIZATION**	NYSDEC
		CLIENT CONTACT	Nicole Hinze
		CLIENT CONTACT PHONE #	(518) 897-1256

( ) AMENDMENT TO EXISTING APPROVED HASP? NA

( ) HASP AMENDMENT NUMBER? NA

( ) DATE OF PREVIOUS HASP APPROVAL NA

OBJECTIVES OF FIELD WORK:
(e.g. collect surface soil samples):

1. Groundwater sampling and synoptic water levels. 2. Oversee Monitoring well surveying. 3. GPR/EM survey of underground structures. 4. Subsurface investigation, collect soil boing samples and groundwater screening samples. 5. Monitoring well installation. 6. Vapor intrusion sampling.

SITE TYPE: *Check as many as applicable*

Active	**(X)**	Landfill	( )	Unknown	( )
Inactive	( )	Uncontrolled	( )	Military	( )
Secure	( )	Industrial	( )	Other (specify)	
Unsecure	**(X)**	Recovery	( )	**Commercial**	**(X)**
Enclosed space	( )	Well Field	( )	Residential	( )

All requirements described in the CDM Smith Health and Safety Manual are incorporated in this health and safety plan by reference.

Names of Staff	Company / Division / Office	Current Training & Medical?	Project or Site Responsibilities	Tasks On Site?
Lia Estrada	CDM Smith / TSU / ALB	Yes	Project Manager (PM)	NA
Tonya Bennett	CDM Smith / TSU / NYN	Yes	Task Manager/Site H&S Coordinator	NA
Sean Marciano	CDM Smith / TSU/ ALB	Yes	Field Team Leader (FTL)	1-2-3-4-5-6
Matt Renko	CDM Smith / TSU/ ALB	Yes	Field Geologist	1-2-3-4-5-6

BACKGROUND REVIEW: **(x) Complete** **( ) Incomplete**

SITE MAP:


LEGEND
Monitoring Wells
Sanitary Manhole
Active Sewer Lateral (Est.)
Fence (Est.)
Test Pit
New Process Cleaners Approximate Building Outline
Notes:
(1) Sewer lateral location estimated based on discussion with city officials and manhole locaiton.
(2) Aerial image from 2014 NYS Statewide Digital Orthoimagery Program http://gis.ny.gov/gateway/orthoprogram
0
Feet
50
New Process Cleaners Site Building
NPC-MW6
NPC-MW1
NPC-MW4
NPC-MW5
NPC-MW3
NPC-MW2
N Market Street
Former R & J Garage Property
Manhole

HEALTH AND SAFETY PLAN FORM

CDM Smith Health and Safety Program

This document is for the exclusive use of CDM Smith and its subcontractors

HISTORY: *Summarize conditions that relate to hazard. Include citizen complaints, spills, previous investigations or agency actions, known injuries, etc.*

Based on a Site Characterization performed at the Site in 2018, the Site was found to be contaminated with chlorinated solvents, primarily tetrachloroethylene (PCE) and trichloroethylene (TCE) in both soil and groundwater. PCE, TCE and their associated degradation products are also found in groundwater at the south-west portion of the property, exceeding groundwater standards (typically 5 micrograms per kilogram (µg/L)), with a maximum PCE concentration of 15,000 µg/L and maximum TCE concentration of 6.6 µg/L. PCE and TCE were found at maximum concentrations in shallow soil at the Site, at concentrations of 40 milligrams per kilogram (mg/kg) and 0.13 mg/kg, respectively. In addition, 1,4-dioxane and per-and polyfluoroalkyl substances (PFAS) were found in the western portion of the site at low levels. 1,4-dioxane was detected at a maximum concentration of 0.34 µg/L, which is below the 1 µg/L screening level. PFOA was detected at a maximum concentration of 9.6 ng/L, which is below the 10 ng/L screening level; PFOS was detected at a maximum of 15 ng/L, which is slightly exceeding the 10 ng/L screening level. The maximum concentration of PFAS was PFPeA at 83 ng/L, which is below the 100 ng/L screening level. The total PFAS concentration was 189.75 ng/L, which is below the screening level of 500 ng/L.

WASTE TYPES: **(X) Liquid** **(X) Solid** ( ) Sludge ( ) Gas ( ) Unknown ( ) Other, specify:

WASTE CHARACTERISTICS: *Check as many as applicable.*

( ) Corrosive
(X) Flammable
( ) Radioactive
(X) Toxic
(X) Volatile
( ) Reactive
( ) Inert Gas
( ) Unknown
( ) Other:

WORK ZONES:

The exclusion zone will include all points within 10 feet of the investigation activities or a sampling location. The contamination reduction zone (CRZ) will consist of a ten foot annulus outside of the exclusion zone. The support zone will be a 10 foot annulus outside of the CRZ. All zones are mobile and will be established and moved as work crew moves.

HAZARDS OF CONCERN: *Check as many as applicable.*

(X) Heat Stress
(X) Cold Stress
(X) Explosive/Flammable
( ) Oxygen Deficient
( ) Radiological
(X) Biological (Ticks, mosquitos, bees)
(X) Other: **Severe Weather**
(X) Other: **Odor, Dust, Vapor**
(X) Other: **Driving/Vehicle Traffic**
(X) Other: **COVID-19**
(X) Other: **Drill Rig**

(X) Noise
( ) Inorganic Chemicals
(X) Organic Chemicals
(X) Motorized Traffic
(X) Heavy Machinery (excavators, etc.)
(X) Slips & Falls

FACILITY'S PAST AND PRESENT DISPOSAL METHODS AND PRACTICES:

The sewer line was found to discharge sub grade within the adjacent former garage site. Upon discovery of the sewer pipe, the City installed a new manhole to receive the discharge pipe from the dry cleaners, and connected this manhole to the city sewer.

This plan incorporates CDM Smith's procedure for: *(Click on the relevant topics to download the hazard guideline. Delete irrelevant topics.)*

Hearing Conservation
Electrical Safety
Cell Phone Safety
Fatigue Management
PPE
Traffic and Work Zone Safety
Tools and Power Equipment
Manual Material Handling
Working Around Heavy Equipment
Cold Stress
Hazardous Waste Site Decontamination
Hazardous Waste Site Controls
Flammable and Combustible Liquids
First Aid and Blood Borne Pathogens

HEALTH AND SAFETY PLAN FORM

CDM Smith Health and Safety Program

This document is for the exclusive use of CDM Smith and its subcontractors

DESCRIPTION AND FEATURES: *Include principal operations and unusual features (containers, buildings, dikes, power lines, hillslopes, rivers, etc.)*

The property characterized during this investigation is located at 115 North Market Street in the City of Johnstown in Fulton County, New York (Figure 1). The 0.11 acre property is zoned commercial and houses an active dry cleaner, New Process Cleaners. The building, its parking lot, and driveway occupies the majority of the parcel with little undeveloped space. It has a one-story building with a basement located in the front portion, while the rear of the building was constructed slab-on-grade. In general the property is located in a mixed commercial and residential area. The site is adjacent to a commercial property that formerly was used as a car maintenance facility.

SURROUNDING POPULATION: **(X) Residential** ( ) Industrial **(X) Commercial** ( ) Rural ( ) Urban OTHER:

HAZARDOUS MATERIAL SUMMARY: ***Highlight or bold waste types and estimate amounts by category.***

CHEMICALS:	**SOLIDS:**	**SLUDGES:**	**SOLVENTS:**	**OILS:**	**OTHER:**
Amount/Units:	*Amount/Units:*	*Amount/Units:*	*Amount/Units:*	*Amount/Units:*	*Amount/Units:*
Acids	Flyash	Paints	Ketones	Oily Wastes (Coal Tar)	Laboratory
Pickling Liquors	Mill or Mine Tailings	Pigments	Aromatics	Gasoline	Pharmaceutical
Caustics	Asbestos	Metals Sludges	Hydrocarbons	Diesel Oil	Hospital
Pesticides	Ferrous Smelter	POTW Sludge	Alcohols	Lubricants	Radiological
Dyes or Inks	Non-Ferrous Smelter	Distillation Bottoms	**Halogenated**	Polynuclear Aromatics	Municipal
Cyanides	Metals	Aluminum	Esters	PCBs	Construction
Phenols	Dioxins		Ethers	Heating Oil	Munitions
Halogens					
Other - *specify*	Other - *specify*	Other - *specify*	Other - *specify*	Other - *specify*	Other - *specify*

HEALTH AND SAFETY PLAN FORM
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KNOWN CONTAMINANTS	HIGHEST OBSERVED CONCENTRATION	PEL (ppm)	IDLH (ppm)	SYMPTOMS & EFFECTS OF ACUTE EXPOSURE	PHOTO IONIZATION POTENTIAL
PCE (Tetrachloroethene)	Soil 40 ppm, Groundwater 15,000 ppb	100	150	irritation eyes, skin, nose, throat, flush face and neck; dizziness,	9.32 eV
TCE (Trichloroethene)	Soil 0.13 ppm, Groundwater 6.6 ppb	100	1,000	Vertigo, visual disturbance, headache, drowsiness	9.45 eV
1,4-dioxane	Groundwater 0.34 ppb	100	500	irritation eyes, skin, nose, throat; drowsiness, headache; nausea, vomiting	9.13 eV
PFAS	Groundwater PFOA 9.6 ppt, PFOS 15 ppt, PFPeA 83 ppt, PFAS total 189.75	0.01 mg/m3 ACGIH TLV	None identified	potential carcinogenic	NA

NA = not applicable
ppb = parts per billion
ppm = parts per million

eV = electronvolt
PEL = permissible exposure level
IDLH = Immediately dangerous to life or health

Verify your access to an SDS for each chemical you will use at the site.

HEALTH AND SAFETY PLAN FORM
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	SPECIFIC TASK DESCRIPTIONS	Disturbing the Waste?	TASK - SPECIFIC HAZARDS	HAZARD & SCHEDULE
1	Collect groundwater samples and synoptic water levels measurements from new and existing wells.	**Non-Intrusive**	Hazards include cold stress, heat stress, motorized traffic, slips and falls, contamination exposure, dust, odor, and noise, working with tools and field instruments. Follow COVID-19 CDM Smith field guidance where applicable.	**Low Hazard** 2022
2	Oversee survey of new and existing monitoring wells..	**Non-Intrusive**	Hazards include cold stress, heat stress, motorized traffic, slips and falls, contamination exposure, odor. Follow COVID-19 CDM Smith field guidance where applicable. Be cautious when walking and driving vehicles onsite.	**Low Hazard** 2022
3	GPR/EM survey of underground structures.	**Non-Intrusive**	Hazards include cold stress, heat stress, motorized traffic, slips and falls. Follow COVID-19 CDM Smith field guidance where applicable. Be cautious when walking and driving vehicles onsite.	**Low Hazard** 2022
4	Oversee Subsurface investigation. Collect soil boing sampling and groundwater screening samples	**Intrusive**	Hazards include cold stress, heat stress, motorized traffic, proximity to heavy machinery, slips and falls, contamination exposure, dust, odor, noise, and utilities. Follow COVID-19 CDM Smith field guidance where applicable.	**Moderate Hazard** 2022
5	Oversee monitoring well installation.	**Intrusive**	Hazards include cold stress, heat stress, motorized traffic, proximity to heavy machinery, slips and falls, contamination exposure, dust, odor, noise, and utilities. Follow COVID-19 CDM Smith field guidance where applicable.	**Moderate Hazard** 2022
6	Perform vapor intrusion sampling.	**Intrusive**	Hazards include cold stress, heat stress, motorized traffic, slips and falls, contamination exposure, dust, odor, noise, utilities, and working with tools and field instruments. Follow COVID-19 CDM Smith field guidance where applicable.	**Moderate Hazard** 2022

SPECIALIZED TRAINING REQUIRED:

40 hour OSHA Training, 8 hour OSHA Refresher Training, OSHA Hazardous Waste Supervisor, First Aid and CPR Training

SPECIAL MEDICAL SURVEILLANCE REQUIREMENTS:

Annual Medical Surveillance

OVERALL HAZARD EVALUATION: ( ) High ( ) Medium **(X) Low** ( ) Unknown *(Where tasks have different hazards, evaluate each.)*

JUSTIFICATION: Main hazards of concern are working near traffic, around heavy machinery, and exposure to contaminated media, dust and cold stress. Typical outdoor physical activities include low exposure to organic volatiles.

FIRE/EXPLOSION POTENTIAL: ( ) High ( ) Medium **(X) Low** ( ) Unknown

HEALTH AND SAFETY PLAN FORM

CDM Smith Health and Safety Program

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CDM Smith

PROTECTIVE EQUIPMENT: *Specify by task. Indicate type and/or material, as necessary. Group tasks if possible. Use copies of this sheet if needed.*

BLOCK A

TASKS: 1, 2, 3
LEVELD - Modified
(X) Primary ( ) Contingency

Respiratory: (X) Not needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
(X) Other: N95/KN95 Face Covering indoors or when 6' cannot be maintained if not vaccinated.

Head and Eye: ( ) Not needed
(X) Safety Glasses
( ) Face Shield
( ) Goggles
(X) Hard Hat
( ) Other:

Boots: ( ) Not needed
(X) Safety-Toe
( ) Rubber
( ) Overboots:
( ) Steel Shank
( ) Leather

Prot. Clothing: ( ) Not needed
( ) Encapsulated Suit:
( ) Splash Suit
( ) Apron:
( ) Tyvek Coverall:
( ) Saranex Coverall
(X) Traffic vest
( ) Cloth Coverall:
(X) Other: Work Clothes

Gloves: ( ) Not needed
( ) Undergloves:
(X) Gloves:
( ) Overgloves:

Other: High Visibility clothing
(X) Bug Spray: As needed
( ) Flotation Device If Over Water
(X) Hearing Protection: consider for gw sampling generator noise
(X) Sun Screen: As needed
(X) Cell phone
(X) Traffic cones

BLOCK B

TASKS: 4, 5, 6
LEVEL: D - Modified
(X) Primary (X) Contingency

Respiratory: (X) Not needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
(X) Other: N95/KN95 Face Covering indoors or when 6' cannot be maintained if not vaccinated.

Head and Eye: ( ) Not needed
(X) Safety Glasses
( ) Face Shield
( ) Goggles
(X) Hard Hat
( ) Other:

Boots: ( ) Not needed
(X) Safety-Toe
( ) Rubber
( ) Overboots:
( ) Steel Shank
( ) Leather

Prot. Clothing: ( ) Not needed
( ) Encapsulated Suit:
( ) Splash Suit
( ) Apron:
( ) Tyvek Coverall
( ) Saranex Coverall
(X) Traffic vest
( ) Cloth Coverall:
(X) Other: Work Clothes

Gloves: ( ) Not needed
(X) Gloves: handling soil and drilling VI ports)
( ) Gloves: Cut-resistant for drillers
( ) Overgloves:

Other: specify below
(X) Bug Spray: As needed
( ) Floatation Device
(X) Hearing Protection (during drilling)
(X) Sun Screen: As needed
(X) Cell phone
(X) Traffic cones

BLOCK C

TASKS: 1, 2, 3
LEVELD - Modified
(X) Primary ( ) Contingency

Exit Area

Respiratory: (X) Not needed
( ) S[illegible]
( ) A[illegible]
( ) C[illegible]
( ) E[illegible] Mask:
(X) O[illegible] wh[illegible] social distance cannot be maintained

Head and Eye: ( ) Not needed
(X) Safety Glasses
( ) Face Shield
( ) [illegible]
(X) [illegible]
([illegible]e[illegible]

[illegible]s: ( ) [illegible]e[illegible]
(X) Safety-Toe
( ) Rubber
( ) Overboots:
( ) Steel Shank
( ) Leather

Prot. Clothing: ( ) Not needed
( ) En[illegible]psulated Suit:
([illegible]sh Suit
([illegible]
([illegible]k Coverall:
([illegible]nex Coverall
(X) [illegible] vest
( ) Cloth Coverall:
(X) Other: Work Clothes

Gloves: ( ) Not needed
( ) Undergloves:
(X) Gloves: Nitrile and as needed
([illegible]es:

O[illegible]isibility clothing
([illegible]: As needed
( ) Flotation Device If Over Water
(X) Hearing Protection: As needed
(X) Sun Screen: As needed
(X) Cell phone
(X) Traffic cones

HEALTH AND SAFETY PLAN FORM CDM Smith Health and Safety Program		*This document is for the exclusive use of CDM Smith and its subcontractors*		
MONITORING EQUIPMENT:		*Specify by task. Indicate type as necessary. Attach additional sheets if needed.*		
INSTRUMENT	**TASK**	**ACTION GUIDELINES**		**COMMENTS**
Photoionization Detector (PID)	1, 4, 5, 6	Above Background: 0-5 ppm: 5-10 ppm: >10 ppm:	 *Proceed with caution* *Clear area - see if detection dissipates* *Exit area*	( ) Not Needed CDM Smith will monitor during field task. A 10.6 eV lamp will be used based on the contaminants of concern.

HEALTH AND SAFETY PLAN FORM
CDM Smith Health and Safety Program

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DECONTAMINATION PROCEDURES

ATTACH SITE MAP INDICATING EXCLUSION, DECONTAMINATION, & SUPPORT ZONES AS PAGE TWO

Personnel Decontamination	Sampling Equipment Decontamination	Heavy Equipment Decontamination
Summarize below or attach diagram; Additional procedures have been implemented by CDM Smith to limit exposure to COVID-19. A protective face mask or cover must be worn at all times indoors or when social distancing can't be maintained outdoors for personnel not vaccinated. Wash hands frequently and thoroughly for a minimum of 20 seconds. Workers will remove PPE in this order: Wash hands and face if necessary with soap and water upon doffing personal protective equipment. Workers will remove protective clothing in the following order: 1. Equipment drop 2. Remove hard hat 3. Remove nitrile gloves 4. Face and hand wash * Health and Safety Manager has authorization to upgrade or downgrade level of H&S personal protective equipment (PPE). ( ) Not Needed	*Summarize below or attach diagram;* All sampling equipment will be thoroughly decontaminated as follows: 1. Wash and scrub with low phosphate detergent 2. Potable tap water rinse 3. Air dry 4. Wrap in aluminum foil, shiny side out for transport Potable water must be from a municipal water treatment supply system. Water quality measurement probes must be rinsed with deionized water between uses. Water level indicator tape must be rinsed/wiped with wet paper towel between uses. ( ) Not Needed	*Summarize below or attach diagram;* CDM Smith will require heavy equipment contractors to decontaminate their equipment upon arrival to the property, between locations, when it is observed to have heavy contamination, and before it leaves the property. Decontaminate DPT equipment at each well/borehole location using steam cleaning. ( ) Not Needed
Containment and Disposal Method	**Containment and Disposal Method**	**Containment and Disposal Method**
All disposable PPE will be containerized in 55 gallon drums and held for appropriate disposal off-site.	Decontamination wastes will be containerized in 55 gallon drums, roll-off containers and held for appropriate disposal off-site. Water will disposed of at the onsite water treatment facility.	Not Applicable

HAZARDOUS MATERIALS TO BE BROUGHT ONSITE

Preservatives		*Decontamination*		*Calibration*	
(X) Hydrochloric Acid	( ) Zinc Acetate	**(X) Alconox ™**	( ) Hexane	**(X) 100 ppm isobutylene**	( ) Hydrogen Sulfide
( ) Nitric Acid	( ) Ascorbic Acid	( ) Liquinox ™	( ) Isopropanol	( ) Methane	( ) Carbon Monoxide
( ) Sulfuric Acid	( ) Acetic Acid	( ) Acetone	( ) Nitric Acid	( ) Pentane	
( ) Sodium Hydroxide	( ) Other:	( ) Methanol	( ) Other:	( ) Hyrogen	
		( ) Mineral Spirits		( ) Propane	

HEALTH AND SAFETY PLAN FORM

CDM Smith Health and Safety Program

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EMERGENCY CONTACTS	
Water Supply	N/A
EPA Release Report #:	(800) 424-8802
CDM Smith 24-Hour Emergency #:	(857) 500-3636
National Response Center - Hazardous Materials Spill	(800) 424-8802
Facility Management	N/A
Other (specify)	N/A
CHEMTREC Emergency #:	(800) 424-9300
24 Hr. First Aid/Non-Emergency Medical Services	(800) 350-4511, Press 1

SAFETY NARRATIVE: *Summarize below*

Evacuate the site and meet at a predetermined location if any unexpected hazardous conditions are encountered. All teams will be in communication with one another via cell phones. If staff observes hazards for which they have not been prepared, they will withdraw from the area and call the CDM Smith Health and Safety Manager, Joe Sabo. CDM Smith personnel will leave the site if they experience nausea or dizziness. The buddy system will also be in effect at all times. Solo CDM Smith representatives will not enter, or remain in, the work area unless accompanied by a contractor or facility personnel.

HEALTH AND SAFETY PLAN APPROVALS (H&S Mgr. must sign each plan)

Prepared by	Jeffrey Rakowski	Date	1/13/2022
HSM Signature	Joe Sabo CSP **Joe Sabo**		1/14/2022

EMERGENCY CONTACTS	**NAME**	**PHONE**
Health and Safety Manager	Joe Sabo	(857) 500-3636
Site Safety Coordinator	Matt Renko	(518) 782-4533
Client Contact	Nicole Hinze	(518) 897-1256
Other *(specify)*	N/A	
Environmental Agency	NYSDEC Region 5	(518) 897-1200
State Spill Number	NY State	1-800-457-7362
Fire Department		911
Police Department		911
State Police		911
Health Department	NY State	(800) 458-1158
Poison Control Center	Nationwide	(800) 222-1222
Occupational Physician	Dr. Kohana	(800) 350-4511

For non-emergency medical services:

1. Call AllOne Health at 1.800.350.4511, PRESS 1, and tell them you are reporting an injury for CDM Smith. Supply requested information.

2. Follow AllOne Health instructions (e.g., first aid, go to clinic, etc.).

3. After care, follow-up with AllOne at the 1-800 #.

MEDICAL EMERGENCY		**PHONE**
Hospital Name:	(518) 725-8621	(518) 725-8621
Hospital Address	99 East State Street, Gloversville, NY 12078	
Name of Contact at Hospital:	N/A	
Name of 24-Hour Ambulance:		911

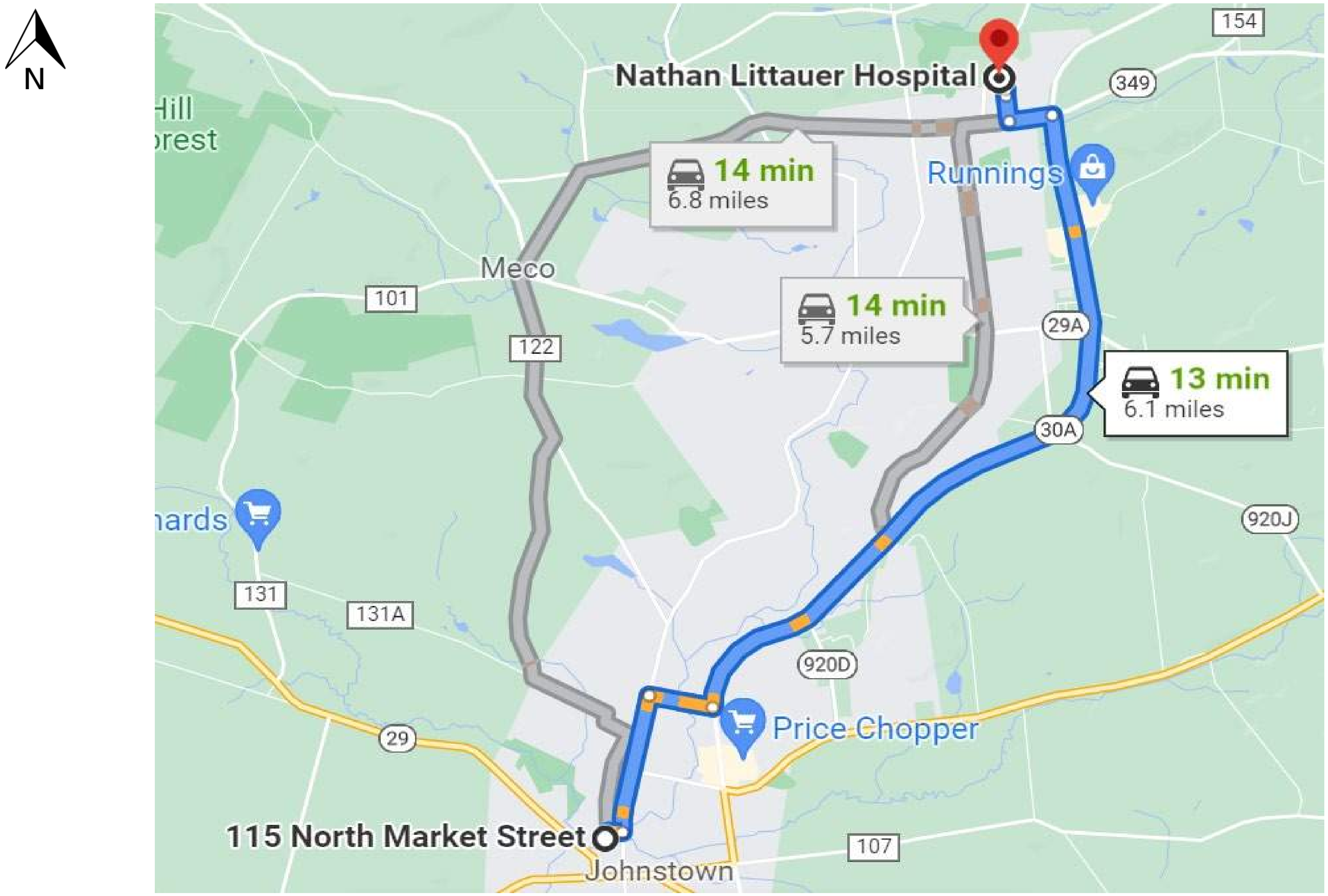
Route to Hospital:

Take Washington St to N Perry St 28 s (0.1 mi)
Turn left onto N Perry St 2 min (0.8 mi)
Turn right onto Townsend Ave 1 min (0.3 mi)
Follow NY-30A N to Gloversville 7 min (4.6 mi)
Drive to your destination 1 min (0.2 mi)

Time to Hospital: 13 minutes

Distance to Hospital: 6.1 miles

Hospital Route Map:



HEALTH AND SAFETY PLAN FORM CDM Health and Safety Program *This document is for the exclusive use of CDM Smith and its subcontractors*	CDM Smith
PRE-ENTRY BRIEFING AND DAILY SAFETY MEETING TOPICS	**COVID-19 MONITORING**
For tasks performed by CDM Smith Staff Review site back ground, contamination levels and exposure systems Review COVID-19 prevention guidelines Buddy system and communication plan Daily tasks, associated risks and hazard control Injury and incident reporting Cold stress/heat stress	All field activities performed onsite must be in accordance with current New York State executive orders. https://www.governor.ny.gov/executiveorders. If a field member shows a fever, a cough, difficulty breathing, lost in sense of taste or smell, or "flu-like" symptoms, do not report to the site and self quarantine. Contact AllOne Health to determine if they should visit a medical facility or local medical provider. From there, notify the supervisor, team lead, or HR representative of the symptoms and any recommendations from AllOne Health. For COVID-19 like symptoms, medical providers are requesting that people call first before seeking treatment.
TRAINING REQUIREMENTS	**COLD STRESS (FROST BITE/HYPOTHERMIA) MONITORING**
All staff shall review the HASP HAZWOPER 40-hour - all on-site staff 8-hour refresher - all on-site staff Supervisor HAZWOPER training (SHSO) One onsite person must have CPR/First Aid Training Certificates will be brought to the site	If a field member shows signs of frost bite (pale, waxy-white skin color, skin becomes hard and numb) or hypothermia (fatigue/drowsiness, uncontrolled shivering, cool bluish skin, slurred speech, clumsy movements, confused behavior), work should be stopped immediately and medical attention should be ensued for the field member. All field members should drink water periodically and take breaks in a heated area when feeling initial signs of frostbite or hypothermia.
MEDICAL MONITORING	**HEAT STRESS MONITORING**
Medical monitoring for field staff are as per OSHA standards 29 CFR 1910.120 (f) and 29 CFR 1926.65 (f). All on-site staff will be cleared by the Health Resources physician (Dr. Kohana) for respirator use if that becomes required. Copies of medical certificates will be kept on-site.	If a field member shows signs of hot, dry skin, profuse sweating or fatigue/drowsiness, slurred speech, clumsy movements, confused behavior work should be stopped immediately and medical attention should be ensued for the field member. All field members should drink water periodically and take breaks in a cool/shaded area when feeling initial signs of heat stress.
EMERGENCY EQUIPMENT	
Fire extinguisher (type ABC) First aid kit Eyewash (when hazardous chemicals present i.e., HCL)	

HEALTH AND SAFETY PLAN SIGNATURE FORM

All site personnel must sign this form indicating receipt of the H&SP. Keep this original on site. It becomes part of the permanent project files. Send a copy to the Health and Safety Manager (HSM).

SITE NAME/NUMBER: New Process Cleaners

DIVISION/LOCATION: TSU- ESG-NY

CERTIFICATION:

I understand, and agree to comply with, the provisions of the above referenced H&SP for work activities on this project. I agree to report any injuries, illnesses or exposure incidents to the site health and safety coordinator (SHSC). I agree to inform the SHSC about any prescription drugs or over-the-counter medication that may cause impairment that I take within 24 hours of site work.

PRINTED NAME	SIGNATURE	DATE

PROJECT STEPS AND EHS HAZARD ASSESSMENT
CDM Smith Health and Safety Program

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Job Steps	Potential Danger	Measures to Eliminate Danger	Stop Criteria	COMMENTS
Detailed steps of the job in sequence (BOLD if critical)	Potential accidents or hazards to be accounted for during job steps:	Precautions: behavioral, organizational, technical. Use of PPE.	What would cause the crew to stop and seek out help from others	
Travel to/from job site	Vehicle collision/personal injury/injury to other personnel	• Do not use cell phone while driving • Pay attention to other vehicles and pedestrians • Follow posted speed limits • Inspect vehicle before each use • Use seatbelts • Park vehicles off-street or in designated parking lot area • Turn headlights on during foggy/rainy/snowing/nighttime conditions • Drive slowly during sleet, freezing rain/fog and rain-snow mixes. Give yourself more time to stop and turn.	Hazardous road conditions or collision that causes injuries	
General on-site activities	Back Strain or Sprain	• The back will be kept as straight as possible. • Legs will be bent.	Before attempting to lift a heavy or awkward item.	
	Injuries	In the event of an emergency, personnel will be transferred to the local emergency facility. In the case of a non-emergency work related injuries or illnesses AllOne Health will be contacted (1.800.350.4511) which will provide first aid and medical advice services.	Upon incident	
	Slips/trips/falls	• Ensure work area is clear of tripping hazards • Wear slip resistant boots and be aware of any icy areas	Injury near misses. Tape off area, set up cones, place warning signs by tripping hazards or icy areas.	
	Traffic hazards	• Wear a high visibility vest • Remain aware of surroundings • Follow traffic signage • Stay on sidewalk or shoulder as much as possible • Face oncoming traffic.	Potential of injury to personnel	
	Cold stress/working in winter conditions	• Take breaks by going indoors • Wear layers of clothing, winter gloves, and heavy jacket • Use hand and toe warmers	Signs of hypothermia	
	Heat stress/working in summer conditions	• Take breaks by going indoors to air conditioned areas or go to shaded areas • Wear light colored and breathable clothing • Drink water	Signs of heat stress	
	Severe Weather	• Cease work until conditions are safe • No work during inclement weather • Be aware of icicles when working close to the building	Thunder - Remain in the shelter for at least 30 minutes after hearing the last sound of thunder	

PROJECT STEPS AND EHS HAZARD ASSESSMENT
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Job Steps	Potential Danger	Measures to Eliminate Danger	Stop Criteria	COMMENTS
Detailed steps of the job in sequence (BOLD if critical)	Potential accidents or hazards to be accounted for during job steps:	Precautions: behavioral, organizational, technical. Use of PPE.	What would cause the crew to stop and seek out help from others	
General on-site activities	COVID-19	• Stay a minimum of 6 feet away from other people. • Wear a face cover (N95 or KN95 mask, surgical mask or similar) indoors or when maintaining 6' distance from onsite personnel cannot be achieved by personnel not vaccinated. Personnel must keep face cover on hand at all times. • Do not shake hands. • Wash your hands frequently and thoroughly with soap and water, for a minimum of 20 seconds. Use hand sanitizer (containing at least 60% alcohol) after contacting common surfaces, when soap and water are not available. • Do not use common coffee pots or water coolers. • Minimize time in shared office spaces, trailers etc. • Avoid touching your face, in particular your mouth, eyes, and nose. • Wipe down common surfaces frequently with disinfectant wipes. • Document daily health checks for all personnel	If you have a fever, a cough, difficulty breathing, lost in sense of taste or smell, or "flu-like" symptoms, do not report to the site and self quarantine	
	Proximity to heavy machinery	• Wear a traffic vest, safety glasses, and hard hat • Stay clear of heavy machinery (drilling equipment, excavators, bulldozers) • If walking in close proximity to heavy equipment, wait until eye contact is made between operator and yourself. Wait for the operator to wave you through. Drill rig inspection must be completed and document with daily safety operation checks	Injury from machinery	
	Dust exposure	• Stand upwind of the dust • Wear safety glasses • Use water sprays to prevent the dust from becoming airborne • The Health and Safety (H&S) consultant will set up four CAMP systems - one positioned upwind and three positioned downwind of construction. CAMP systems will alert the H&S consultant if there are any exceedances in dust.	Sneezing, itchy or teary eyes, wheezing, coughing, tightness in chest	
	Contamination Exposure	• Don appropriate personal protective equipment (PPE), such as nitrile gloves • Be aware of where intrusive work is occurring • Monitor work area • Wash hands after leaving exclusion zone.	Lack of PPE	
	Odors	• Wear a face mask or respirator to mitigate gasoline or mothball-like smell • Odor-control foam will be sprayed onto the excavated area	If the odors reach hazardous levels	
	Noise	• Wear hearing protection and limit the hours working in hazardous noise areas	Hearing loss symptoms: Speech and other sounds seem muffled, Ringing in the ears	
	Biological Hazards	• If personnel come in contact with poison ivy, wash the affected area immediately with Ivy Cleaner provided in the first aid kit. • Inspect Porter John and dumpsters for bees, wasps, and hornets • Wear bug spray to prevent ticks and mosquitoes. • Routinely check for ticks after being outdoors.	Serious allergic reaction.	

PROJECT STEPS AND EHS HAZARD ASSESSMENT
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Job Steps	Potential Danger	Measures to Eliminate Danger	Stop Criteria	COMMENTS
Detailed steps of the job in sequence (BOLD if critical)	Potential accidents or hazards to be accounted for during job steps:	Precautions: behavioral, organizational, technical. Use of PPE.	What would cause the crew to stop and seek out help from others	
Groundwater Sampling	Carbon Monoxide	The generator being used to power the sampling pump will be placed downwind of the person sampling.	Exhaust affecting breathing	
	Contamination Exposure	• Don appropriate personal protective equipment (PPE), such as nitrile gloves • Be aware of where intrusive work is occurring • Monitor work area • Wash hands after leaving exclusion zone.	Lack of PPE	
	Cutting tubing	Wear leather work gloves.	Lack of PPE	
VI Sampling	Domesticated animals	Ensure that the homeowner does not have any animals tha my attack or cause allergies.	Homeowner confirms issue with pets	
	Installing ports	Ensure that drilling does not occur in line with underground utilities.	Undeground utility paths unclear	

Attachment A-1

CDM Smith COVID-19 Prevention Guidance for Field Activities

CDM Smith

CDM Smith

Memorandum

Date: *August 3, 2021*

Subject: *COVID-19 Prevention Guidance for Field Activities*
(This guidance supersedes all previous COVID-19 guidance for field activities)

This document is intended to provide basic guidance to field and project teams that have operations outside of a CDM Smith office, other than CCI construction sites. Included are measures on how to best protect employees and minimize potential exposure to COVID-19.

Planning

Projects involving field work should have an H&S plan to address specific hazards associated with that project. Since potential exposure to this virus is a universal hazard, H&S plans will need to address COVID-19 protocols at the project level. This includes both new plans and any existing plans that have not yet been revised.

The practices below must be evaluated and included in any greater planning activities and project-specific H&S plans.

COVID-19 Exposure

COVID-19 exposure is most directly associated with close personal contact with an infected individual. Close personal contact generally means one of the following:

- Within 6 feet of an infected person for a cumulative total of 15 minutes or more over a 24-hour period starting from 2 days before illness onset (or, for asymptomatic patients, 2 days prior to test specimen collection) until the time the patient is isolated. Employees in countries outside the U.S. should follow the definition of close personal contact based on their country's requirements.

- In direct contact with infectious secretions (been coughed/sneezed upon, etc.).

- Live in the same household.

There are also less direct means of exposure such as contact with contaminated surfaces, aerosols/droplets, and residues. To limit exposure, incorporate the following practices into your field activities.

Best Practices

- Get one of the FDA approved COVID-19 vaccines when you become eligible.

- Maintain social distancing whenever possible of at least 6 feet away from others if you are not fully vaccinated.
    - *"Fully vaccinated" means an individual has taken all required doses of a vaccine and waited the time recommended by the government health organization for full protection to take effect – generally 14 days following final dose.*

- Use of a face covering or mask is required for all employees regardless of vaccination status working in indoor settings around others, except when at an individual workspace which allows for 6 feet of social distancing.
- Use of a face covering or mask is also required for those employees not fully vaccinated when working outdoors where social distancing of 6 feet is not possible. Be aware that face coverings or masks may also be required by certain local governments and/or clients.
    - *CDM Smith's Field Equipment Center has a supply of work gloves, hand sanitizer, and face masks that meet CDC, local government, and client requirements. Contact the Equipment Center to request any PPE.*
    - *Face coverings or masks should not be used in place of N95 masks or any respirators that have been approved for protection from contaminants.*
    - *Face coverings or masks with exhalation valves do not limit the user's exhalation of respiratory droplets and do not protect others - they should never be used in place of standard face coverings or masks.*
    - *Face coverings or masks must cover both the mouth and nose; those that fit the face without gaps and have molded nosepieces have been shown to be more effective at limiting exposure.*
- Increase the frequency of hand washing with soap and water, for a minimum of 20 seconds. Incorporate the routine use of hand sanitizer, especially after touching common surfaces and when soap and water is not available.
- Minimize contact with others. Consider using non-contact greetings.
- Avoid touching your face, in particular your mouth, eyes, and nose.
- Clean and/or disinfect common surfaces regularly.
- Consider our Health & Safety Guidelines for Meetings, Gatherings, and Events for any group activities, including meals.
- Employees may carpool and share vehicles with others, however individualsmust wear face masks regardless of vaccination status.
    - *Best practices when sharing rides includes: introducing fresh air through open windows or climate systems and spreading out passengers in the vehicle.*
- Travel-related information can be found at the COVID-19 Information Return to Travel site.

When Not to Report for Field Work

Employees should refer to the firm's COVID-19 Employee Notification and Return to Work Requirements policy for current details. **Please note that some requirements may be different for fully vaccinated versus unvaccinated employees.**

For non-emergency medical issues that are work-related, please contact AllOne Health (1-800-350-4511, Press 1) for 24-hour care advice. In emergency situations (e.g., severe COVID-19 symptoms) you should continue to contact 911 first.

Attachment A-2

CDM Smith COVID-19 Travel Guidance

CDM Smith

Travel Protocols & Tips

Travel during the COVID-19 pandemic

All sectors of the travel industry have implemented new standards of cleanliness. We have summarized them here for you along with some helpful tips. However, with things changing rapidly, please refer to your specific travel vendor's instructions at the time of travel.

Form of Payment

- Check to make sure your credit card has not expired.
- Is your current credit limit sufficient if you have to quarantine or in case you have other unexpected expenses? Talk to your manager if you need to increase your limit.
- Use old non-refundable tickets before buying a new ticket. Unused tickets that are available to use are displayed in the ALERTS section of Concur and unused Southwest Airlines tickets will be shown in your Rapid Rewards account.

Booking Travel

- Evaluate your destination and check several times prior to departure.
  - Will you be able to accomplish your trip's purpose? Will you be allowed into a client's office, municipal building or job site? Are there curfews or other restrictions at this location?
  - Use reliable sources for information: CDC, WHO, ISOS. Situations can be fluid.
- Book early! Due to reduction in demand, options are limited for flights, hotel availability and car rentals.
- Only use CDM Smith travel systems when booking business travel. These include: CTM, SWABIZ or Concur.
- Contact your HRBP to obtain a travel authorization letter pertaining to your assignment if needed.

Tip: ***Select window seat to avoid contact with people using the aisle.***

Packing

- Pack extra clothes and medications in case of an unexpected quarantine at your destination.
- Bring your own PPE (mask, sanitizer) and disposable pillow cases.
- Be sure to bring a refillable water bottle. Fewer concessions at airports and train stations will be open and hotel restaurants and bars could also be closed.
- Bring a back-up pack: Copy of photo ID/passport, second credit card, cash, phone battery/charger. Keep this in the hotel safe.
- Bring plastic ziplock bags to store or carry snacks, laundry, etc.
- Keep toiletries in a toiletry bag instead of unpacking them.
- When you get to your destination, sanitize everything with disinfectant wipes or spray.

Tip: ***When you arrive to your destination, put your travel clothes in a ziplock bag until they can be washed.***

The Airport

- **Arrive early!** New requirements mean longer security lines.
- Don't go into the airport unless you are the traveller.
- Download the airline's app to your phone to stay updated on your flight status and to use an e-boarding pass.
- The TSA is implementing new security requirements. These include:
  - Face coverings are required.
  - Follow the markers on the floor and signage about social distancing as you move through security.
  - TSA officers will not touch your ID or boarding pass. You will show the ID to the officer and place your boarding pass on the scanner. A mobile boarding pass on your phone is best. Be sure your phone is fully charged!
  - 12 oz. of hand sanitizer will be allowed in your carry-on, however you need to place it in a bin for inspection.
  - Place your watch, belt, etc. in your carry-on bag rather than in a bin.
- Do not linger in the baggage claim area.

Protecting our best and brightest

CDM Smith

Travel Protocols & Tips

Travel during the COVID-19 pandemic

Your Flight

- Check to see what PPE is required at the airport and on your flight. **Bring your own face covering.** Not all airlines will provide them, and you could be denied boarding if you don't have one. This also applies to AMTRAK trains.
- Boarding and deplaning processes have changed.
  - Social distancing will be required while waiting to board
  - Most airlines will board the back of the aircraft first and the number of people allowed to board at one time will be reduced.
  - For deplaning, rows will be called a few at a time to exit the aircraft.
- Your airline may require you to complete a health screening at check-in; either online, using the app, at the kiosk or with an agent.
- When on board, request permission to move your seat away from others if needed to maintain distancing.
- No congregating near the restrooms.
- Avoid touching surfaces such as door handles and faucets (use disposable towel or tissue).

Tip: ***On the plane, use the air nozzle on high to help circulate air.***

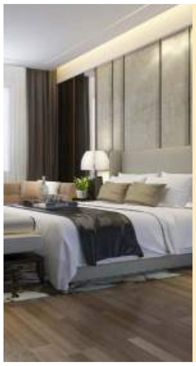
Ground Transportion

- **Rental Cars:**
  - **Book early!** Car rental inventory has been reduced due to lack of demand.
  - Limit rental cars to two passengers per vehicle: the driver and one passenger in the back.
  - Be sure to enroll in National Emerald Club to avoid checking in at the desk.
  - Request that your rental receipt be emailed to you.
    - National/Enterprise: on your Emerald Club profile/Communication/check "receive receipt by email".
    - AVIS (USVI only): go to your Wizard profile/email and click Edit/Toggle to YES/Save.
  - Although car rental agencies have put enhanced cleaning measures in place, wipe down the steering wheel, door handles and common surfaces with disinfectant wipes.
  - Check state listings for checkpoints and PPE requirements.
- **Ride Shares:**
  - Opt for an individual car, not a "pooling" service.
  - Touch as few surfaces as possible and only with a towel/tissue.
  - Sit in the back seat to maintain distance.
  - Roll down the window to promote air circulation.
  - Face coverings are required for drivers and passengers.
  - Use hand sanitizer getting in and out of the car.
- **Zip Car:**

  Use caution. Although they have enhanced their cleaning protocols, due to the "on demand" nature of this vendor, cars may not be cleaned between renters.
- **Personal car use:**
  - If you use your personal vehicle, you do not need to complete the POV calculator. When completing your expense report, add the following comment on the Concur expense line: "Exception due to Covid-19 travel restrictions". The 250 mile threshold is currently suspended. Do not use valet services.

Travel Protocols & Tips

Travel during the COVID-19 pandemic



The Hotel

- Commercial hotels should be used for business travel. They are more likely to have enhanced cleaning protocols, touchless check-in and keyless entry.
- Airbnb, VRBO and HomeAway-type accommodations are not allowed.
- For shorter stays, tell front desk NOT to send in housekeeping. Pick up fresh towels and linens at front desk.
- Request a room that has not been occupied recently.
- Avoid hotel drinking glasses. Use your water bottle or sealed items.
- Make use of slippers if offered. Remove shoes when entering room to avoid possible contamination.
- Avoid spending time in lobbies, common areas, fitness centers, pools, hot tubs and business centers.

Tip: ***Consider hotels with kitchen facilities and grocery delivery for self-cook meals.***

Meals

- Do not use common serving scenarios (buffets, self-service meals, coffee pots, utensil baskets).
- Restaurants may be limited in some locations; check with your hotel. Is their restaurant/bar open? Do they offer room service? What are the options for meals in the surrounding neighborhood?
- If outdoor dining only, pack a sweater and insect spray.
- Look into the details to make your meal plans.
  - Are open restaurants taking walk-ins or reservation only?
  - Will the hotel allow restaurant delivery, i.e. Uber Eats?
  - Do local grocery stores offer delivery?
- If you are driving your personal vehicle, pack a cooler with food options.

When you return home, wash your hands and clothes immediately!

Attachment A-3

NYSDOH COVID-19 Guidance

Face Masks and Coverings for COVID-19

- You must wear a face mask or face covering in public when social distancing (staying at least 6 feet apart) is not possible, unless a face covering is not medically tolerated. This includes on public transport, in stores and on crowded sidewalks.
- Children over 2 years of age should wear a face mask in public, too. Children under 2 years of age should NOT wear face coverings for safety reasons.
- Cloth face coverings should be made from fabric you can't see through when held up to the light. They must be cleaned before reusing.
- Disposable paper face masks should be used for one outing outside the home. They cannot be properly cleaned.
- The best way to prevent COVID-19 is to continue social distancing (staying at least 6 feet away from others), **even when wearing a face covering.**

Putting On Face Covering

- **DO** clean your hands with soap and water or if that's not available, alcohol-based hand sanitizer, before putting on your face covering.
  - Make sure the face covering covers both your nose and mouth.
- **DON'T** wear your mask hanging under your nose or mouth or around your neck. You won't get the protection you need.
- **DON'T** wear the face covering on top of your head, or take it off and on repeatedly. Once it is in place, leave the covering in place until you are no longer in public.

Taking Off Face Covering

- **DO** clean your hands with soap and water or if that's not available, alcohol-based hand sanitizer, before taking off your face covering.
  - Remove your mask only touching the straps.
  - Discard the face covering if it is disposable. If you are reusing (cloth), place it in a paper bag or plastic bag for later.
- Wash your hands again.
- When cleaning a cloth face covering, **DO** put in the washer (preferably on the hot water setting).
  - Dry in dryer at high heat. When it is clean and dry, place in a clean paper or plastic bag for later use. If you live in a household with many people, you might want to label the bags with names so the face coverings are not mixed up.

Protect yourself and others from COVID-19

Help reduce the spread of novel coronavirus and keep yourself and your community healthy.

Practice “Social Distancing”

- Stay at home as much as possible
- Keep 6 feet of distance from others in public
- Avoid large gatherings or events
- Avoid unnecessary appointments
- Cancel unnecessary travel plans

Wash Your Hands & Cover Your Cough

- Wash your hands often with soap and water for at least 20 seconds
- Avoid touching your eyes, nose and mouth
- Cover your cough or sneeze with a tissue, then throw the tissue in the trash
- Clean and disinfect frequently touched objects and surfaces

Look Out for NYers At-Risk

- Avoid visiting those most at risk
- Offer your help in getting those most at risk groceries and other goods
- Take special caution to avoid exposing those most at risk

Stay up to date **www.health.ny.gov/coronavirus**

NEW YORK STATE | Department of Health

13087

3/20

Worker Exposure Risk to COVID-19

Classifying Worker Exposure to SARS-CoV-2

Worker risk of occupational exposure to SARS-CoV-2, the virus that causes COVID-19, during an outbreak may depend in part on the industry type and need for contact within 6 feet of people known to have, or suspected of having, COVID-19.

OSHA has divided job tasks into four risk exposure levels, as shown below. Most American workers will likely fall in the lower exposure risk (caution) or medium exposure risk levels.

Occupational Risk Pyramid for COVID-19

The four exposure risk levels represent probable distribution of risk.

VERY HIGH EXPOSURE RISK

Jobs with a high potential for exposure to known or suspected sources of COVID-19 during specific medical, postmortem, or laboratory procedures. Workers include:

- Healthcare and morgue workers performing aerosol-generating procedures on or collecting/handling specimens from potentially infectious patients or bodies of people known to have, or suspected of having, COVID-19 at the time of death.

HIGH EXPOSURE RISK

Jobs with a high potential for exposure to known or suspected sources of COVID-19. Workers in this category include:

- Healthcare delivery, healthcare support, medical transport, and mortuary workers exposed to known or suspected COVID-19 patients or bodies of people known to have, or suspected of having, COVID-19 at the time of death.

MEDIUM EXPOSURE RISK

Jobs that require frequent/close contact with people who may be infected, but who are not known or suspected patients. Workers in this category include:

- Those who may have contact with the general public (e.g., schools, high-population-density work environments, some high-volume retail settings), including individuals returning from locations with widespread COVID-19 transmission.

LOWER EXPOSURE RISK (CAUTION)

Jobs that do not require contact with people known to be, or suspected of being, infected.

- Workers in this category have minimal occupational contact with the public and other coworkers.

For more information, see the *Guidance on Preparing Workplaces for COVID-19*.

Handwashing and Hand Sanitizer Use

at Home, at Play, and Out and About

Germs are everywhere! They can get onto hands and items we touch during daily activities and make you sick. Cleaning hands at key times with soap and water or hand sanitizer is one of the most important steps you can take to avoid getting sick and spreading germs to those around you.

There are important differences between washing hands with soap and water and cleaning them with hand sanitizer. For example, alcohol-based hand sanitizers don't kill ALL types of germs, such as a stomach bug called norovirus, some parasites, and *Clostridium difficile,* which causes severe diarrhea. Hand sanitizers also may not remove harmful chemicals, such as pesticides and heavy metals like lead. Handwashing reduces the amounts of all types of germs, pesticides, and metals on hands. Knowing when to clean your hands and which method to use will give you the best chance of preventing sickness.

When should I use?

Soap and Water

- Before, during, and after preparing food
- Before eating food
- Before and after caring for someone who is sick
- Before and after treating a cut or wound
- After using the bathroom, changing diapers, or cleaning up a child who has used the bathroom
- After blowing your nose, coughing, or sneezing
- After touching an animal, animal food or treats, animal cages, or animal waste
- After touching garbage
- If your hands are visibly dirty or greasy

Alcohol-Based Hand Sanitizer

- Before and after visiting a friend or a loved one in a hospital or nursing home, unless the person is sick with *Clostridium difficile* (if so, use soap and water to wash hands).
- If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60% alcohol, and wash with soap and water as soon as you can.

* Do **NOT** use hand sanitizer if your hands are visibly dirty or greasy: for example, after gardening, playing outdoors, or after fishing or camping (unless a handwashing station is not available). Wash your hands with soap and water instead.

How should I use?

Soap and Water

- **Wet** your hands with clean running water (warm or cold) and apply soap.
- **Lather** your hands by rubbing them together with the soap.
- **Scrub** all surfaces of your hands, including the palms, backs, fingers, between your fingers, and under your nails. Keep scrubbing for 20 seconds. Need a timer? Hum the "Happy Birthday" song twice.
- **Rinse** your hands under clean, running water.
- **Dry** your hands using a clean towel or air dry them.

Alcohol-Based Hand Sanitizer

Use an alcohol-based hand sanitizer that contains at least 60% alcohol. Supervise young children when they use hand sanitizer to prevent swallowing alcohol, especially in schools and childcare facilities.

- **Apply.** Put enough product on hands to cover all surfaces.
- **Rub** hands together, until hands feel dry. This should take around 20 seconds.

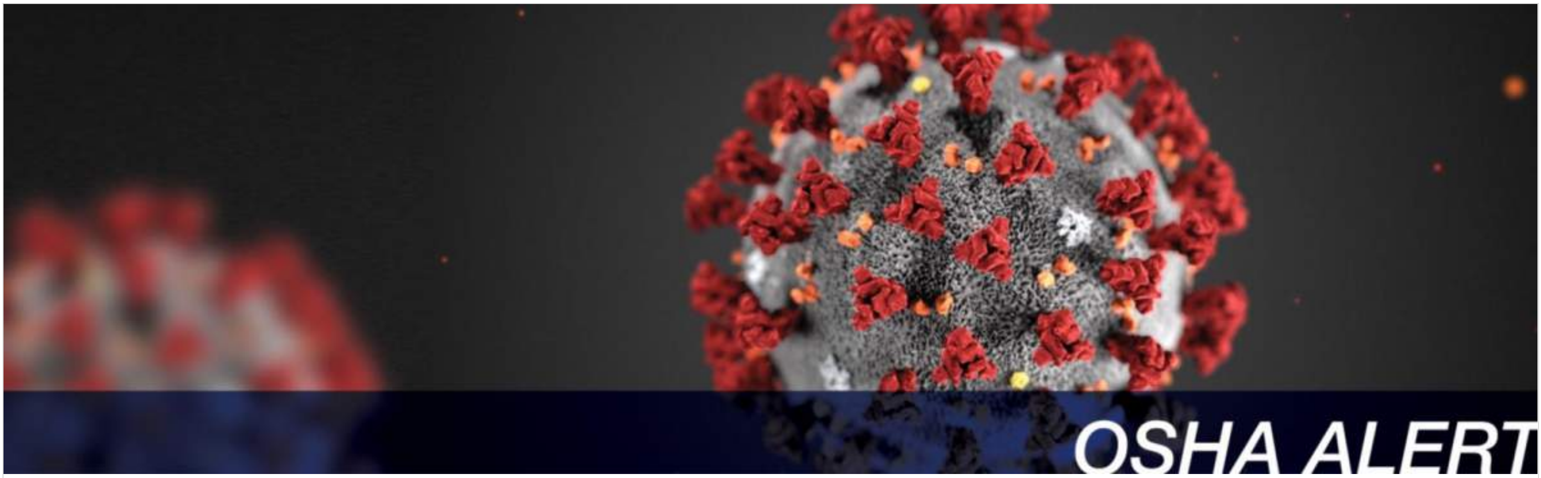
Note: Do not rinse or wipe off the hand sanitizer before it's dry; it may not work as well against germs.

For more information, visit the CDC handwashing website, www.cdc.gov/handwashing.

Attachment A-4

OSHA COVID-19 Alerts (English)

CDM Smith



Prevent Worker Exposure to Coronavirus (COVID-19)

The novel coronavirus (officially called COVID-19) is believed to spread from person-to-person, primarily through respiratory droplets produced when an infected person coughs or sneezes. The virus is also believed to spread by people touching a surface or object and then touching one's mouth, nose, or possibly the eyes.

Employers and workers should follow these general practices to help prevent exposure to coronavirus:

- Frequently wash your hands with soap and water for at least 20 seconds.
- If soap and running water are not available, use an alcohol-based hand rub that contains at least 60% alcohol.
- Avoid touching your eyes, nose, or mouth with unwashed hands.
- Avoid close contact with people who are sick.

Employers of workers with potential occupational exposures to coronavirus should follow these practices:

- Assess the hazards to which workers may be exposed.
- Evaluate the risk of exposure.
- Select, implement, and ensure workers use controls to prevent exposure, including physical barriers to control the spread of the virus; social distancing; and appropriate personal protective equipment, hygiene, and cleaning supplies.

For the latest information on the symptoms, prevention, and treatment of coronavirus, visit the Centers for Disease Control and Prevention coronavirus webpage.

For interim guidance and other resources on protecting workers from coronavirus, visit OSHA's COVID-19 webpage.

OSHA 3989-03 2020

News Release

U.S. Department of Labor | April 6, 2020

U.S. Department of Labor Publishes New OSHA Poster Aimed At Reducing Workplace Exposure to the Coronavirus

WASHINGTON, DC – The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has issued a new poster listing steps all workplaces can take to reduce the risk of exposure to coronavirus.

The poster highlights 10 infection prevention measures every employer can implement to protect workers' safety and health during the coronavirus pandemic. Safety measures include encouraging sick workers to stay home; establishing flexible worksites and staggered work shifts; discouraging workers from using other workers' phones, desks and other work equipment; and using Environmental Protection Agency-approved cleaning chemicals with label claims against the coronavirus.

The new poster is available for download in English, or Spanish.

Visit OSHA's Publications webpage for other useful workplace safety information.

The release is the latest effort by OSHA to educate and protect America's workers and employers during the coronavirus pandemic. In response to President Trump's action to increase the availability of general use respirators, OSHA has issued a series of guidances that expand access to respirators in the workplace. OSHA has also published Preparing Workplaces for COVID-19, a guidance aimed at helping workers and employers learn about ways to protect themselves and their workplaces during the ongoing pandemic.

Visit OSHA's coronavirus webpage frequently for updates. For further information about coronavirus, please visit the U.S. Department of Health and Human Services' Centers for Disease Control and Prevention.

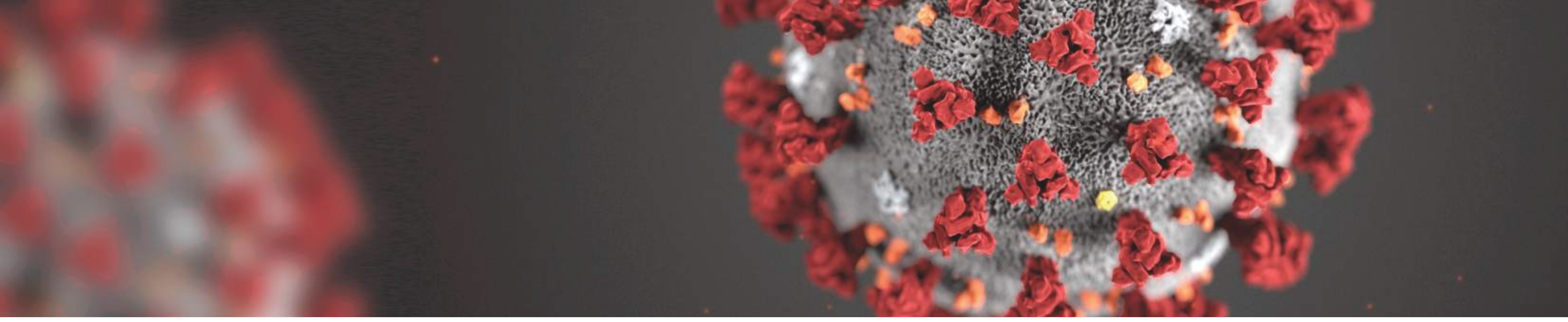
Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to help ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov.

The mission of the Department of Labor is to foster, promote and develop the welfare of the wage earners, job seekers and retirees of the United States; improve working conditions; advance opportunities for profitable employment; and assure work-related benefits and rights.

# # #

Media Contact:
Emily Weeks, 202-693-4681, weeks.emily.c@dol.gov

Release Number: 20-581-NAT



Ten Steps All Workplaces Can Take to Reduce Risk of Exposure to Coronavirus

All workplaces can take the following infection prevention measures to protect workers:

- Encourage workers to stay home if sick.
- Encourage respiratory etiquette, including covering coughs and sneezes.
- Provide a place to wash hands or alcohol-based hand rubs containing at least 60% alcohol.
- Limit worksite access to only essential workers, if possible.
- Establish flexible worksites (e.g., telecommuting) and flexible work hours (e.g., staggered shifts), if feasible.
- Discourage workers from using other workers' phones, desks, or other work tools and equipment.
- Regularly clean and disinfect surfaces, equipment, and other elements of the work environment.
- Use Environmental Protection Agency (EPA)-approved cleaning chemicals with label claims against the coronavirus.
- Follow the manufacturer's instructions for use of all cleaning and disinfection products.
- Encourage workers to report any safety and health concerns.

For more information, visit www.osha.gov/coronavirus or call 1-800-321-OSHA (6742).

Occupational Safety and Health Administration
www.osha.gov

1-800-321-OSHA (6742)
TTY 1-877-889-5627

OSHA 3994-04 2020

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Entry/Exit Log with COVID-19 Acknowledgement

Project Name: ___________________________________

Project #: _______________________________________

New York State Department of Environmental Conservation's (DEC) objective is to provide a safe and healthy workplace. In response to COVID-19, DEC is prohibiting access to our work areas by those who pose an elevated risk of spreading COVID-19. By completing this site Entry/Exit log, you acknowledge your understanding of this policy and confirm that your health and travel history is NOT in one of the prohibited access groups listed below, and to the best of your knowledge, you do not pose an elevated risk of transmitting COVID-19 to others. Please leave the site immediately and follow recommendations from public health agencies and your healthcare provider if you fall into one of the prohibited access groups listed below:

- You are experiencing flu-like symptoms including but not limited to fever, chills, cough, sore throat, diarrhea, vomiting, runny/stuffy nose, muscle or body aches, headaches, fatigue.

- You have traveled to CDC-restricted destinations in the last 2 weeks including China, South Korea, Iran, United Kingdom & Ireland, all European Union countries, Switzerland and regions within the U.S. for which public health agencies have prohibited travel.

- You had direct contact with a person diagnosed with COVID-19 or suspected of having COVID-19 during the last 2 weeks.

Name	Initials	Affiliation	Date	Time In	Time Out

Health

COVID-19 Cleaning and Disinfection Log Template

Location: ____

New York State (NYS) requires regular cleaning and disinfection at least every day, and more frequent cleaning and disinfection of shared objects (such as tools), frequently touched surfaces, and high transit areas, such as restrooms and common areas.

- Examples of high-touch surfaces and objects include meeting tables, chair armrests, doorknobs, cabinet pulls, refrigerator door handles, faucets, toilets and light switches.
- Please review the New York City Department of Health and Mental Hygiene's guidance on cleaning and disinfection.
- Cleaning and disinfection must be performed with products identified by and registered with the Environmental Protection Agency (EPA) as effective against COVID-19. To find a list of products that meet the EPA's criteria, use their interactive tool.

This is a sample log designed to help you comply with the NYS requirements. Tailor it to your setting.

Date	Time	Type of Cleaning		Staff Responsible for Cleaning	Staff Signature	Notes	Manager Initials
		Regular daily cleaning	High touch surfaces/high transit areas				
		☐	☐				
		☐	☐				
		☐	☐				
		☐	☐				
		☐	☐				
		☐	☐				
		☐	☐				
		☐	☐				
		☐	☐				
		☐	☐				

The NYC Health Department may change recommendations as the situation evolves. 6.14.20

CDM Smith

Daily Health Screening Questionnaire					
Project Name:		**Project No.:**			
Employee Name:		**Company Name:**		**Date:**	

Questions	**Yes**	**No**
1. Have you had COVID-19 symptoms in the past 10 days that are not due to a separate, known medical condition? Symptoms include: cough, difficulty breathing, fever, body/muscle aches, headache, chills, fatigue, sore throat, runny or stuffy nose, diarrhea, or loss of taste or smell?		
2. Have you tested positive for COVID-19 in the past 10 days?		
3. Have you been in close personal contact with someone diagnosed with COVID-19 or exhibiting symptoms within the last 10 days?		
If any of the above questions were answered "Yes" leave the site immediately and inform site contact and direct supervisor.		

Appendix B

Work Practices and Guidelines

Section 9
Personal Protective Equipment (PPE)

CDM Smith employees frequently perform tasks that require the use of protective clothing and equipment to shield or isolate them from chemical and physical hazards.

The nature and extent of potential chemical and physical hazards are key factor in choosing PPE. Before mobilization, CDM Smith performs a detailed review of the project site. We review site history, types, and quantities of materials handled at the site, operations performed at the project site, and activities we will perform during the course of the project.

9.1 Use of Personal Protective Equipment

Employees who must use PPE identified in H&S plans, as directed by site managers, where recognizable hazards exist, to meet client requirements and in accordance with the guidelines described in this section must receive documented training, and be retrained when the workplace changes, making the earlier training obsolete; the type of PPE changes; or when the employee demonstrates lack of use, improper use, or insufficient skill or understanding. Employees must also inspect PPE assigned to them and have worn out or defective equipment replaced.

Personal protective equipment in use shall be inspected daily and maintained in serviceable condition. Items of personal issue shall be cleaned and sanitized as appropriate before any other employee uses them. Defective or damaged equipment shall be taken out of service immediately. Selected PPE must be fitted to each affected employee.

9.1.1 "Baseline" Protection

CDM Smith employees are expected to wear the ensemble of personal protective equipment listed below during all field tasks.

- Full-length trousers (See Section 9.2.10)
- Shirt with sleeves and a collar (See Section 9.2.10)
- Safety glasses with side shields (See Section 9.2.1)
- Hardhat (See Section 9.2.2)
- Steel toe and shank footwear (See Section 9.2.3)
- Protective gloves (if hands will contact rough or contaminated surfaces) (See Section 9.2.4)
- High-visibility vest (if vehicles or heavy equipment operate on site) (See Section 9.2.5)

9.1.2 Rules and Standards for PPE

Use of personal protective equipment is required by OSHA standards contained in 29 CFR 1910 and 29 CFR 1926, and reinforced by EPA regulations in 40 CFR Part 300. Types of protection required by OSHA and the relevant consensus standards are listed in **Table 9-2**.

9.2 Basic Personal Protective Equipment

9.2.1 Eye Protection

Employees should wear safety glasses during field activities unless it can be demonstrated that there are no potential hazards to the eye. Such hazards include active construction sites, hazardous waste sites and potential contact between hazardous or foreign substances and the eye.

For most dusts and particulates, safety glasses with side shields meeting the requirements of ANSI standard Z87.1-2003 - Occupational and Educational Eye and Face Protective Devices are adequate. For potential splash hazards of liquids, a face shield or splash hood should be used in conjunction with regular safety glasses. In some exposures to mist or heavy dust, goggles may provide the best form of eye protection. If lasers are used, specialized eye protection using specific lenses for the wavelength and energy emitted by a specific laser may be required.

Contact Lenses – Based on current information related to the use of contact lenses in the industrial work environment, contact lenses may be used in most situations. Eye protection such as safety glasses, face shields, or goggles appropriate for the hazards present should be used as well.

9.2.2 Hard Hats

Employees should wear hard hats meeting the requirements of ANSI Z89.1 (2009) unless the safety manager grants a waiver per Section 9.1.1.[no need for link here] Hard hats should be worn with the brim facing forwards unless there is a specific safety related reason to turn the hat backwards. In such instances the webbing in the hat shall be repositioned in the hat so that the back of the webbing is at the back of the head.

9.2.3 Foot Protection

Personnel should wear protective footwear when working on active construction sites, field hazardous waste sites and while performing work activities where there is a danger of foot injuries due to falling or rolling objects, objects piercing the sole, and where employees' feet are exposed to electrical hazards. Safety footwear shall meet the requirements of ASTM standards F2412-05 (Standard Test Methods for Foot Protection) and F2413-05 (Standard Specification for Performance Requirements for Foot Protection) and cover the ankle. Any footwear worn for fieldwork must have a good sturdy tread appropriate for outdoor use and a defined heel.

9.2.4 Hand Protection

Various types of gloves are available for protection against cuts, scrapes, bruises, etc. that may occur during the physical handling of material, equipment tools etc. Gloves should have the qualities required for the work conditions as set by ANSI/ISEA 105 American National Standard for Hand Protection Selection Criteria. [would a link to a glove selection table be appropriate here?]CDM Smith issues cotton, leather, nitrile, neoprene, and Kevlar® gloves depending on the work activity and potential hazards. If needed, leather or mesh work gloves can be worn over chemical protective gloves.

9.2.5 High-Visibility Clothing

High-visibility vests or jackets are required whenever personnel work in or around vehicular traffic. High-visibility clothing should meet the level of visibility required for the work conditions in ANSI / ISEA 107 (2010). Employees should also wear high-visibility clothing on active construction or industrial sites where there is frequent movement of trucks, excavation, or other heavy equipment. See Section 16.22 Traffic and Work Zone Safety.

9.2.6 Protective Clothing

Personnel should wear protective clothing in circumstances where there is the potential for hazardous dusts, toxic or contaminated material, mists, or liquids contact the employee's skin or personal clothing. Protective clothing may include disposable or reusable coveralls, polymer coated coveralls, or splash suits. When there is a significant potential for direct contact of liquids or mists, polymer-coated coveralls or splash suits are indicated.

Selection consideration should be given to such factors as size, durability, chemical compatibility, and heat stress potential. Project managers are particularly reminded to consider the correct size of protective garment for very large and small workers. When ANSI/ISEA standard 103, Classification and Performance Requirements for Chemical Protective Clothing, is published, CDM Smith expects to implement its requirements.

Chemical Protective Footwear – Chemical protective footwear should be worn when there is the potential for boots to come into direct contact or be splashed with hazardous materials or waste. When direct contact hazards exist, chemical resistant boots may be worn or boot covers may be worn.

Chemical Protective Gloves – For those activities where there is a potential for direct contact with hazardous or toxic materials, or contaminated soil or groundwater, employees should wear chemical protective gloves. The selection of glove should be based on the activity and the material of potential contact. A wide variety of gloves are available and consideration should be given to dexterity, durability, and material compatibility. Gloves should have the qualities required for the work conditions as set by ANSI/ISEA 105 American National Standard for Hand Protection Selection Criteria.

Flame and Arc – Flash Protective Clothing – Fire resistant clothing used where fires or electrical arcs are a problem shall have a rating of at least HRC Level 2 as set by NFPA Code 2112 Standard on Flame Resistant Garments for Protection of Industrial Personnel against Flash Fire. NOTE: If an arc flash study described in Section 16-4 requires a higher level of protection, wear that level.

9.2.7 Respirators

CDM Smith may issue a respirator to individuals who will frequently use respiratory protection. Employees who are expected to work on projects where the use of respiratory protection is anticipated or required must fulfill the training and medical approval requirements for respirators as described in Section 11, Respiratory Protection of this manual.

9.2.8 Hearing Protection

Employees shall use hearing protection when noise levels exceed the allowable limit. A Hearing Conservation Program (Section 14) shall be implemented if the allowable limits are exceeded. Devices used for hearing protection shall be certified for the purpose per USEPA regulation 40 CFR 211 subpart B *Noise Labeling Standards for Hearing Protection Devices.*

9.2.9 Specialized Protective Equipment

Specialized protective equipment is available for a wide variety of activities and includes:

- Fall protection harnesses and lanyards (See Safety Guideline 16.7)
- Face shields
- Chaps for work in rough brush
- Spark resistant tools
- Shin guards for chain saws
- Cooling vests (See Safety Guideline 16.13)
- Personal floatation devices

9.2.10 Personal Work Clothing

Employees are expected to supply personal clothing appropriate for their work assignments including long pants, a shirt with sleeves (at least 4" long). NOTE: Some CDM Smith clients insist that employees wear long-sleeve shirts.)

Employees are expected to provide basic outerwear appropriate for protection against normal weather conditions in the geographical areas they are normally assigned. The equipment centers do stock clothing for extreme cold or wet weather. (See Safety Guideline 16.14.) These include rain suits, insulated coveralls, cold weather work gloves, hardhat liners, etc. Employees may request this equipment directly from the equipment centers.

9.3 Availability of PPE

CDM Smith field equipment centers maintain an inventory of basic PPE including hard hats, safety glasses, hearing protection, harnesses, traffic vests, etc. The specific make and model of equipment is reviewed periodically by the H&S managers to ensure equipment issued to CDM Smith Inc. personnel is of adequate quality. Projects and employees may obtain basic PPE by requesting equipment from the field equipment centers by telephone or through the field equipment center website at http://cdmweb/fieldequipment/ .

9.3.1 PPE Assigned to the Employee

CDM Smith typically assigns items such as hardhat, safety glasses, hi-visibility vests etc to individual employees. The employee's Group Leader or Direct Manager, in consultation with the H&S Manager assigned to support the employee's division, shall decide what PPE employees need, based on their expected role, and help to arrange for it. Employees may, with the approval of their manager or group leader, submit a PPE request.

PPE required for use on CDM Smith work activities is provided to CDM Smith employees at no expense to the employee.

9.3.2 Project vs. Overhead Expense

PPE that is used to support activities for specific projects should be charged to those projects. Typical project specific PPE would include consumables such as gloves, disposable Tyvek® suits, respirator cartridges, etc. Non - disposable PPE, used on a specific project can be obtained from the equipment centers for short or moderate durations on a rental basis. In some cases it may be more cost effective for projects to have the equipment centers purchase the equipment for the project. Non-disposable PPE may include respirators, air-supplied respiratory protective systems, or specialized chemical protective clothing. The specific PPE ensemble for a specific project will be identified in the project specific H&S plan and approved by the service group H&S manager responsible for that project.

Employees may request equipment using the Personal Protective Equipment Request form in Appendix A of this section. Individual PPE that is assigned to a specific employee for use on multiple projects should be charged to the employee's division safety equipment overhead number, typically 20000X HEALTH & SAFETY. The employee's Group Leader or Direct Manager, with the advice of the relevant health and safety manager, shall decide what PPE may be charged to an overhead account.

Reimbursement for Safety Footwear – CDM Smith will reimburse CDM Smith employees for the cost of purchasing safety footwear up to a maximum amount of $150.00.

Reimbursement for Prescription Safety Glasses – CDM Smith employees, who require prescription glasses and are expected to work more than 30 days per year in the field or on locations where safety glasses are required, will be reimbursed for the cost of prescription safety glasses meeting the requirements of ANSI Z87.1 up to a maximum of $175.00. Employees who wear prescription glasses and work less often on projects that require the use of safety glasses should be provided eye protection that fits over their glasses.

Employees may request reimbursement through the expense account system from their resource manager or group leader. The resource manager or group leader shall make the final determination as to whether or not safety glasses are a reimbursable item as described above.

Employees are eligible for this allowance whenever their existing equipment becomes unsafe to use. If, for example, pair of safety glasses breaks the day after CDM Smith pays for them, the employee is eligible to use the allowance again. If the steel-toe shoes are still fully functional 15 years after purchase, the employee is not.

9.4 Levels of Protection

Each type of protective equipment has been designed specifically to protect against a reasonably anticipated chemical and physical hazard. To standardize PPE ensembles, "levels of protection" have been defined to address those chemical and physical hazards that may be present at hazardous waste sites. The levels of protection are defined accordingly:

Level A	This level is worn when the highest level of respiratory, skin, and eye protection is anticipated as being required.
Level B	This level is worn when the highest level of respiratory protection is anticipated as being required, with a lesser level of skin protection being necessary.
Level C	This level is worn when criteria for air-purifying respirators are determined to be necessary and a lesser level of skin protection needed.
Level D, Modified	This level is worn when activities do not pose a problem from a respiratory protection point of view but may present a skin problem and where cross contamination via shoes needs to be considered.
Level D	This level is worn when activities and areas do not present a respiratory or skin hazard.

Detailed equipment, use, and limitations associated with each level of protection appear in **Table 9-1**.

Table 9-1

Levels of Protection

Level	Equipment	Protection Provided	Should be Used When:	Limiting Criteria
A	**Recommended**: ▪ Pressure-demand, full facepiece self-contained breathing apparatus (SCBA) or pressure-demand supplied-air respirator with escape SCBA ▪ Full-encapsulating, chemical-resistant suit ▪ Inner chemical-resistant gloves ▪ Chemical-resistant safety boots/shoes ▪ Two-way radio communications **Optional:** ▪ Cooling unit ▪ Coveralls ▪ Long cotton underwear ▪ Hard hat ▪ Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection	▪ The chemical substance is thought to require the highest level of protection for skin, eyes, and the respiratory system based on either: - Measured (or potential for) high concentration of atmospheric vapors, gases, or particulates - Site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through intact skin ▪ Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible ▪ Operations must be conducted in poorly ventilated areas until the absence of conditions requiring Level A protection is determined	Fully encapsulating suit material must be impermeable to the substances involved The use of Level A protection severely limits the practical duration of work effort.

Table 9-1 (Continued)

Level	*Equipment*	*Protection Provided*	*Should be Used When:*	*Limiting Criteria*
B	**Recommended:** ▪ Pressure-demand, full-facepiece SCBA or pressure-demand supplied air respirator with escape SCBA ▪ Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one-piece chemical splash suit; disposable chemical resistant one-piece suit) ▪ Inner and outer chemical-resistant gloves ▪ Chemical-resistant safety boots/shoes ▪ Hard hat ▪ Two-way radio communications **Optional**: ▪ Coveralls ▪ Disposable boot covers ▪ Face shield ▪ Long cotton underwear	The same level of respiratory protection but less skin protection than Level A It is the minimum level recommended for initial site entries until the hazards have been further identified	▪ The type and atmospheric concentrations of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: - With IDLH concentrations of specific substances that do not represent a severe skin hazard *or* - That do not meet the criteria for use of air-purifying respirators ▪ Atmosphere contains less than 19.5 percent oxygen ▪ Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the skin	Used only when the vapor of gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates or splashes of material that will affect exposed skin

Table 9-1 (Continued)

Level	*Equipment*	*Protection Provided*	*Should be Used When:*	*Limiting Criteria*
C	**Recommended:** ▪ Full-facepiece, air-purifying, cartridge-equipped respirator ▪ Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one-piece chemical splash suit; disposable chemical-resistant one-piece suit ▪ Inner and outer chemical-resistant gloves ▪ Chemical-resistant safety boots/shoes ▪ Hard hat ▪ Two-way radio communications **Optional:** ▪ Coveralls ▪ Disposal boot covers ▪ Face shield ▪ Escape mask ▪ Long cotton underwear	The same level of skin protection as Level B, but a lower level of respiratory protection	▪ The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin ▪ The types of air contaminants have been identified, concentrations measured, and a cartridge is available that can remove the contaminant ▪ All criteria for the use of air-purifying respirators are met	Effective only against conditions that are fairly well understood. Not effective for conditions that involve: • Unknown chemicals that the filtering element might not remove well • Oxygen-deficient atmospheres • Unpredictable concentrations that might overwhelm the filtering element
D MODIFIED	**Recommended:** ▪ Chemical-resistant outer gloves ▪ Disposable shoe covers ▪ Work clothes ▪ Safety boots/shoes ▪ Safety glasses or chemical splash goggles ▪ Hard hat	No respiratory protection; minimum skin protection	▪ The atmosphere contains no known hazard ▪ Work functions may involve skin contact with hazardous chemicals	

Table 9-2 OSHA & Consensus Standards for Personal Protective Equipment		
Type of Protection	**Regulation**	**Reference**
General	29 CFR 1910.132	41 CFR Part 50-204.7 General Requirements for Personal Protective Equipment
Eye and Face	29 CFR 1910.133(a)	ANSI standard Z87.1-2003 - Occupational and Educational Eye and Face Protective Devices
Noise Exposure	29 CFR 1910.95	USEPA 40 CFR 211 subpart B
Respiratory	29 CFR 1910.134	ANSI-[1] Z88.2 (1992) Standard Practice for Respiratory Protection
Hand	29 CFR 1910.132	ANSI/ISEA 105 American National Standard for Hand Protection
Head	29 CFR 1910.135	ANSI Z89.1 (2009) Safety Requirements for Industrial Head Protection
Foot	29 CFR 1910.136	ASTM F2412-05and F2413-05
Electrical Protective Devices	29 CFR1910.335(a)(2)	NFPA 70E: Standard for Electrical Safety in the Workplace
Flame – Resistant Garments	29 CFR1910.335(a)(2)	NFPA Code 2112 Standard on Flame Resistant Garments
Chemical Protective Clothing	29 CFR 1910.132	ANSI/ISEA standard 103, Chemical Protective Clothing (Draft)
High-Visibility Safety Apparel	29 CFR 1926.651(d)	ANSI / ISEA 107(2010) National Standard for High-Visibility Safety Apparel

[1] *American National Standards Institute (ANSI), http://www.ansi.org/*

Appendix A

Personal Protective Equipment Request Form

Employee ________________________ Division ________ Office________

Active in CDM Smith Medical Surveillance Program? Yes ___ No ___

Date of last CDM Smith medical exam? ______________________

Equipment Requested

Item	Requested	Issued
Hard Hat	______	______
Safety Glasses	______	______
Hi-Visibility Vest	______	______
Fall Protection Harness	______	______
Work Gloves (____ pairs)	______	______
Glove Liners (____ pairs)	______	______
Electrical Gloves (____ pairs)	______	______
Rain suit	______	______
Cloth Coveralls	______	______
Fire – Resistant Coveralls	______	______
Insulated Coveralls	______	______
Goggles	______	______
Ear Muffs (____ pairs)	______	______
Respirator	______	______
Make______________		
Model_____________		
Size_______________		
Corrective Lens Inserts	______	______
______________________________	______	______
______________________________	______	______

You must take reasonable measures to safeguard the items issued to you. Should your employment with CDM Smith terminate for any reason you must return equipment issued for your use. Any loss, theft, or damage of the equipment should be reported promptly to the Equipment Center manager.

Approved by:

_____________________________________ ________ ____________________

Group Leader or Direct Manager/Date Division Charge Number

Section 14
First Aid & Bloodborne Pathogens

14.1 Purpose and Scope

This section describes how CDM Smith provides First Aid Coverage for employees working in it's offices and is intended to meet the requirements of the OSHA General Industry Standard for Medical Services and First Aid (29 CFR 1910.151) and the OSHA Bloodborne Pathogens Standard (29 CFR 1910.1030). CDM Smith employees not working for CDM Constructors, Inc. do not engage in construction work and are **not** subject to the OSHA Construction Industry Standard for Medical Services and First Aid, (29 CFR 1926.50).

14.2 First Aid

14.2.1 Offices

All CDM Smith offices have readily available access to municipal emergency services and are in areas where 911 or other local notification of emergency services are available. Procedures to summon emergency services are provided to new employees during the new employee orientation and are listed in each office's Emergency Plan. In addition, in most cases office security personnel (non-CDM Smith employees) have first aid and/or CPR training and may provide first aid to office occupants. Some CDM Smith employees voluntarily take first aid and CPR training and may provide first aid to employees who may be injured in the office. However, they are not obligated to do so and providing first aid is not considered part of their job function (Note: Employees who volunteer to provide first aid are considered "Good Samaritans" and are not subject to the OSHA Bloodborne Pathogens Standard).

All offices are required to be equipped with a first aid kit appropriate for the number of personnel working in the office and the kit is intended to serve. First aid kits should be located with the office receptionist or kitchen or break area, stored in weatherproof containers containing individually sealed items. CDM Smith has over 100 office locations, with as few as 4 employees to over 500 employees in a given location. There is no one standard office first aid kit that applies to all office locations. Office first aid kits should be checked and maintained by the office services or health and safety coordinator. Alternatively arrangements can be made with a local vendor to check and maintain first aid kits. The responsibility for having and maintaining a first aid kit appropriate for the office lies with local office management. The contents of a typical first aid kit are shown in Exhibit 14-A.

Employees that voluntarily participate in first aid/CPR training shall be provided information on:

- Hazards associated with bloodborne pathogens and potential routes of exposure,
- Universal precautions, and
- This procedure and the opportunity for post-exposure evaluation and follow up.

14.2.2 Field Engineering Activities

Field engineering projects at locations where access to a medical facility, hospital or other provider of first aid services is not in near proximity shall include an employee or subcontractor employee who is trained in first aid and have access to a first aid kit. (Note: This does not apply to project locations controlled and operated by an owner or third party that have first aid and or emergency services available in proximity to the project location.) Field engineering projects where a first aid trained employee is required by contract shall also have an employee or subcontractor employee assigned to the project site who is trained in first aid and have access to a first aid kit.

First aid supplies shall be stored in a weatherproof container and contain individually sealed items. The First aid kit will be checked by the project manager or by a designee prior to commencing work at the project location. First aid supplies will be restocked as needed and checked weekly by the project H&S coordinator.

Field engineering projects with potential exposure to corrosive materials or eye irritants shall have available a portable eyewash station or bottle.

A list of supplies provided in a typical field or office first aid kit is provided in Exhibit 14-A

14.2.3 Automatic External Defibrillator (AED) (For offices/locations with access to AEDs)

Any employee who is expected to provide emergency care will be trained in Cardiopulmonary Resuscitation (CPR) and AED use according to the American Heart Association, American Red Cross standards, National Safety Council or other equivalent programs.

First Aid Providers

A First Aid Provider is an employee working within the office or project site that has completed a qualified program of First Aid/CPR/AED training and meets the training requirements to use an AED. Where required by contract or H&S plan, designated individuals will be listed within the office emergency plan or the site-specific HASP plan.

Emergency Response Action

Employees treating a non-responsive person will call 911 or have another employee call.

Assessment/Intervention

- Assess situation/scene safety.
- Evaluate patient's consciousness, breathing and circulation status.

- If a child, establish the victim's age (AEDs are not recommended for children younger than 8 years of age).
- Follow manufacturer's recommended guidelines for use of available AED.

Post Event Action

- Replace any used AED equipment as recommended.
- Provide requested information to medical director

Equipment Maintenance Plan

- Develop written monthly and annual AED maintenance plan per manufacturer's recommendations.
- Assign individual(s) responsible for AED maintenance. This may be a qualified 3rd party provider.

Physician Oversight

- Medical oversight to provide a prescription to purchase an AED and assists with quality assurance.

14.3 Bloodborne Pathogens

14.3.1 Exposure Assessment

The program applies to all CDM Smith employees who may be occupationally exposed to blood or other potentially infectious materials.

CDM Smith employees do not normally work where skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials would reasonably result from the normal performance of their duties.

There are two job functions that may reasonably expose employees to blood or other infectious materials without regard to the use of PPE;

List of Exposure Determinations

1. Employees assigned to provide first aid services on field engineering projects.
2. Employees assigned to solid waste characterization projects.

CDM Smith's medical consultants evaluated the risk associated with potential hepatitis exposure to employees working around sewage and wastewater treatment plants and the merits of providing prophylactic vaccination against hepatitis. They provided a written opinion indicating that the risk of contracting hepatitis did not warrant administration of the vaccine. The full text of the physician opinion is available on the H&S home page.

14.3.2 Exposure Control Plans

Exposure Controls for Field Engineering Project First Aid Providers

Employees providing first aid care in the field shall observe "universal precautions" and use PPE provided in first aid kits. "Universal precautions" are defined as "an approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens."

First aid kits shall contain appropriate PPE such as latex gloves and face shields. Employees working on field engineering project normally wear safety glasses. Employees shall wear the provided PPE when providing first aid when designated as a field project first aid provider.

In addition, first aid kits shall contain hand sanitizer or disinfectant wipes employees are to use after providing first aid.

Any bandages or blood soaked materials shall be place in a leak proof plastic bag for proper disposal. Any employee clothing soiled with blood or infectious material while applying first aid shall be cleaned or disposed of and replace at CDM Smith's expense.

Employees who are assigned responsibilities as first aid providers on field engineering projects shall be provided the opportunity be vaccinated for Hepatitis B at CDM Smith's expense.

Employees who are assigned responsibilities as first aid providers on field engineering projects shall be provided information on:

- Hazards associated with bloodborne pathogens and potential routes of exposure,
- Universal precautions, and
- This procedure and the opportunity for post-exposure evaluation and follow up.

Exposure Controls for Solid Waste Characterization Projects

Employees engaged in solid waste characterization projects shall observe "universal precautions" and use appropriate PPE identified in a project H&S plan and provided by CDM Smith. "Universal precautions" are defined as "an approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens."

Employees who are assigned to solid waste characterization projects that come into direct contact waste material shall be provided the opportunity be vaccinated for Hepatitis B at CDM Smith's expense.

Employees who are assigned to solid waste characterization projects shall be provided information on:

- Hazards associated with bloodborne pathogens and potential routes of exposure,
- Universal precautions, and
- This procedure and the opportunity for post-exposure evaluation and follow up.

14.3.3 Post-Exposure Evaluation and Follow-Up

Following a verbal report of an exposure incident, the direct manager, resource manager, HSC or HSM should immediately offer the exposed employee confidential medical evaluation and testing as well as a post-exposure hepatitis vaccination. The results of medical evaluations and test data maintained by CDM Smith's medical consultant will be reported only to the employee or someone they designate in writing. The examining physician will inform CDM Smith's H&S staff or Human Resources manager only if needed to provide adequate support to affected employee.

Post-exposure evaluation and follow-up should consist of the following steps:

- Documentation of the route(s) of exposure.
- Collection and testing of blood of the exposed employee for HBV and HIV serological status with employee's consent. After obtaining the exposed employee's consent for follow-up testing, a sample of his/her blood shall be collected and tested for HBV and/or HIV as soon as feasible following the exposure incident.
- If the exposed employee consents to baseline blood collection, but does not give consent at that time for HIV serological testing, the sample shall be preserved for at least 90 days. If, within 90 days of the exposure incident, the employee elects to have the baseline sample tested, such testing shall be done as soon as feasible.
- Post-exposure prophylaxis as recommended by the CDM Smith medical consultant when medically indicated. Note: To have maximum potential effect, initiation of post exposure Hepatitis B vaccination should begin within 48 hours of the exposure incident.
- Counseling.
- Evaluation of reported illnesses.

Following post-exposure evaluation and follow-up, the exposed employee shall be provided with a copy of the evaluating healthcare professional's written opinion.

Incident Reporting

Exposure incident means a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties. If an exposure incident occurs while the employee is in a work setting or while working for CDM Smith, the following steps should be taken:

- Employees shall notify their direct manager, resource manager, HSC, or division HSM as soon as feasible following an exposure incident.

- Employees shall complete a bloodborne pathogen (BBP) occupational exposure report, available in Exhibit 14-B of this section or in the Forms section of the H&S Web site. Employees shall sign the BBP occupational exposure report and give the signed and completed form to his/her direct manager or resource manager for review and sign-off.

- The direct manager or resource manager shall forward a copy of the report to the division HSM.

Post-Exposure Testing of the Source Individual

- CDM Smith shall make a good faith effort to identify and obtain consent for HBV and HIV testing of the source individual.

- The source individual's blood shall be collected and tested as soon as feasible and after consent is obtained in order to determine HBV and HIV infectivity.

- If consent is not obtained, CDM Smith shall establish that legally required consent cannot be obtained, and the source individual shall not be tested.

- When the source individual's consent is not required by law, the source individual's blood, if available, shall be collected, tested, and the results documented. The condition "if available" applies to blood samples that have been drawn from the source individual for other testing.

- When the source individual is already known to be infected with HBV or HIV, testing for the source individual's known HBV or HIV status need not be repeated.

- Results of the source individual's testing shall be made available to the exposed employee, and the exposed employee shall be informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.

14.3.4 Training and Medical Records

Training records for all employee training are maintained in CDM Smith's Learning Management System and include date of training, training content, names and job titles. Records are maintained for the duration of employment or 3 years whichever is greater.

The results of medical evaluations and test data maintained by CDM Smith's medical consultant will be reported only to the employee or someone they designate in writing. The examining physician will inform CDM Smith's H&S staff or Human Resources manager only if needed to provide adequate support to affected employee. Records will be provided in a timely manner at no cost to the employee.

Employees are notified of the right to access to medical records associated with their employment at CDM Smith annually.

14.4. BBP Engineering Controls

Virtually all of CDM Smith's potential occupational exposure to blood or other infectious materials occurs in field locations where there are no fixed facilities making implementation and maintenance of engineering controls not feasible. Protection from BBP is provided through administration of proper work procedures, use of PPE and follow up.

Exhibit 14-A Typical First Aid Kit Contents for up to 50 personnel

50 - 1 x 3 Adhesive Bandages
10 - Knuckle Adhesive Bandages
3 - Fingertip Adhesive Bandages
1 - 2 inch Sterile Gauze Rolled Bandage
2 - 3x3 Sterile Gauze Pads (2/pk)
3 - 4x4 Sterile Gauze Pads (2/pk)
1 - Triangular Bandage
1 - 5" x 9" Trauma Pad (sterile)
2 - Sterile Eye Pads
1 - 1/2 inch x 10 yds Medical Tape
4 - Latex Gloves
15 - BZK Antiseptic Wipes (no alcohol)
6 - Triple Antibiotic Ointment packs
4 - Sting Relief Pads
1 - Instant Cold Pack
1 - Scissor
1 - Tweezer
1 - 4 oz. Eye Wash
6 - WaterJel Foil Packets
1 - CPR Filtershield
Acetaminophen Packets(optional)
Aspirin Packets (optional)
1 - First Aid Guide

Exhibit 14-B Bloodborne Pathogens Exposure Incident Report

Section 1 – To be completed by Exposed Employee, Local Team Leader or Direct Manager. Information about Exposed Employee:

First Name: ____________________ Middle Initial: ____________

Last Name: ____________________ Division: ____________

Office: ____________________ Employee Number ________

Sex: ☐ M ☐ F Age: __

Address: ____

____

Phone Number: ____

Employment Category: **Length of Employment:** **Time in Occupation:**

☐ Regular Full time ☐ Regular Part time ☐ Temporary ☐ Non-employee

Section 2 – To be completed by Exposed Employee, Local Team Leader or Direct Manager. Information about Exposure Incident:

Date of Incident ____________________ Time: ____________

Specific Location of Incident: ________________________________

Witness(es) to the Incident: ________________________________

Employee's Usual Occupation: ________________________________

Occupation at Time of Incident: ________________________________

Local Team Leader or Direct Manager: ________________________________

Phase of Employee's Workday at Time of Injury:

☐ Performing Work Duties ☐ During Meals ☐ During Rest Period

☐ Entering or Leaving Workplace ☐ Other ____________________

General Type of Task Being Performed at Time of Incident: ____________________

____

Supervision at Time of Accident:

☐ Directly Supervised ☐ Indirectly Supervised ☐ Not Supervised ☐ Supervision Not Feasible

Exhibit 14-B Bloodborne Pathogens Exposure Incident Report (Continued)

Description of Exposure Incident:

Location: ______________________ Date: _____________ Time: ________

Details of Exposure Incident – Identify Type of Exposure, Frequency, Duration, Intensity and Exposure Route

____

____

____

____

____

____

Name, Address, and Phone Number of Attending Physician (If Applicable): ____________________

____

Section 3 –	**To be completed by Exposed Employee, Local Team Leader or Direct Manager. Information about the Exposure Source (If known):**

Name of Source Individual (If known): ______________________________________

Employer of Source Individual: ______________________________________

Contact Phone Number: ______________________________________

____

____

Section 15
Hearing Conservation

15.1 Purpose and Scope

The purpose of this section is to prevent permanent and temporary occupational hearing loss that results from overexposure to noise. This section is applicable to all CDM Smith employees and to all equipment and property used by CDM Smith.

15.2 Definitions

Action Level - An exposure to an 8-hour time-weighted average of 85 decibels measured with a dosimeter or sound-level meter on the A-scale at slow response; or equivalently, a dose of 50 percent measured as per Subsection 15.5.5. The action level is the criterion for instituting noise surveys and employee participation in the audio metric testing program.

Administrative Control - Any procedure that limits noise exposure by control of work schedules.

Audiogram - A chart, graph, or table that results from an audiometric test. An audiogram shows an individual's hearing threshold level as a function of frequency (Hz).

Audiologist - A professional who specializes in the study and rehabilitation of hearing and who is certified by the American Speech, Hearing, and Language Association or licensed by a state board of examiners.

Audiometer - An electronic instrument that measures hearing threshold levels and conforms to the requirements and specifications of the current ANSI Standard S3.6.

Baseline Audiogram - An audiogram against which future audiograms are compared. It may also be described as a reference, pre-placement, pre-assignment, or entrance audiogram.

Biological "Functional" Calibration Check - An audiometric test that uses one or more individuals with known, stable hearing levels to check proper functioning and stability of an audiometer and to identify any unwanted or distracting sounds.

Cut-Off Level - All sound levels at or above the cut-off level are averaged into the calculations that relate to noise exposure. All sound levels below the cut-off level are not included.

Deafness: The condition in which the average hearing threshold level for pure tones at 500; 1,000; 2,000; and 3,000 Hz (frequencies used for speech) is at least 93 decibels (reference ANSI S3.6-1969). This is generally accepted as representing a 100 percent hearing handicap for normal speech.

Decibel (dB) - A unit of measurement of sound-pressure level. The decibel level of a sound is related to the logarithm of the ratio of sound pressure to a reference pressure. The dB has meaning only when the reference is known. The internationally accepted reference pressure used in acoustics is 20 micropascals.

Decibels, A-Weighted (dBA) - A sound level reading in decibels made on the A-weighting network of a sound-level meter at slow response.

Decibels, Peak (dBP) - A unit used to express peak sound-pressure level of impulse noise.

Dose Criterion Sound Level - The average sound level at a given dose criterion length for which the dose represents 100 percent of the allowable exposure. The Federal Occupational Safety and Health Administration (Fed-OSHA) requires a dose criterion sound level of 90 dBA for an exposure duration of 8 hours. ARC has a dose criterion level of 85 dBA for an 8-hour exposure, per Section 29.6.

Dose Criterion Length - The permissible exposure duration (in hours) for a given dose criterion sound level for which the dose represents 100 percent of the allowable exposure.

Eight-Hour Dose - The actual dose (as a percentage) accumulated over the duration of the work shift and based on a regulations defined criterion level and criterion length.

Engineering Control - Any mechanical device, physical barrier, enclosure, or other design procedure that reduces the sound level at the source of noise generation or along the path of propagation of the noise to the individual. This does not include protection equipment such as earmuffs, plugs, or administrative controls.

Hazardous Noise - Noise generated by an operation, process, or procedure that is of sufficient duration and intensity to be capable of producing a permanent loss of hearing in an unprotected person. Generally, this is interpreted as persistent noise levels equal to or greater than 85 dBA or combinations of higher intensities for durations shorter than 8 hours.

Hertz (Hz) - A unit of measurement of frequency that is numerically equal to cycles per second.

Impulsive or Impact Noise - Variations in noise levels that involve peaks of intensity that occur at intervals of greater than 1 second. If the noise peaks occur at intervals of 1 second or less, the noise is considered continuous.

Lav - The average sound level (in dBA) computed for a chosen averaging time duration.

Lav (80) - The average sound level (in dBA) computed for a chosen averaging time duration, using an 80-dBA cut-off level. The 80-dBA cut-off level is used by Fed-OSHA for hearing conservation compliance requirements.

Manager - A broad term that can refer to managers, program and project managers, direct managers, site managers, supervisors, department heads, group heads, branch chiefs, owners, and/or persons that operate in a management capacity or supervisory roll with respect to affected employees.

Medical Pathology - A disorder or disease. For the purposes of this chapter, a condition or disease that affects the ear and should be treated by a physician specialist.

Monitoring Audiogram - An audiometric test obtained at least annually to detect shifts in an individual's threshold of hearing by comparison to the baseline audiogram.

Noise - Unwanted sound.

Noise Dose - A measure of cumulative noise exposure over a stated period, which takes into account both the intensity of the sound and the duration of the exposure.

Noise Dosimeter - An electronic instrument that integrates cumulative noise exposure over time and directly indicates a noise dose.

Noise Hazard Area - Any work area with a noise level of 85 dBA or greater.

Otolaryngologist - A physician who specializes in the diagnosis and treatment of disorders of the ear, nose, and throat.

Representative Exposure - The measurements of an employee's noise dose, or an 8-hour time-weighted average sound level that a qualified person deems representative of the exposure of other employees in that work area or job classification.

Standard Threshold Shift (STS) - An average hearing threshold shift of 10 dB or more at 2,000; 3,000; and 4,000 Hz in either ear. A threshold shift can be temporary or permanent. Temporary threshold shift is a change in hearing threshold, primarily due to exposure to high-intensity noise that is usually recovered in 14 to 72 hours. Any loss that remains after an adequate recovery period is termed permanent threshold shift.

Sound-Pressure Level - The term used to identify a sound measurement (expressed in decibels) obtained with a sound-level meter that has a flat frequency response. This is mathematically equivalent to 20 times the common logarithm of the ratio of the measured A-weighted sound pressure to the standard reference pressure of 20 micropascals (measured in decibels). For use with this standard, slow time response is required in accordance with the current ANSI.S1.4.

Sound-Level Meter (SLM) - An electronic instrument for the measurement of sound levels that conforms to the requirements for a Type II sound-level meter as specified in ANSI S1.4-1971.

Time-Weighted Average (TWA) Sound Level - The sound level that, if constant over an 8-hour workday exposure, would result in the same noise dose as is measured.

TWA (80) - The time-weighted average level that corresponds to a noise dose computed with an 80-dBA cut-off level.

15.3 Responsibilities

Health and Safety Manager

- Develops and implements a hearing conservation program.

- Provides guidance to employees (and their managers) whose jobs expose them to hazardous noise levels.
- Provides periodic noise monitoring when necessary.
- Periodically reviews the hearing conservation program for compliance standards.
- Provides employees access to noise survey/dosimetry records.
- Coordinates the medical surveillance program that includes baseline and annual audiograms.
- Recommends the selection of hearing protection and specifies performance (attenuation) requirements.
- Notifies management of all areas that have been designated as noise hazard areas.

Health and Safety Coordinators

- Reports suspected hazardous noise areas to the HSM so that noise monitoring can be conducted.
- Ensures that employees who work in designated noise hazard areas (or are otherwise exposed to hazardous noise) receive pre-placement, annual, and termination audiograms.
- Ensures that employees in high-noise areas use hearing protection devices.
- Notifies the HSM of any changes in operations that require noise determinations or evaluations.
- Ensures that hearing protection devices that have been approved by the HSM are available for use by employees.
- Ensures that employees who participate in the Hearing Conservation Program attend required training and provides documentation of such training to the HSM.
- Ensures that caution signs are posted in designated noise hazard areas.
- Ensures the design and application of engineering controls recommended by the HSM that are needed to reduce noise exposures to acceptable limits or to the maximum extent feasible.

Employees

Responsibilities of employees who work in high noise areas are:

- Wear and maintain hearing protection as required by the HSC
- Cooperate with H&S personnel in activities undertaken to evaluate hazardous noise

- Notify direct or project manager or HSC of areas, operations, or equipment that may produce hazardous noise
- Attend hearing conservation training when necessary
- Participate in the medical surveillance program

15.4 Noise Exposure Limits

Protection against the effects of noise exposure shall be provided when sound levels exceed those in Tables 15-1 and 15-2 below. Noise exposure limits are generally applied as an 8-hour exposure limit of 85 dBA. For exposures of shorter or longer durations, the exposure limit may be adjusted as indicated in the table. Hearing conservation program elements are expected to be implemented whenever employee noise exposures equal or exceed an 8-hour time-weighted average of 80 dBA measured as per Subsection 15.5.5. Hearing conservation program elements include exposure monitoring, audiometric testing, medical monitoring, and training. The dose criterion of 80 dBA for an 8-hour exposure is referred to as the action level.

Table 15-1
Continuous Noise Permissible Exposure Limits

Duration (Hours)	*Sound Level (dBA)**
16	80
8	85
4	90
2	95
1	100
0.5	105
0.25	110
0.125 or less	115

*Measured on the A-scale of a standard sound-level meter set at slow response.

Table 15-2
Impulse Noise Permissible Exposure Limits

*Sound Level (dBP)**	*Permitted Impulses/Day*
140	100
130	1,000
120	10,000

*Peak sound-pressure level.

15.5 Hearing Protection Methods

15.5.1 Engineering Controls

Where feasible, facilities and equipment will be procured, designed, operated, and/or modified in such a manner as to prevent employee exposure to continuous noise levels above 85 dBA over an 8-hour TWA or impulsive noise above 125 dBP. Any reduction in employee noise exposure, even if not reduced below 85 dBA, is beneficial. If engineering controls fail to reduce sound levels to within the limits of

Section 15, hearing-protective equipment and/or administrative methods of noise-exposure protection must be used.

15.5.2 Personal Hearing Protection

- PPE is to be used only temporarily or if engineering controls are not feasible or practical.
- The HSCs shall enforce the use of earmuffs and/or plugs by employees assigned to work in areas where they will be exposed to continuous noise (without regard to duration of exposure) in excess of 85 dBA or to impulse noise in excess of 140 dB. Disposable earplugs and/or earmuffs will be made available for employee use (if desired) if noise exposures under 85 dBA create a nuisance. Earplugs will be provided for the exclusive use of each employee and will not be traded or shared.
- Hearing protectors must attenuate employee noise exposure to a level of 85 dBA or below. Both earmuffs and plugs are required where noise levels equal or exceed 110 dBA. For employees with standard threshold shift, protectors must attenuate exposure to an 8-hour TWA of 80 dBA. Estimation of the adequacy of hearing-protector attenuation should be performed according to the methods OSHA specifies in 29 CFR 1910.95 App B, Methods for Estimating the Adequacy of Hearing Protector Attenuation.
- If reusable preformed earplugs are used, they will be permanently issued to the employee and fitted to the employee under medical supervision. During fitting, the employee will be instructed in the proper method of insertion, storage, and cleaning of the earplugs. Earplugs will be checked during annual medical examinations.
- Earmuffs will be provided for employees when analysis of noise environments shows that the attenuation provided by earplugs is not sufficient to reduce noise exposures below 85 dBA. The user shall inspect earmuffs on a regular basis.
- Special hearing-protective equipment, such as sound-suppression communication headsets, may be used in noise hazard areas. These devices should be inspected regularly. Sound-suppression headsets may not be used if they have been damaged, altered, or modified in any way that affects the attenuation characteristics. If replacement parts (such as ear cup seals) are available, the headsets may be repaired and reused. If sound-suppression headsets are not permanently issued to employees, such equipment must be cleaned and sanitized before reissuance.

15.5.3 Administrative Controls

If hearing-protective equipment or engineering controls are not sufficient to attenuate noise to less than 85 dBA, the duration of time spent in the noise hazard area shall be limited so as not to exceed the exposure limits specified in Section 15.4.

15.5.4 Noise Monitoring

- Measurement of potentially hazardous sound levels shall be conducted when any information, observation, or calculation suggests that an employee could be exposed to a noise level in excess of an 8-hour TWA. This includes, but is not limited to, times when representative exposures need to be documented, when employees complain of excessive noise, or when it is difficult to understand a normal conversation if the speaker and the listener face each other at a distance of 2 feet. Any new equipment, operation, job, or procedure with the potential for creating hazardous noise should be evaluated with regard to noise emissions before startup. All continuous, intermittent, and impulsive sound levels from 80 to 130 dBA will be integrated into the noise measurements.

- Both noise dosimetry and area monitoring will be repeated periodically, or whenever any changes to facilities, equipment, work practices, procedures, or noise-control measures alter potential noise exposures.

- Employees and/or their representatives will be provided an opportunity to observe noise dosimetry and area monitoring activities.

- Areas determined to have noise levels at or above 85 dBA must be posted as noise hazard areas.

- Affected employees (employees whose exposures have been determined to exceed the action level) shall be notified of the results of noise monitoring.

15.5.5 Noise-Measurement Methods

- Sound-level meters must meet Type II requirements of ANSI S1.4 and must be capable of measuring sound in the range of 80 to 130 dBA.

- Noise dosimeters must meet Class 2A-90/80-5 requirements of ANSI S1.25 and be capable of integrating sound levels of 80 dB and above.

- Employee noise doses may be ascertained by using either a noise dosimeter or sound-level meter. If a sound-level meter is used to estimate an employee's dose, the noise survey will include a time and motion study to document the variations in the employee's noise exposure during the working shift. If an employee moves about or noise intensity fluctuates over time, noise exposure is more accurately estimated by personal dosimetry. Regardless of the method chosen, a sufficient number of readings/measurements will be made to accurately reflect noise exposure.

- Employee exposure measurements will be made in such a manner as to accurately represent the actual exposure to noise.

  B When using a noise dosimeter to determine an employee's noise exposure, the microphone will be attached to the employee in the area of the employee's shoulder.

  B When using a sound-level meter, the microphone should be positioned not less than 2 inches nor more than 2 feet from the employee's ear.

  B Measurements will be made with the employee at his/her regular work stations(s).

- Before and after each use, dosimeters and sound-level meters will be calibrated using acoustical calibrators to verify the accuracy of the measuring equipment.

  B If any sound-level meter or noise dosimeter is dropped, or if the microphone receives a sharp impact, a calibration check shall be performed to ensure that it is still working properly before taking additional measurements.

  B Sound-level meters and noise dosimeters that are not working properly or are out of calibration shall not be used to determine an employee's noise exposure.

15.6 Medical Surveillance Program

Program Participation

- Whenever an employee is routinely occupationally exposed to continuous noise at or above the action level or to impact or impulsive noise in excess of the limits specified in Section 15.4, the employee shall be enrolled in a medical surveillance program. Employee noise exposure shall be determined without regard to any sound attenuation provided by the use of hearing protectors.

- Each employee placed in a job that required participation in a medical surveillance program shall undergo a physical examination before being assigned to duties that involve exposure to high-intensity noise. The examination shall include a baseline audiogram, a medical examination to determine any preexisting medical pathology of the ear, and a work history to document past noise exposures. The history shall include a detailed review of past work histories and possible occupational and nonoccupational noise exposures.

- When it is discovered that employees have been working where they encounter hazardous noise or incur exposures that exceed the action level and have not had a physical examination, one shall be conducted within 30 days. The audiogram must follow at least 14 hours of no known exposure to sound levels in excess of 80 dBA. This interval should be sufficient to allow recovery from noise-induced temporary threshold shift.

- Personnel who suffer from acute diseases of the ear shall not be placed in hazardous noise areas until the condition has abated, particularly if such diseases preclude the wearing of hearing protectors, cause hearing impairment, or produce tinnitus.

- All employees who are participants in the medical surveillance program must receive an annual audiogram.

- All CDM Smith employees who have participated in the medical surveillance program shall receive a final audiometric examination before termination of employment with CDM Smith, job changes within the installation that would alter noise exposure, transfer to another installation, or retirement.

15.7 Audiometric Testing

15.7.1 Medical Personnel

Medical personnel who perform audiometric tests must be qualified, trained, and knowledgeable in operating equipment used and be under the supervision of an audiologist or physician. If manual audiometers are used, the Council for Accreditation in Occupational Hearing Conservation must certify qualifications of personnel who operate the audiometer. Hearing threshold levels will be determined by audiometers calibrated to zero reference levels of the ANSI S3.6 standard for audiometers.

15.7.2 Pure Tone, Air Conduction Testing

Pure tone, air conduction testing shall be conducted at test frequencies of 500; 1,000; 2,000; 3,000; 4,000; and 6,000 Hz for each ear. Audiometric test equipment shall meet the specification, maintenance, and use requirements of ANSI S3.6. Where a pulsed-tone, self-recording audiometer is used, it will also meet the requirements of 29 CFR 1910.95, Table 3.

- A listening check shall be performed daily before use to ensure that the audiometer is free from distorted or unwanted sounds.
- A functional check shall be performed each day either by using an "acoustical ear" calibrator (dBA sound-level meter with 9A Type Earphone Coupler) or by testing an individual with a known and stable hearing baseline (a "biological check"). A record will be kept of the daily checks. Deviations of 5 dB or more require an acoustical calibration test.
- An acoustical calibration test (using a sound-level meter, octave-band filter set, and a National Bureau of Standards 9A Coupler) shall be performed at least annually (semi-annually for self-recording audiometers), or when a functional check indicates a deviation of 5 dB or more. The acoustical calibration tests shall conform to the requirements of 29 CFR 1910.95, Appendix E. Deviations of 10 dB or more will require an exhaustive calibration.
- An exhaustive calibration shall be performed at least every 2 years, or whenever an acoustical calibration test indicates an error of 10 dB or more. The test will meet the criteria of the current ANSI S3.6 guidelines appropriate for the instrument. Following calibration, the front panel of the audiometer shall be labeled with a tag indicating that is has been calibrated to ANSI S3.6 guidelines and the date of the calibration.
- Rooms used for audiometric testing shall not have background sound-pressure levels that exceed those in the table below. Sound-pressure levels for rooms used for audiometric testing must be checked at least every 2 years.

Table 15-3
Maximum Background Sound-Pressure Levels
for Audiometric Test Booths

Frequency (Hz)	Sound-Pressure Level (dBA)
500	27
1,000	30
2,000	35
4,000	42
8,000	45

- Employees must receive advance written notification of the need to avoid high levels of occupational and nonoccupational noise during the 14 hours immediately preceding an audiometric test. Properly fitted hearing protectors and/or other hearing-protective devices may be used to prevent excessive noise exposures during this period.

- A physician or other qualified person shall compare annual audiograms with the employee's baseline audiogram to determine if it is valid and if a standard threshold shift has occurred. It is desirable to review the employee's audiogram record for patterns of change over time. When determining if a standard threshold shift has occurred, allowances for the effects of aging to the hearing threshold level may be made using the procedure described in 29 CFR 1910.95, Appendix F. Audiograms referenced to ASA-1951 must be converted to ANSI S3.6-1969 before hearing threshold levels can be properly determined (see the table below for conversion).

Table 15-4
Threshold Audiogram Conversion
ASA-1951 to ANSI-1969

Frequency	dB Difference
250	15
500	15
1,000	10
2,000	10
3,000	10
4,000	5
6,000	10
8,000	10

B To convert an ASA-1951 reference threshold audiogram to ANSI-1969, add the difference in values.

B To convert ANSI-1969 to ASA-1951, subtract the values.

- When evaluation of an audiogram indicates that a standard threshold shift has occurred, a retest shall be scheduled within 30 days to determine if the shift is temporary or permanent. A medical evaluation may be warranted at this time to determine if an acute medical condition is a contributing factor.

- An annual audiogram may be substituted for the baseline when, in the judgment of the audiologist, otolaryngologist, or physician who is evaluating the audiogram, the hearing threshold shown on the annual audiogram indicates significant improvement over the baseline audiogram.

- The employee will be notified of audiometric testing results in writing within 21 days of determination of a permanent threshold sift. The subcontract health care provider retained by CDM Smith shall notify the employer and employee in writing of determinations of permanent threshold shifts.

15.7.3 Criteria for Referral to an Audiologist

The following are criteria for referral to an audiologist for more comprehensive testing:

- Average hearing threshold level greater than 25 dB at 500; 1,000; and 2,000 Hz.
- Single frequency loss greater than 55 dB at 3,000 Hz; or greater than 30 dB at 500; 1,000; or 2,000 Hz.
- Difference in average hearing threshold level between the better and poorer ear of more than 15 dB at 500; 1,000; and 2,000 Hz; or more than 30 dB at 3,000; 4,000; and 6,000 Hz.
- Reduction in hearing threshold level in either ear from the baseline or previous monitoring audiogram of more than 15 dB at 500; 1,000; or 2,000 Hz; or more than 30 dB at 3,000; 4,000; or 6,000 Hz.
- Variable or inconsistent responses or unusual hearing loss curves.

15.7.4 Conditions that Require Follow-Up Review of Employees with Hearing Illness and Responses

- When a permanent threshold shift is detected, a follow-up review must be conducted.
- An employee who is not currently using hearing protection shall be provided (and fitted as necessary) with hearing protectors and shall be trained in their use.
- The employee shall be provided/refitted with hearing protectors that offer greater sound attenuation, as warranted, if hearing protectors are already in use.
- The employee shall be trained/retrained on the hazardous effects of noise and the need to use hearing protection.
- The employee’s work area shall be investigated to determine if work practices or changes in equipment or procedures can be made that will decrease noise hazards or if changes have resulted in an increase in noise hazards.
- The employee shall be reassigned to work in a low-noise area, as necessary, to prevent further hearing impairment. The employee will continue to participate in the hearing conservation program.

15.8 Noise Hazard Warning Signs

Caution signs that clearly indicate a hazard of high noise levels and the requirements to wear hearing protection shall be posted at the entrance(s) to, and the periphery of, noise hazard areas. Decals or placards with similar statements shall be affixed to power tools and machines that produce hazardous noise levels. Signs and decals shall have wording in black letters on a yellow background (refer to Section 15.11 for noise hazard warning sign specifications).

15.9 Employee Training

- Each employee who participates in the hearing conservation program shall receive annual training. The training must include, but not be limited to:
  - An overview of the CDM Smith Hearing conservation program
  - A review of the effects of noise on hearing (including permanent hearing loss)
  - Noise control principles
  - The purpose, advantages, disadvantages, and attenuation characteristics of various types of ear protectors
  - Instruction on selection, fitting, use, and care of hearing protectors
  - An explanation of the audiometric testing and its purposes
- Personnel will be encouraged to use hearing protectors when exposed to hazardous noise in nonoccupational settings (e.g., from lawn mowers, firearms, etc.).

15.10 Records Maintenance

- Audiogram and noise-exposure records shall be maintained as a permanent part of employee medical records. If noise-exposure measurement records are representative of the exposures of other employees participating in the hearing conservation program, the range of noise levels and the average noise dose will be made a permanent part of the medical records of the other employee as well.
- In addition to audiometric test data, each medical record will, as a minimum, identify:
  - The audiometric reference level to which the audiometer was calibrated at the time of testing
  - The date of the last calibration of the audiometer
  - The name, social security number, and job classification of the employee tested

- B The employee's most recent noise exposure assessment

- B The date(s) hearing conservation training was received

- Records of the background sound-pressure levels in the audiometric test rooms and data and information concerning calibration and repair of sound-measuring equipment and audiometers (as well as all audiometric test data) will be maintained by CDM Smith's medical consultant in accordance with OSHA and other applicable regulations.

- Accurate records of noise surveys/monitoring, results of the special noise studies, and records of special actions or engineering controls installed to control noise exposures will be maintained for the duration of the affected employee's employment, plus 30 years.

15.11 Signs and Decals

15.11.1 Noise Hazard Warning Sign Specifications

Warning signs must read:

CAUTION

NOISE AREA

MAY CAUSE HEARING LOSS

USE PROPER

HEARING PROTECTION

IN THIS AREA

The lettering is almost always all caps, black, and on a yellow background.

15.11.2 Noise Hazard Warning Decal Specifications

Decals must have a yellow background and black lettering (all caps). The decal must be self-adhesive on the side opposite the written warning. The written warning must read:

CAUTION

NOISY EQUIPMENT MAY CAUSE HEARING LOSS

USE PROPER

HEARING PROTECTION

The word caution is in yellow lettering with a black background superimposed on the yellow background of the label. As shown, the word caution is 2 point sizes larger than the lettering in the rest of the warning.

16.2 Housekeeping

These guidelines are for the establishment and administration of a clean and orderly work environment at field project sites. A continuous housekeeping program strongly tends to prevent accidents. A clean and orderly work environment can be achieved and maintained through ongoing housekeeping efforts undertaken by personnel at all levels. Project managers shall initiate participation in housekeeping activities and good work habits, not only at the end of a work assignment but throughout the evolution of the project.

- To achieve these benefits, the team shall plan the location of equipment and storage facilities to allow the easy flow of personnel, equipment, materials, fire hazards, and to prevent the obstruction of evacuation, fire fighting, or rescue activities.

- Store materials in a manner that facilitates access of material handling equipment and personnel handling limitations. Lack of sufficient workspace and storage capacity leads to the potential for accidents and decreases efficiency.

- Avoid storage of flammable liquids, such as paints and thinners, unless they are required for specific project needs. If needed, such storage shall be within a metal storage cabinet that has been labeled and approved for the storage of flammable liquids.

- Continuously maintain work areas in a neat and orderly manner.

- Containers should be provided for the collection of waste, trash, and other nonhazardous refuse. Investigation-derived waste and other waste materials that are potentially hazardous should be stored and labeled in accordance with project-specific procedures that meet regulatory and client requirements.

- Deploy leads, hoses, and extension cords so they do not present tripping hazards and are not subject to contact with moisture or physical stress. Where possible, they should be hung overhead with nonconductive material and kept away from walkways, doors, stairs, and ladders.

- Protect protruding rebar and anchor bolts and conspicuously mark them.

- Clean small spills that create slip hazards and/or flammability hazards immediately and do not leave them unattended.

- Keep walkways, aisles, stairways, and passageways in a clear and unobstructed condition.

- Prohibit eating and drinking in work areas where there is potential exposure to toxic or hazardous materials. Smoking is limited to designated smoking areas where there is no such exposure.

16.3 Manual Material Handling

CDM Smith employees should follow the work practices outlined below when lifting and carrying heavy objects.

- Test any load they are required to lift and compare its weight, volume, and shape to their lifting abilities. Employees shall not attempt to lift beyond their capacity.
- Obtain assistance in lifting heavy objects. Back belts or back braces may be used if desired; however, many ergonomists do not believe that these devices create a benefit or provide protection.
- When two or more persons are involved in a manual lift, one person should provide direction of the lift.
- When two or more persons are carrying an object, each employee, if possible, should face the direction in which the object is being carried.
- When two or more persons carry a heavy object that is to be lowered or dropped, there shall be a prearranged signal for releasing the load.
- The right way to lift is easiest and safest. Crouch or squat with the feet close to the object to be lifted, secure good footing, take a firm grip, bend the knees, keep the back vertical, and lift by bending at the knees and using the leg and thigh muscles. Exercise caution when lifting or pulling in an awkward position.
- Employees should avoid twisting or excessive bending when lifting or setting down loads.
- When moving a load horizontally, employees should push the load rather than pull.
- For tasks that require repetitive lifting, the load should be positioned to limit bending and twisting. The use of lift tables, pallets, and mechanical devices should be considered.
- When gripping, grasping, or lifting an object such as a pipe or board, the whole hand and all the fingers should be used. Gripping, grasping, and lifting with just the thumb and index finger should be avoided.

16.4 Electrical Safety Program

CDM Smith addresses the needs of electrical safety through this program. The program was designed to meet the requirements of the:

- National Fire Prevention Association's standard 70E for electrical safety,
- IEEE 1584 standard for arc flash safety, and
- OSHA's electrical safety standards (29 CFR 1910 subpart S & 1926 subpart K)

If this program differs from any of these standards, the more protective policy will prevail. If any word or phrase in this section is unclear, refer to the definitions in NFPA 70 E. (You can download NFPA 70E from http://subscriptions.techstreet.com/home)

Employees conducting electrical work, or employees whose work may involve contact with electrical devices, must:

- Comply with this and other sections of the CDM Smith health and safety manual AND
- Only do work for which they are "qualified" in accord with this program AND
- Complete the health and safety training required for their tasks in accord with this program AND
- Complete an electrical safety work permit (Exhibit B) that includes
    - Lock-out and tag-out, if feasible, to bring their workplace into an electrically safe (*zero-state*) work condition
    - Shock hazard analysis as required in program
    - Flash hazard analysis as required in program

Qualified Workers

The electrical safety program makes different provisions for "unqualified" and "qualified" personnel. Most CDM Smith personnel are "unqualified" to work on electrical devices or circuits except in an "electrically safe work condition" (an area that is reliably free of electrical charge and current).

CDM Smith allows "unqualified" personnel to perform work:

- Where electrical hazards are effectively absent
- When all electrical parts and devices present are in closed enclosures approved for site conditions.
- Within the limits of their abilities on systems that are in an "electrically safe work condition,"
- ***Outside*** the "limited approach boundary" that qualified persons may work inside.

Personnel in the following job classifications ***may*** be "qualified" to perform work on live electrical devices and circuits as described in this section if their division approves the qualification and they have also completed an acceptable electrical safety course. The limits of each person's qualification will be stated in the qualification letter. See Exhibit A.

- Electricians
- Electrical engineers
- Health and safety managers
- Instrument & control (I & C) engineers
- Others approved by operating units

NOTE: Divisions may "qualify" persons for one type of task or situation and not for others. Each employee is responsible to know the limits of his or her qualification.

- CDM employees who have valid licenses to practice as ***electricians*** are "qualified" to perform any type of electrical work for which CDM Smith has issued an energized electrical work permit (Exhibit B).
- CDM Smith's ***electrical engineers*** are "qualified" to perform tests and collect field data and measurements on any electrical parts and devices for which CDM Smith has issued an energized electrical work permit. They are not "qualified" to modify systems or install electrical parts and devices, except in an "electrically safe work condition."
- CDM Smith's ***I & C engineers*** and ***health and safety managers*** are "qualified" to perform tests and collect measurements on electrical parts and devices operating at no more than 250 volts if CDM Smith has issued an energized electrical work permit. They are not "qualified" to modify systems or install electrical parts and devices, except in "electrically safe work conditions." They may, however, modify "live" parts of data – management systems that operate at less than 25 volts
- CDM Smith's ***electrical engineers***, ***I & C engineers***, and ***health and safety managers*** are, however, "qualified" to take steps (as conservative as possible) to reduce electrical hazards that become apparent during those tests. Examples of permitted actions might include bending a loose wire away from other conductors and notifying an electrician to properly affix it.
- Presidents of CDM Smith operating divisions may recognize ***other personnel*** as "qualified," with the advice of their safety managers and the employee's group leader. Of course, these presidents should seek advice from knowledgeable personnel.

Training

Your job title alone does not qualify you to conduct electrical work for CDM Smith. Qualified personnel must also complete appropriate electrical safety training. That electrical safety training should include an understanding of

- Appropriate regulations,
- CDM Smith's Company program, and the
- Information that can be derived from appropriately labeled equipment.

A person who is appropriately trained should understand personal protective equipment including how to select it, don it, doff it, understand its limitations, and know how to maintain it. Completion of CDM Smith University courses HS #106i and THS #191 meets this requirement.

Qualified employees must re-complete the training requirements above when:

- Their work habits fail to comply with this program,
- Work procedures require work practices different from those that the employee normally uses, or
- Three years have passed since the last training experience.

Electrically Safe Work Condition

Unqualified personnel may work on electrical devices only when in an electrically safe work condition. Even qualified personnel must work in electrically safe work condition whenever it's possible. An "electrically safe work condition" exists when which no conductor or parts that an employee can contact carries an electrical current that can harm the employee.

The most common examples of "electrically safe work condition" are places where no electricity is present or where all of the electrical devices are enclosed as required to protect unqualified workers by the National Electrical Code.

Lock-Out

If electrical devices are present, and their enclosures will be disturbed, creating a safe work condition may require lock-out or tag-out. Effective lock-out requires you to follow a specific procedure and describe it in your lockout permit. See Exhibit A in Section 16-5. CDM Smith offers another course (HS#119) to teach employees how to perform lockout. You should take that course if you need to create "electrically-safe work conditions."

Lockout is not complete until a qualified person verifies the safe working condition by verifying the absence of electrical potential. Any meter used for this test must first respond properly to a known live voltage source, followed by a check on the equipment that has been locked out, then again on the known live source. After this test, the qualified person should install Personal Protective Grounds to protect against accidental energization. Wear the appropriate PPE when attaching Personal Protective Grounds. Remove these grounds before re-energizing equipment.

Energized Circuit Work Condition

Some electrical tasks can only be performed while power is still present. Obvious examples include voltage testing and observation of the equipment under load conditions. Such tasks may only be conducted on systems over 50 V only by qualified persons, and only with a CDM Smith Energized Circuit Work Permit (Exhibit B).

Permits are issued to qualified persons by CDM Smith's health and safety managers and other persons designated by the corporate health and safety officer. CDM Smith will normally issue an energized circuit work permit for the duration the work requires. For electricians, who will install or modify a specific electrical appliance or device, the permit may allow work for a period of one day. For electrical engineers, who typically conduct studies during preliminary design or consultation, the permit may last up to a month. For I&C engineers, who maintain instrumentation and control systems, the permit may last up to six months.

The purpose of the permit is to identify appropriate personal protective equipment and any applicable procedures. Every energized circuit work permit must include a shock hazard analysis and a flash hazard analysis. If the owner's electrical consultant has conducted these analyses and properly labeled the equipment, CDM Smith personnel may rely on those analyses.

Shock Hazard Analysis

The qualified person should perform a shock hazard analysis to identify the control distances and assess the condition of the electrical system. The purpose is to identify hazardous conditions and the appropriate personal protective equipment for the team inside the controlled work zone.

After the qualified person examines the system and identifies all of the shock hazards present, he or she must determine the appropriate distances for the

- Limited approach boundary
- Restricted approach boundary and
- Prohibited approach boundary (the distance at which the hazards is the same as touching the

conductors)

The most <u>convenient</u> way to assess the shock hazard is to rely on a previous characterization of electrical hazards provided by the owner of the location in which you work. Unless you suspect that the previous analysis was incompetent or inadequate,
you may base your decisions on the shock hazard labels you see on the electrical equipment.

The most <u>accurate</u> way to assess the hazard risk category is to have CDM Smith's electrical engineering group performed a shock hazard analysis. If you will perform work in one location over a long period, and no previous analysis has occurred, consider asking the electrical engineering group for help. NOTE: This is a service for which CDM Smith should, normally, charge the client.

If neither of the two methods above are possible in your work situation, qualified personnel may use the rules of thumb provided below to conduct shock hazard analysis.

During work on live electrical parts, "unqualified" personnel must maintain the following distance (the "**Limited Approach Boundary**") from the nearest live part.
- 3.5′ (42″) for non-moving circuits between 50 and 750 volts
- 5′ (60″) for non-moving circuits between 751 and 15,000 volts
- 6′ (72″) for non-moving circuits between 15,001 and 36,000 volts
- 8′ (96″) for non-moving circuits between 36,001 and 121,000 volts
- 10′ (120″) for <u>movable conductors</u> less than 72,500 volts

During work on live electrical parts, "qualified" personnel must wear electrical PPE on any parts of their body that comes within the "**Restricted Approach Boundary**" of the nearest live part.
- 1′ (12″) for circuits between 300 and 750 volts
- 2.3′ (26″) for circuits between 751 and 15,000 volts
- 2.6′ (31″) for circuits between 15,001 and 36,000 volts
- 2.8′ (33″) for circuits between 36,001 and 46,000 volts
- 3.2′ (38″) for circuits between 46,001 and 72,500 volts

Any body part that approaches an electrical conductor closer than allowed by the restricted approach zone must be protected with:

- Systems operating at 50 to 500 volts
  - Class 00 material (e.g. gloves)
  - Leather protectors above 250 volts
- Systems operating at 500 to 1000 volts
  - Class 0 material (e.g. gloves)
  - Leather protectors above 250 volts

Flash Hazard Analysis

The qualified person should conduct a flash hazard analysis to determine the flash hazard present, the associated flash hazard boundary, and the required PPE. Flash hazards are represented by the Hazard Risk Category, which in turn depends on the energy intensity that could affect the hands, face, or body of an exposed employee.

The most convenient way to assess the hazard risk category is to rely on a previous characterization of electrical hazards provided by the owner of the location in which you work. Unless you suspect that the previous analysis was incompetent or inadequate, base your decisions on the arc flash hazard labels you see on the electrical equipment.

The most accurate way to assess the hazard risk category is to have CDM Smith's electrical engineering group performed an arc flash analysis. These studies are complicated, long in duration, and expensive. If you will perform work in one location over a long period of time, and no previous analysis has occurred, consider asking the electrical engineering group for help. NOTE: this is a service for which CDM Smith should, normally, charge the client.

If neither of the two methods above are possible in your work situation, qualified personnel may use the tables in Exhibit C to identify the potential energy intensity associated with common levels of electric service.

The Hazard Risk Categories are shown below.

- Hazard Risk Category 0 (0 - 2 cal/cm^2)
- Hazard Risk Category 1 (2 - 4 cal/cm^2)
- Hazard Risk Category 2 (4 – 8 cal/cm^2)
- Hazard Risk Category 3 (8 – 25 cal/cm^2)
- Hazard Risk Category 4 (25 - 40 cal/cm^2)

Personal Protective Equipment

The qualified person conducting the shock and flash hazard analyses should specify the level of protection needed for the work based on the energy that could contact the employee. The following table (from NFPA 70E) describes the ensembles of personal protective equipment that are appropriate.

Work on low-voltage circuits in PLC panels is normally Hazard level 0. Work in PLC panels that may involve contact with conductors operating between 50 and 250 volts is normally Hazard Level 1, unless that conductor is enclosed as required by NEMA codes. A personal protective ensemble for Hazard Level 1 work might include:

- Fire Resistant (FR) long-sleeved shirt and FR pants or an FR coverall
- Hard Hat (Type E)
- Safety glasses/goggles
- Electrical safety gloves (ASTM Class 00, minimum) for hands that penetrate the restricted approach boundary
- Insulating blankets (ASTM Class 00, minimum) over any exposed live parts that an employee might inadvertently contact

Risk Category	Protective Clothing required	Examples
0	Non-melting, flammable materials (i.e., untreated cotton, wool, rayon, or silk, or blends of these materials) with a fabric weight at least 4.5 oz/yd2.	- 100% cotton shirt - jeans or - 100% cotton slacks
1	FR shirt and FR pants or FR coverall.	- Nomex clothing - FR pants
2	Cotton underwear – conventional short sleeve and brief/shorts, plus FR shirt and FR pants Face shield with side protection, chin cups	Flash suits and Flash hoods must be rated above the flash energy levels expected and meet the appropriate ASTM standard.
3	Cotton underwear plus FR Shirt and FR pants plus FR coverall and Flash hood, or cotton underwear plus two FR coveralls and Flash hood *or* Flash suit and Flash hood.	
4	Cotton Underwear plus FR Shirt and FR Pants plus multilayer flash suit. *or* Flash suit meeting ASTM F1506 and ASTM F2178	

*: The requirement for Fire Resistance (FR) discourages the use of metal zippers and fasteners, and fasteners or fabric made of meltable plastic.

Work on low-voltage circuits in PLC panels is normally Hazard level 0. Work in PLC panels that may involve contact with conductors operating between 50 and 250 volts is normally Hazard Level 1, unless that conductor is enclosed as required by NEMA codes. A personal protective ensemble for Hazard Level 1 work might include:

- Fire Resistant (FR) long-sleeved shirt and FR pants or an FR coverall
- Hard Hat (Type E)
- Safety glasses/goggles
- Electrical safety gloves (ASTM Class 00, minimum) for hands that penetrate the restricted approach boundary
- Insulating blankets (ASTM Class 00, minimum) over any exposed live parts that an employee might inadvertently contact

Safe Practices for Work with Electrical Equipment

The following work practices can eliminate or minimize the potential for electrical shock, fires, and burns when working or around electrical equipment.

- Treat all electrical circuits as live until their condition has been verified. Treat even low voltages as dangerous.
- Don't wear watches, jewelry, or other conductive objects.
- Use Ground Fault Circuit Interrupters (GFCIs) whenever you use portable electric tools or electrical equipment. If a GFCI outlet is not available, a portable GFCI outlet adapter or GFCI-equipped extension cord should be used. (available from the equipment center)
- Do NOT use your finger or any conductive object to point to circuits, panels, fixtures etc.
- Conduct a tool count before beginning work and after work is completed.
- Visually inspect electrical cords before each use for fraying, cuts, or other damage.
- Do not work with electrical equipment or tools with wet hands or standing in wet areas.

Installation and Maintenance of Electrical Equipment

Electrical equipment can cause shock, flash, or burns, if it is poorly maintained. CDM Smith personnel should observe the following rules of thumb in maintaining tools and equipment.

- Inspect all electrical equipment and tools before each use. Inspect insulation, fixtures, switches, plugs, fuses, etc. Remove from service any faulty equipment and notify the source of the equipment.
- Use the following precautions when using electrical cords:
  - Do not use light-duty (household) extension cords for field work.
  - Do not use extension cords for permanent installations.
  - Keep extension cords properly covered or raised overhead to prevent tripping hazards and damage from traffic.
  - Extension cords or cables shall not be secured with staples, hung from nails, or suspended by bare wire
  - Only use electrical cords that are equipped with a grounding pole on the plug (three-prong plugs). Never remove a grounding prong from a cord.
- Do not install fuses or circuit breakers larger than the circuit rating.

- Use only approved and properly rated lighting devices and tools in vessels, boilers, and confined spaces.
- All electrical equipment, including motors, generators, wiring, and controls should be installed so that exposed live parts are properly guarded or insulated to provide adequate protection to operating personnel. Avoid open panels, circuit boxes, and exposed wiring.
-

In wet locations:

- Plugs and receptacles shall be kept out of water unless they are an approved submersible type.
- Where a receptacle is used in a wet location, it shall be contained in a weatherproof enclosure, the integrity of which is not affected when an attachment plug is inserted. [Connecting through a ground-fault circuit interrupter (GFCI) is the most effective protection.]
- Temporary lighting strings in outdoor or wet locations (such as tunnels, culverts, valve pits, floating plant, etc.) shall consist of lamp sockets and connection plugs permanently molded to the hard service cord insulation.

Electrical Emergencies

If a rescue from electrical equipment is required, use the following precautions:

- Disconnect the circuit before attempting any rescue.
- Make sure you are standing on a dry surface.
- Use a dry belt, rope, coat, or other non-conductive material to loop over the victim and drag them away from the contact.
- Assess the condition of the victim; do not approach if they are still in contact with the circuit.
- Apply first aid and/or CPR (if you are qualified) and get medical help.

Andrew A.
Anybody Electrical
engineer Saskatoon
office
Camp Dresser and McKee

Sunday, January 15, 2012

Dear Mr. Anybody:

Based on professional credentials for which CDM Smith hired you, and the training that you have already received, I designate you as a "Qualified Person" for work near and with electrical devices up to _________volts and ____________kilovolt ¤ amperes. This designation is, of course, subject to the following requirements:

- You must follow the procedures outlined in CDM Smith's electrical safety program, which is described in Section 16-4 of CDM Smith's Health and Safety Manual.

- You must maintain training on electrical safety as described in that program

If the boxes below are checked, you must complete the training shown before this letter becomes effective.

__________CDM Smith University course HS #106i

__________CDM Smith University course THS #191

Salvatore Safety
Senior Vice President
Consulting and Engineering Division
Camp Dresser and McKee

CDM Smith Permit for Work on Energized Circuits

Date work to commence: ________________ Date work complete: ____________

Equipment description: ____

Work Description: ____

Can this equipment be shut down? ☐ Yes ☐ No

If "No", why not? ____

Does this equipment have a disconnect? ☐ Yes ☐ No

Is a utility shutdown required? ☐ Yes ☐ No

Safe Work Practices:			
Results of Shock Hazard Analysis:			
Shock Protection Boundary: All points within ___feet ___inches of an exposed live part.			
Results of Flash Hazard Analysis:			
Flash Protection Boundary: All points within ___feet ___inches of an exposed live part.			
Names of individuals who will perform work:			
1.		2.	
3.		4.	
Name of individuals who will be present with a valid First Aid/CPR card:			
1.		2.	
Emergency procedures: <u>Leave the area quickly. Contact authorities.</u>			
Task Supervisor (name and phone #):			
Safety equipment that will be required: ________________________________			
(Attach a sketch of the layout and setup if necessary.)			
Submitted By:			Qualified Person
Approved By:			CDM Smith Site Safety Representative
Approved By:			Client Representative (if required)

System Voltage (volts, phase to phase)	Upstream Protection Fault Clearing Time (sec)	Maximum 3 Phase Bolted Fault Current for Use of HRC 2 PPE (8 CAL/CM2)	Maximum 3 Phase Bolted Fault Current for Use of HRC 4 PPE (40 CAL/CM2)
690	0.05	39 kA	180 kA
	0.10	20 kA	93 kA
	0.20	10 kA	48 kA
	0.33	Not Recommended	29 kA
	0.50	Not Recommended	20 kA
600	0.05	48 kA	200 kA*
	0.10	24 kA	122 kA
	0.20	12 kA	60 kA
	0.33	Not Recommended	36 kA
	0.50	Not Recommended	24 kA
480	0.05	68 kA	200 kA*
	0.10	32 kA	183 kA
	0.20	15 kA	86 kA
	0.33	8 kA	50 kA
	0.50	Not Recommended	32 kA
400	0.05	87 kA	200 kA*
	0.10	39 kA	200 kA*
	0.20	18 kA	113 kA
	0.33	10 kA	64 kA
	0.50	Not Recommended	39 kA
208	0.05	200 kA*	Not Applicable
	0.10	104 kA	200 kA*

16.5 Lockout/Tagout

Although CDM Smith employees normally oversee, rather than do, construction and maintenance work, they sometimes must examine, enter, or service mechanical equipment. In many cases, CDM Smith employees must work in or around energy sources that are owned and operated by clients or a third party. **Any locks or tags CDM Smith places on equipment owned and operated by an organization other than CDM Smith must be coordinated with the owner/operator of the equipment.**

These guidelines cover inspecting, servicing, and maintaining equipment where unexpected energization or startup of the equipment has the potential to harm employees. These guidelines are intended to prevent accidents and injuries caused by the accidental release of energy.

16.5.1 Definitions

Lockout - The process of preventing the release of material or energy (mechanical, kinetic, potential, electrical, or chemical) from a power source using physical means, such as a lock to maintain an energy isolation device in the safe position, and prevent the inadvertent energization of machinery, equipment, or a system. Lockout usually involves installing a lock at a power (or flow) source so that equipment supplied by that source cannot be operated. Locks may be obtained from the equipment centers. The lockout locks are provided only for lockout purposes and should not be used to lock toolboxes, storage sheds, or other devices.

Tagout - Accomplished by placing a tag on the power source. The tag acts as a warning not to restore energy. It is not a physical restraint. Tags must clearly state **Do Not Operate** or the like. Identifying information must be applied by hand. CDM Smith uses tagout as a complement to lockout, **not** as a substitute.

Authorized Employees - Those who physically lock or tagout equipment for servicing or maintenance. Note that these individuals are not necessarily the people who normally operate the equipment. In some cases, the authorized employee may be a representative of a client or third party operator.

Affected Employees - Those whose job requires them to operate equipment subject to lockout or tagout, or those employees who work in areas where lockout or tagout is used.

16.5.2 What Must Be Locked or Tagged Out?

Employees should implement these guidelines when they are potentially exposed to hazards such as unguarded moving parts, live electrical systems, or flow of material from open pipes, valves, or other systems. This program applies to nonroutine activities. This includes inspections, repair and replacement work, renovation work, and modifications or other adjustments to equipment that may affect CDM Smith employees. For routine activities, mechanical guarding and electrical insulation are the preferred protection.

Some types of energy that lockout/tagout must be used to control include:

Electrical	Mechanical	Pneumatic
Fluids and gases	Hydraulic	Thermal
Gravity		

16.5.3 Client-Performed Lockout

In most cases, lockouts or tagouts should follow the procedures of the owner and operator because they are more likely to understand any special conditions that apply to their facility and its equipment. CDM Smith should request that the operator either perform or oversee lockouts and tagouts for those work activities that require the lockout or tagout of equipment to protect CDM Smith employees or subcontractors. CDM Smith should request that its employees be allowed to place personal locks on systems under the client's procedures. CDM Smith may rely on lockouts performed by client operators provided:

- The lockout follows an established procedure, as opposed to an improvised one. CDM Smith should ask for and review the procedure before performing the work.

- The CDM Smith employees observe the lockout and believe that it controls all harmful energies

The procedure below describes a procedure that CDM Smith personnel should follow when they are responsible for the lockout.

16.5.4 Lockout/Tagout Procedure

When CDM Smith employees perform a service that requires lockout or tagout, they must coordinate all activities with the operator of the facility. The following actions should be performed to execute a lockout or tagout:

- Shut down the equipment
- Isolate equipment
- Apply lockout devices or warning tags
- Release stored energy to achieve a "zero energy state"

Shut the Equipment Down and Isolate It - First, locate all energy sources that power the piece of equipment you will work on. Always look for hidden energy sources. Many machines have more than one power source, so you must study the machines and power sources involved. Notify any affected employees before you start a lockout procedure, then shut off each power and material feed to the equipment.

Every power source has its own procedure for shutoff. Shutoff may be accomplished by pulling a plug, opening a disconnect switch, removing a fuse, closing a valve, bleeding the line, or placing a block in the equipment. Generally, follow this sequence of events:

- Shut down the machine by following the normal method for shutdown.

- Turn off the energy at the main power source.
- Turn the machine switch back on to confirm that the power source has been deactivated.
- Attempt to restart the machine to guarantee that the power is shut off, then return the switch to the off position.

Apply Lockout Devices - Make absolutely sure the power cannot be supplied unless you know about it. If several people will work on a piece of equipment, each must apply his/her own lock. Use a **multiple lockout** device that can accommodate several locks at once. All personal locks shall be accompanied by a tag that identifies the employee(s), is signed and dated by the employee(s) and specifies the work activity being performed. This prevents any accidental startups while another employee may still be working on the machinery.

When all energy sources are locked, inform others of the lockout situation. One way to do this is by applying a tag to the power source. ***Note***: Never use another employee's lock and never lend your lock to another employee.

Safe Release of Stored Energy - Equipment must be at "zero energy state" before servicing or maintenance work can begin. To achieve a zero energy state, release energy by draining valves, releasing springs, bleeding air or hydraulic pressure, or supporting elevated weights. When you are finished, test the machine to ensure that all energy was disconnected or released.

Putting the Power Back On - After servicing is finished, make sure all tools and personnel are removed from the area and replace all machine guards. Only then can you remove your tag and lock and reconnect all sources of energy. You may then restart the equipment in accordance with normal startup procedures.

16.5.5 Training and Inspections

Training - All affected CDM Smith employees must be trained in the purpose and use of lockout and tagout before the effort begins. All authorized CDM Smith employees will be trained in recognition of hazardous energy sources, hazardous energy sources in use, and how to follow the lockout/tagout procedure. CDM Smith will conduct retraining when an audit shows deficiencies with the procedures or at the request of a division or resource manager.

Inspections – When these procedures are applied to a single site for more than a month, an inspection must be done by an authorized employee. This inspection should include questions to determine if employees understand the purpose of lockout/tagout, if proper locks and tags are being used, and if established procedures are being followed. Each inspection should be documented with a Lockout/Tagout Inspection Form found in Exhibit 16-A of this section.

16.5.6 Special Conditions

Other Contractors - Contractors and facility operators should inform each other of their lockout/tagout procedures in enough detail for their employees to recognize the function of locks or tags that they may observe during their work. If CDM Smith finds locks or tags on equipment that is related to neither CDM Smith nor client work, the project manager or site supervisor should notify the client. Work should not proceed until the need, function, and ownership of all locks or tags are clarified. Under no circumstance may CDM Smith employees or subcontractors remove locks or tags not placed by CDM Smith or its subcontractors.

Shift and Personnel Changes - The employees ending their shift should remove their locks before leaving. However, they may only remove their lock if it is safe to operate the equipment or another lock is put in place that is under the control of someone on the next shift. When a piece of equipment will remain unsafe until the employee next returns, that lock may remain in place.

Power Sources that Cannot be Locked Out - When a power source cannot be physically locked out, a tagout may be used without locks.

Plug-Supplied Equipment - Any CDM Smith employee who works on an appliance or device that obtains its power through a flexible cord must apply a plug lockout device to its attachment plug or keep the plug in his or her control throughout that effort.

Exhibit 16-A
Lockout/Tagout Inspection Form

Project Name:________________________________ **Project Number:** ___________________

1. Inspection Conducted by:______________________________ on __________________________
2. Machines/Equipment/Operation Inspected: ____
   ____
3. Names of Employees Observed: ____
   ____
4. Deficiencies Noted: ____
   ____
5. Corrective Action Taken: ____
   ____

		YES	NO
6.	Have employees (contractors) been trained/instructed in our lockout procedure?	_____	_____
7.	Are the lock and/or tag devices authorized by the company procedure?	_____	_____
8.	Are all effected employees (contractors) notified that a lockout is required and the reason for it?	_____	_____
9.	Is equipment being shut down by required shutdown procedure?	_____	_____
10.	Are the switches, valves, or other energy isolating devices disconnected or isolated from the equipment?	_____	_____
11.	Are the energy isolating devices located out/tagged out by an authorized employee's individual lock/tag?	_____	_____
12.	Are the push buttons or other normal operating controls checked to see if the energy sources are disconnected and that the equipment cannot operate?	_____	_____
13.	Upon completion, are equipment areas checked to see that no personnel are in the area and all locks/tags are removed?	_____	_____
14.	If more than one individual is required to lockout equipment, does each person place his/her own personal lock/tag on the energy isolating device(s)? or Are all steps of group lockout/tagout procedures observed?	_____	_____
15.	If an employee or contractor is not available to clear his/her lock/tag, does the supervisor remove the lock/tag after taking all the precautions listed in the lockout/tagout program?	_____	_____

16.6 Compressed Gas Cylinders

CDM Smith employees may occasionally be required to work in industrial, laboratory, or construction work environments where compressed gases are stored or used. In some circumstances, employees may be required to use or handle cylinders directly. Employees that perform work involving compressed gas cylinders should be familiar with their hazards and safe practices.

16.6.1 Identification and Labeling

- All gas cylinders should be clearly labeled with their contents and manufacturer.
  - Do not accept a compressed gas cylinder for use that does not legibly identify its contents by name.
  - Never rely on the color of the cylinder for identification.
- Gas lines leading from a remote compressed gas supply should be labeled to identify the gas, the laboratory or area served, and the relevant emergency telephone numbers.
- Signs should be posted in areas where flammable compressed gases are stored, identifying the substances and appropriate precautions (e.g., HYDROGEN - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES).

16.6.2 Engineering Controls / Design Considerations

- Keep hazardous gas cylinders in gas cylinder cabinets or racks, with the exception of cylinders containing a nontoxic flammable gas and cylinders used in fume hood applications. Those must be firmly braced to prevent falling.
- Place a smoke detector adjacent to flammable gas cylinders, connected if possible to the building alarm system. If possible, interlock smoke detector activation with the shutdown of hazardous gas flow.
- Connect all ducts used to exhaust hazardous compressed gas cylinders or gas-carrying components to a source of exhaust ventilation.
- Place a safety shower or eyewash with a shower wand in areas where corrosive gases are used or stored.
- Make sure that all gas piping is compatible with the gases used and capable of withstanding full cylinder pressure.
- Never lubricate, modify, force, or tamper with a cylinder valve. Use the appropriate regulator on each gas cylinder.
- Use check valves when there is the possibility of backflow into the cylinder.

16.6.3 Using Cylinders

- Always use safety glasses with side shields when handling and using compressed gases, especially when connecting and disconnecting compressed gas regulators and lines.
- Never use a cylinder that cannot be identified positively.
- Never use a cylinder of compressed gas without a pressure-reducing regulator attached to the cylinder valve.
- Use regulators and pressure gauges only with gases and pressure ratings for which they are designed and intended.
- Do not use oil or grease as a lubricant on valves or attachments to oxygen cylinders.
- Never use oxygen as a substitute for compressed air.
- Test cylinders with toxic, corrosive, and pyrophoric gases for possible leaks when receiving, installing, disconnecting, or shipping. Always close the cylinder valve before attempting to stop leaks between the cylinder and regulator.
- Damaged or leaking cylinders should be removed from service and tagged as "DAMAGED or DEFECTIVE."

16.6.4 Storing Cylinders

- Keep cylinders in storage upright, secure, and locked into a compact group.
- Cylinders containing the same gas shall be stored in a segregated group; empty cylinders shall be stored in the same manner.
- Properly secure cylinders with chain, rope, or brackets to prevent falling. Valve protection caps must be fully screwed on unless the container is in active service.
- Protect cylinders stored outside from standing water by providing proper drainage. Where outdoor storage is necessary, an overhead cover is required to avoid rain damage and overheating in sunlight.
- For short-term experiments using hazardous gases, select the smallest cylinder available.
- Return corrosive gas cylinders to the gas supplier within 1 year to avoid regulator and cylinder valve problems due to corrosion.
- Some small cylinders, such as lecture bottles and cylinders of highly toxic gases, are not fitted with rupture devices and may explode if exposed to high temperatures. Use and store these with great care.
- Never place cylinders where they may become part of an electric circuit.

- Avoid areas that are damp or subject to other corrosive materials.
- Do not store flammables, toxic gases, and oxidizers adjacent to each other. Store cylinders in well ventilated locations.
- Areas containing hazardous gas in storage must be appropriately placarded.
- Cylinders in storage must be separated from flammable or combustible liquids and from easily ignitable materials (such as wood, paper, packaging materials, oil, and grease) by at least 40 feet (12 meters) or by fire-resistant partition having at least a 1-hour rating.
- Maintain at least a 20-foot separation between fuel and oxygen cylinders, or install a firewall a minimum of 5 feet high with a 30-minute fire rating.
- Empty cylinders must be closed and the valve cap secured. They must be clearly tagged or marked as MT or EMPTY.

16.6.5 Transporting Cylinders

- Never transport a cylinder with a regulator attached.
- Cylinders larger than lecture-bottle size should be chained or strapped to a wheeled cart during transport to ensure stability.
- Only trained personnel using approved trucks may transport cylinders.
- To protect the valve during transportation, the cover cap should be screwed on hand tight and remain on until the cylinder is in place and ready for use.
- Handle only one cylinder at a time.
- Secure cylinders in a basket or similar device when moving them using a crane or derrick. Do not use slings, ropes, or electromagnets for lifting cylinders. Do not allow cylinders to strike each other.

16.6.6 Piping Incompatibilities and Restrictions

- Do not use copper piping for acetylene.
- Do not use plastic piping in any portion of a high-pressure system.
- Do not use cast iron pipe for chlorine.
- Do not conceal distribution lines where a high concentration of a leaking hazardous gas can build up and cause an accident.
- Distribution lines and their outlets must be clearly labeled as to the type of gas contained.

- Piping systems should be inspected for leaks on a regular basis, preferably weekly. Special attention should be given to fittings.

16.6.7 Emergency Procedures

- Do not remove leaking cylinders from their ventilated enclosures until the leakage has stopped.
- Trip the remote emergency gas shutoff valve/button, if present.
- Close the main cylinder valve to stop or slow the leak. The hazardous gases should be contained in their enclosure until it is clearly safe to approach.
- Do not extinguish a flame involving a combustible gas until the source of gas has been shut off.

16.6.8 Training

Employees that handle or use compressed gases need the following training:

- Safe handling practices for hazardous substances contained in gas cylinders: corrosive, explosive, toxic, etc.
- Identification and signs
- Storage and transportation requirements
- Emergency procedures

16.7 Fall Protection

CDM Smith employees who visit active construction sites may be exposed to falls. A fall exposure is considered to exist when an employee is within 6 lateral feet of a change in elevation of 6 vertical feet or more. Typical exposures can include:

- Excavations
- Roofs
- Leading edge of a surface (floor)
- Floor openings

All employees should use fall protection 100 percent of the time when exposed to a fall in excess of 6 feet or when required by rules such as those of a client or the owner or operator of a facility. Fall protection may consist of any of the following:

- Guardrails
- Safety nets
- Positioning systems
- Warning systems
- Personal fall arrest systems

Employees should not use fall arrest equipment until they have been properly trained. Fall protection training can be arranged by contacting your division HSM. Project managers and site managers shall ensure fall protection is available and used as required for all employees for whom they are responsible and that employees receive adequate training in the use of the equipment.

The following work practices and guidelines should be considered for protection against falls:

- Before working or walking on a surface, consider the strength and structural integrity of the surface. Can it support employees and any needed equipment or material safely? Employees shall work on those surfaces only when the surfaces have the requisite strength and structural integrity.

- When not protected by any other means of fall protection, such as safety nets or scaffold with proper guardrails, employees shall use full body harnesses, lanyards with double-locking snap hooks, and an adequate anchorage (fall arrest equipment). To achieve 100 percent fall protection, employees may need to use a two-lanyard system and/or vertical or horizontal lifelines, retractable lifelines, or other approved positioning devices.

- Employees shall rig fall arrest equipment so that it minimizes the potential for a fall arrest event or any potential free-fall, lateral swing, or contact with any lower object. Under no circumstances shall fall arrest equipment be rigged so that an employee can free-fall more than 6 feet.

- Anchorage points for fall arrest equipment shall be capable of supporting 5,000 pounds per employee attached. Anchorage points for fall arrest equipment shall be located above the employee's body harness attachment point where practical.

- When vertical lifelines are used, a separate lifeline shall protect each employee. The lifeline shall be properly weighted at the bottom and terminated to preclude a device such as a rope grab from falling off the line.

- Horizontal lifelines should be limited to two persons at one time between supports and maintain a safety factor (strength/requirement) of at least 2.

- Before each use, employees shall visually inspect all fall arrest equipment for cuts, cracks, tears or abrasions, undue stretching, overall deterioration, mildew, operational defects, heat damage, or acid or other corrosion. Equipment showing any defect shall be withdrawn from service. All fall arrest equipment subjected to impacts caused by a free-fall or by testing shall be removed from service. CDM Smith personnel shall use full body harnesses for personal fall protection. Fall protection equipment is available from the field equipment centers.

- Fall arrest equipment should be stored in a cool dry place not subjected to direct sunlight.

- Fall arrest equipment shall not be used for any other purpose, such as towropes or hoist lines.

- Proper guardrails shall be installed on open sides of all walkways and runways where the fall distance exceeds 4 feet. Proper guardrails shall be installed on open sided floors where the fall distance exceeds 6 feet. All floor openings or floor holes shall be protected by guardrails or hole covers. If hole covers are used, they shall be strong enough to support the maximum intended load, secured against displacement, and properly labeled.

- When guardrails are used for fall protection, they shall consist of a top rail, intermediate rail, and toeboard. The top rail shall have a vertical height of 42 inches, the midrail shall be at 21 inches, and the toeboard 4 inches. When wood railings are used, the post shall be of at least 2-inch by 4-inch stock spaced not to exceed 8 feet, the top rail shall be of at least 2-inch by 4-inch stock, and the intermediate rail shall be of at least 1-inch by 6-inch stock. If pipe is used, it shall be at least 1½-inch nominal diameter. If structural steel is used, it shall be of 2-inch by 2-inch by 3/8-inch angles or equivalent. If wire rope is used for railings, it shall have a diameter of at least 2 inches and shall be stretched taut to allow no more than a 3-inch deflection.

- When operating a scissor-lift work platform, the lift shall have guardrails on all open sides, with the door access chains or rails in place.

- Employees operating aerial lifts shall wear a body harness and lanyard attached to the aerial lift. Employees shall not attach the lanyard to an independent structure.

- Employees riding in a crane-suspended work platform shall wear a body harness and lanyard attached to the grab rail of the platform.
- Employees working on or near wall forms or rebar shall wear a body harness lanyard and/or positioning device when exposed to a fall in excess of 6 feet.
- Positioning devices shall be rigged to prevent a free-fall greater than 24 inches.
- Stairs, ladders, or ramps shall be provided for all access ways where there is a change in elevation greater than 19 inches.
- Manila or synthetic rope shall not be used as guardrails.
- Employees shall not stand or sit on guardrails.
- Personal fall arrest systems shall not be attached to guardrail systems.
- If warning lines are used, they should consist of rope, wire, or chain and be flagged at intervals of 6 feet or less with high-visibility material. The lowest point should be no less and 34 inches from the surface, and the highest point should be no more than 39 inches. The warning line should be placed at least 6 feet from the edge.
- Safety net systems should be installed as close to the working surface as practical, but in no case more than 25 feet below the working surface and should extend outward at least 8 to 13 feet depending on the vertical fall distance. Safety nets should be drop-tested after initial installation and at 6-month intervals. The maximum size of net mesh should not exceed 36 square inches nor be longer than 6 inches on any side. Mesh opening should be secure to prevent enlargement.
- Body belts should not be used for personal fall arrest. Full body harnesses are required.

16.12 Tools and Power Equipment

16.12.1 Hand Tools

CDM Smith employees who have a need to use basic hand tools should use the following work practices:

- All tools used on CDM Smith projects, regardless of ownership, shall be of an approved type and maintained in good condition. Tools are subject to inspection at any time. The project manager has the authority and responsibility to condemn unserviceable tools, regardless of ownership.
- Tag defective tools to prevent their use or removal from the job site.
- Use the proper tool for the job performed.
- Do not use hammers with metal handles, screwdrivers, knives with metal continuing through the handle, and metallic measuring tapes on or near energized electrical circuits or equipment.
- Do not throw tools from place to place or from person to person. Tools that must be raised or lowered from one elevation to another shall be placed in tool buckets or firmly attached to hand lines.
- Do not place tools unsecured on elevated places.
- Dress, repair, or replace all impact tools such as chisels, punches, drift pins, etc., that become mushroomed or cracked before further use.
- Use suitable holders or tongs, not the hands, to hold chisels, drills, punches, ground rods, or pipes that are struck by another employee.
- Do not use shims to make a wrench fit.
- Do not use wrenches with sprung or damaged jaws.
- Do not use pipe or other means to extend a wrench handle for added leverage unless the wrench was designed for such use.
- Use tools only for the purposes for which they have been designed.
- Store and handle tools with sharp edges so that they will not cause injury or damage. They shall not be carried in pockets.
- Use eye protection when using or working around impact type tools (e.g., hammer, chisel, ax, hatchet, etc.).
- Replace wooden handles that are loose, cracked, or splintered. The handle shall not be taped, glued, or lashed with wire.

- Keep all cutting tools such as saws, wood chisels, knives, or axes in suitable guards or in special compartments.

- When using such tools as screwdrivers and wrenches, avoid using your wrists in a bent, flexed, extended, or twisted position for long periods of time. Employees should maintain their wrists in a neutral or straight position.

- Do not leave tools lying around where they may cause a person to trip or stumble.

- When working on or above open grating, use a canvas or other suitable covering to cover the grating to prevent tools or parts from dropping to a lower level where others are present, or barricade or guard the danger area.

- Do not depend on the insulation on hand tools to protect users from shock.

16.12.2 Electric Tools

CDM Smith employees who have a need to use electric power tools should use the following work practices:

- The non-current carrying metal parts of portable electric tools such as drills, saws, and grinders shall be effectively grounded when connected to a power source unless the tool is an approved double-insulated type or the tool is connected to the power supply by means of an isolating transformer or other isolated power supply, such as a 24-volt DC system.

- All power tools shall be examined before use to ensure general serviceability and the presence of all applicable safety devices. The electric cord and components shall be given a thorough examination for cracks, exposed wires, or other defects.

- Power tools shall be used only within their capability and shall be operated in accordance with the manufacturers' instructions.

- The use of eye protection is required when using or working around power tools.

- Operators should take care to use appropriate hand positions on cutting tools such as saws, drills, or grinders to avoid hand injury.

- All tools shall be kept in good repair and disconnected from the power source while repairs are being made.

- Electrical tools shall not be used where there is a hazard of flammable vapors, gases, or dusts until that hazard is firmly under control.

- GFCI should be used with all electric power tools.

- All guards and safety interlocks with which the tools were purchased shall be in place and in working order.

- Any tool that is identified as defective should be tagged "not for use," and set aside for repair and/or discarded.
- Do not wear loose or frayed clothing while operating power tools and equipment. Hair should not stick out from hard hats.
- Do not use electrical cords to transport, suspend, hoist, or lower tools.
- Do not allow power cords to lie in water.
- Disconnect rotating tools from the power source before adjusting, servicing, or cleaning them. Follow the lockout procedure described in Section 16.5.
- Do not modify tools.

16.12.3 Pneumatic Tools

CDM Smith employees that use pneumatic power tools should use the following work practices:

- Compressed air and compressed air tools shall be used with caution.
- Pneumatic tools shall never be pointed at another person.
- Pneumatic hose connections should be secured by some positive means to prevent them from becoming accidentally disconnected. Chicago fittings have wire holes to allow such security.
- Pneumatic power tools shall be secured to the hose by some positive means to prevent the tool from becoming accidentally disconnected.
- Safety clips or retainers shall be securely installed and maintained on pneumatic impact tools to prevent attachments from being accidentally expelled.
- Compressed air shall not be used for cleaning purposes except when reduced to less than 30 psi and then only with effective chip guarding and PPE.
- Compressed air shall not be used to blow dust or dirt from clothing (or skin).
- The manufacturer's safe operating pressure for hoses, pipes, valves, filters, and other fittings shall not be exceeded.
- The use of hoses for hoisting or lowering tools shall not be permitted.
- All compressed air hoses exceeding 30 psi shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure or disengagement of a connection.

- Before making adjustments or changing air tools, the air shall be shut off at the air supply valve ahead of the hose. The hose shall be bled at the tool before breaking the connection. Disconnection at the quick-change connectors is one way to meet this goal.
- Eye protection is required when using or working around pneumatic tools.
- Use hearing protection if noise exposure is a concern (i.e., if it is too loud to conduct a normal conversation).
- Pneumatic tools shall be operated only by persons trained in their use.
- A pneumatic tool used where it may contact exposed live electrical parts shall have a nonconductive hose and an accumulator to collect moisture.
- Employees shall not use any part of their bodies to locate or attempt to stop an air leak.
- All guards and safety interlocks must be in place and functional.

16.12.4 Engine-Powered Tools

CDM Smith employees that use engine-powered tools should use the following work practices:

- Stop the engine and allow it to cool before refueling, servicing, or maintenance.
- Use care in refueling. Clean up any small spills of fuel or oil immediately.
- The use of eye protection is required when using or working around engine-powered tools.
- Use hearing protection if noise exposure is a concern (i.e., if it is too loud to conduct a normal conversation).
- If possible, disconnect the spark plug before performing an adjustment, maintenance, or service.
- Use tools in well ventilated areas to eliminate any accumulation of fumes.
- Do not use tools in a flammable or explosive atmosphere.
- Equip engines with spark-arresting mufflers.
- Avoid contact with hot engine components.
- All guards and safety interlocks should be in place and functional.

16.14 Cold Stress

Persons working outdoors in low temperatures, especially below freezing, or in wet or snowy weather are potentially subject to cold stress disorders. Factors that contribute to cold stress exposure include temperature, humidity, wind, sunlight, rain, snow, fog, exposure duration, clothing, and work activity. Individual susceptibility to cold stress disorders can vary widely. Individual physical factors that can affect a person's response to cold work environments include a person's general fitness and age.

The following guidelines should be considered when working in ambient air temperatures below 40°F, especially when other contributing weather conditions such as snow, rain, or wind are present.

16.14.1 Hazards Associated with Cold Stress

Hypothermia – Hypothermia results from a cooling of the body's core temperature and if left unattended can become a serious condition. Hypothermia can result in the loss of physical skills and impair judgment thereby contributing to the potential for other accidents. Severe hypothermia can result in death. Hypothermia can occur at temperatures above freezing as well as below.

- Symptoms include shivering, teeth chattering, fumbling hands, slurred speech, and loss of coordination. Eventually, the pulse and respiratory rate may slow. The victim may appear blue or lose color in the face.

- Treatment for hypothermia is to catch symptoms early and move the individual to a warm environment indoors or in a vehicle. If a warm location is not immediately available, the victim should be sheltered from the wind and provided extra clothing such as coats or blankets and observed to determine if their condition is improving. If the victim continues to deteriorate and becomes colder, they should be transported to a medical facility for assistance.

Frostbite – Frostbite is a condition in which the fluids around cells of body tissue freeze. The condition can lead to body tissue damage. The most vulnerable parts of the body are the nose, ears, cheeks, fingers, and toes.

- Symptoms of frostbite include body parts becoming white, firm, cold to the touch, and may feel waxy. The victim will not feel pain in the affected area.

- Treatment of frostbite requires that the victim be brought to a warm environment and the affected areas be allowed to thaw and warm. If frostbite has progressed beyond small patches of skin and affects whole body parts such as a hand, foot, or ear, the victim should be transported to a medical facility for treatment and observation.

16.14.2 Cold Stress Monitoring

Personnel should monitor themselves and each other for signs and symptoms of frostbite and/or hypothermia. If symptoms are observed in an employee or subcontractor, steps should be taken to treat the symptoms by having the individual go to a warm environment either in a nearby structure or vehicle.

16.14.3 Cold Stress Control and Prevention

Cold stress can easily be prevented with proper planning and prevention. Some basic controls and preventative measures are listed below:

- Forecasted conditions. Consider the effect of wind chill (Table 16-2 on next page).
- Dress in layers and stay dry. Avoid cotton clothing such as socks or T-shirts. Bring extra clothing.
- Wear hardhat liners and gloves. Wear rain gear in rain and snow.
- Curtail work if extreme weather conditions such as a blizzard, extreme wind chill (e.g., less than 0°F), torrential cold rains, or wind is expected.
- For long-term projects in cold environments, consider setting temporary structures with portable heaters.
- Take warming breaks as needed.
- Avoid beverages with caffeine, alcohol, or medications that restrict blood flow.
- Drink warm noncaffeine beverages such as hot chocolate or soups on breaks.

Table 16-2
Windchill Index

WINDCHILL INDEX	***Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature (under calm conditions)***											
Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
Wind speeds greater than 40 mph have little additional effect	**LITTLE DANGER** in < hour with dry skin. Maximum danger of false sense of security.				**INCREASING DANGER** Danger from freezing of exposed flesh within 1 minute.			**GREAT DANGER** Flesh may freeze within 30 seconds.				
	From *Fundamentals of Industrial Hygiene,* Third Edition. Plog, B.A., Benjamin, G. S., Kerwin, M.A., National Safety Council, 1988.											

16.15 Working Around Heavy Equipment

Good work practices while working around heavy equipment include:

- Assume the operator cannot see you. The operator's vision may be blocked by blind spots. He or she is frequently concentrating on their work and equipment and may not notice a site visitor.
- If you must approach the operator, be sure you have made eye contact with the operator and they know you will be approaching them before approaching the equipment. Verbal contact, direct or by radio, is even better. Do not approach if the equipment is moving or in operation.
- Stay clear of pinch points and swing areas of equipment. At CDM Smith projects, these areas should be taped or barricaded off; however, when equipment moves frequently, you cannot count on other organizations to mark these zones.
- Do not walk near a moving piece of equipment. It could turn or rotate any minute. Modern construction equipment moves fast and in any direction.
- On a noisy site, you may not notice the equipment's back-up alarm. Keep aware of what is happening around you.
- Never walk under a load on a crane or hoist. Indeed, avoid the area under the hook or bucket.
- Do not cut across the path of equipment backing up.
- Wear your hardhat and safety glasses. The safety glasses protect your eyes from dust and debris and the hardhat provides protection for your head and makes you more visible on the site.
- On sites where there is frequent vehicle or construction equipment movement, wear high-visibility clothing.
- Maintain a clearance of at least 10 feet between any part of the machine or its load and any electrical line or apparatus carrying up to 50,000 volts. One foot of additional clearance is required for every additional 30,000 volts.

16.17 Flammable and Combustible Liquids

Work with flammable or combustible liquids exposes the employees to fire, explosion, and toxicity hazards. They should implement the following controls.

16.17.1 Storage and Handling

- Only approved containers and portable tanks should be used for the storage and handling of flammable and combustible liquids.
  - B Approved safety cans shall be used for the handling and use of flammable liquids in quantities greater than 1 gallon.
  - B For quantities of 1 gallon or less, only the original container or approved safety cans shall be used for storage, use, and handling of flammable/combustible liquids.
  - B The requirements for shipping these liquids exceeds those described here. If flammable or combustible liquids must be shipped, the individual offering the material for shipment must have completed DOT Hazardous Material Training. Contact your HSM for information on DOT training.
- Flammable or combustible liquids shall not be stored near exits, stairways, or pathways that people normally use for safe passage.
- No more than 25 gallons of flammable/combustible liquids shall be stored in a room outside of a storage cabinet or tank approved for the purpose.
- Quantities of flammable and combustible liquids in excess of 25 gallons shall be stored in an acceptable or approved cabinet meeting the requirements of 29 CFR 1926.152(b)(2)(i).
- Cabinets shall be labeled in conspicuous lettering, "Flammable - Keep Fire Away."
- Not more than 60 gallons of flammable or 120 gallons of combustible liquids shall be stored in any one storage cabinet. Not more than three cabinets may be located in a single storage area.

16.17.2 Outdoor Storage

- For storage of flammable and combustible liquids outdoors, containers (not more than 60 gallons each) shall not exceed 1,100 gallons in any one pile or area. Five feet of clearance shall separate piles or groups of containers. These containers shall remain at least 20 feet from any other building or structure.
- Within 200 feet of each pile of containers, there shall be a 12-foot wide access way to permit approach of fire control apparatus.

- The storage area shall be graded in a manner to divert possible spills away from buildings or other exposures, or shall be surrounded by a curb or earth dike at least 12 inches high. Provisions shall be made for the controlled draining of accumulations of groundwater or rainwater, or spills of flammable or combustible liquids when curbs or dikes are used.

- At least one portable fire extinguisher, having a rating of not less than 20 pounds, shall be located not less than 25 feet or more than 75 feet from any flammable or combustible liquid storage area located outdoors.

- Precautions shall be taken to prevent the ignition of flammable/combustible vapors. Sources of ignition include, but are not limited to: open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical, and mechanical sparks; spontaneous ignition, including heat-producing chemical reactions; and radiant heat.

16.17.3 Dispensing Flammable and Combustible Liquids

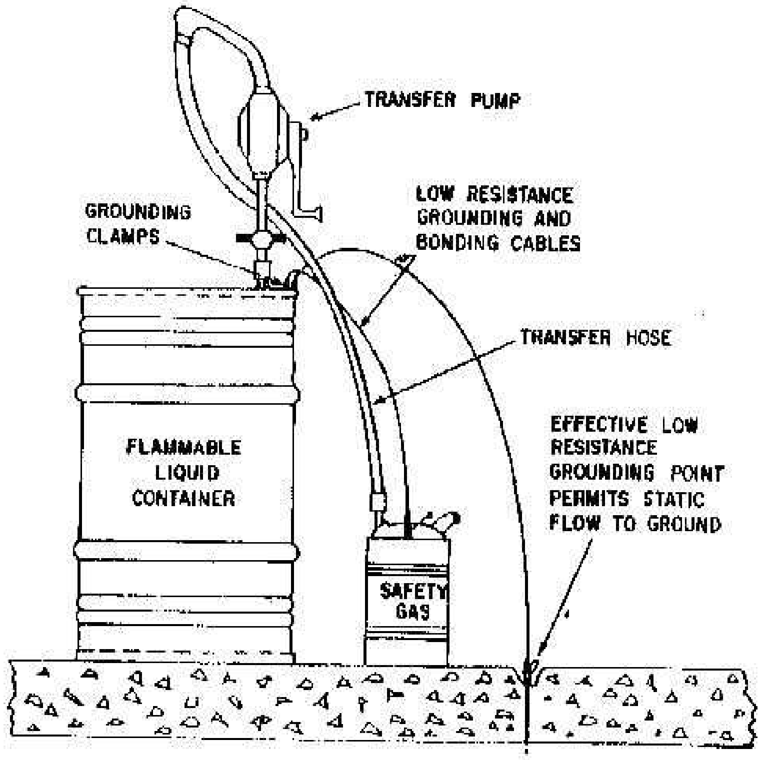
- Areas where flammable or combustible liquids are dispensed at one time, in quantities greater than 5 gallons from one tank or container to another tank or container, shall be separated from other operations by a distance of 25 feet or by construction having a fire resistance of at least 1 hour. Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable/combustible vapor at or below 10 percent of the LEL.

- Static electricity is generated by the contact and separation of dissimilar material, such as when fluid flows through a pipe or from an orifice into a tank. If the accumulation of static charge is sufficient, a static spark may occur. Transfer of flammable/combustible liquids from one container to another should be done only when containers are electrically bonded and grounded to prevent such accumulation of static charge (Figure 16-3).

- The management of flammable and combustible liquids is much more complicated than is indicated by the length of this section, which reviews only those issues appropriate to the incidental use of these materials.

- Storage and handling of the mobile and combustible liquids should comply with the requirements of National Fire Code No. 30 (see http://www.nfpa.org/Codes/NFPA_Codes_and_Standards/List_of_NFPA_documents/NFPA_30.asp – you will need a password from the CDM Smith Infocenter).

Figure 16-1
Typical Grounding System



16.20 Hazardous Waste Site Controls

Work sites designated as hazardous waste sites must control access to the work area to only authorized personnel and conform to general work practices expected at hazardous waste site operations as required by the OSHA Standard for Hazardous Waste Operations, 29 CFR 1910.120. The following concepts should be reflected in the HSP for the project.

16.20.1 Access Control

Controlled access to hazardous waste site work areas is required to protect personnel working on the site as well as to limit the potential for transporting contaminants off site. Depending on the size of the work site, hazards and contaminants present, and complexity of the work, access control may range from verbally cautioning nonauthorized personnel to stay away from the work area, to a program including site security, signs, or formal sign-in and sign-out procedures. Details of site-specific access control procedures should be included in the site-specific HSP. Some general work practices for access control are noted below:

For small-scale site investigations that are short-term projects (i.e., days, not weeks or months), identify a work area to the work crew and keep persons not associated with the job site out of the work area. If the site is in an area where nonauthorized persons are likely to be encountered, traffic cones, caution tape, and signs identifying the area as a controlled access area may be used.

For more extensive projects where work may be done for weeks or longer, the team should deploy more extensive access controls. They should:

- Set up physical barriers and hire security personnel to prevent nonauthorized persons from entering the work site.
- Keep the number of personnel and equipment on site to the minimum required to do the project effectively and safely.
- Establish work zones within the site (Section 16.20.2).
- Establish controlled access points to be used by authorized personnel.
- Track the entry and exit of personnel through a check-in, checkout system.
- Establish a formal decontamination corridor from exclusion zones.

16.20.2 Work Zones

Field project managers working under HSPs for hazardous waste operations are required to establish work zones to prevent or reduce the spread of site contaminants to noncontaminated areas on or off site. Movement between zones should be restricted to those that need access to a specific area, and entry and exit between zones should be through designated access control points. A description of the three work-zone system for hazardous wastes is provided below.

Exclusion Zone – The exclusion zone should include any area where contamination is known or suspected. Areas of air, water, or soil that are contaminated with hazardous materials (biohazards, radioactive materials, chemicals) should be included in the exclusion zone. The zone should be well known to site workers. On smaller projects, this can be a verbal identification to site workers, such as "a 20-foot radius around the drill rig." On larger projects, or in areas that may be encountered by observers or the general public, the zone may need to be defined with caution tape, traffic cones, or in some instances, fencing and barriers. The need will be site-specific and the specific method should be identified in the site-specific HSP. Some work practices that should be followed in the exclusion zone include:

- Employees in the exclusion zone must wear the PPE designated in the site HSP for tasks executed within the zone.
- No eating, drinking, chewing gum or tobacco, smoking, application of cosmetics, including application of lip balm, sunscreen, or insect repellant is allowed in the exclusion zone.
- Sitting or kneeling in areas of high concentrations of contaminants should be avoided.
- If any PPE becomes defective, the employee should leave the work area via the designated egress area, decontaminate as needed, and replace the defective PPE before returning to work in the exclusion zone.
- Prescription drugs should not be used within the exclusion zone unless approved by CDM Smith's medical consultant. The use of illegal drugs or consumption of alcohol is prohibited.
- When leaving the exclusion zone, employees should exit via the designated access/ egress point(s) and follow decontamination procedures described in the site HSP.

Contaminant Reduction Zone – A contaminant reduction zone (CRZ) is established to provide a transition between the exclusion zone and the support zone. The CRZ is set up at the access control points of the exclusion zone and will vary in size depending on the complexity of activities that need to occur within the zone. For small site investigations, the CRZ may simply be a designated area near containers set up to collect used disposable PPE and some soap and water. For larger projects, the CRZ may include specific decontamination points and be staffed by personnel specifically designated to participate in the decontamination of personnel and equipment exiting the exclusion zone. Depending on the site contaminants, level of contamination, and decontamination procedures, personnel in the CRZ may be required to wear protective clothing, gloves, or respirators. The specific requirements will be outlined in the site HSP. The CRZ should be placed in an area that is not contaminated at the boundary of the exclusion zone.

Support Zone – The support zone is established near the entrance to the site and is far enough from the exclusion zone and CRZ that specialized protective clothing or respirators are not used. The use of normal field PPE such as hard hats, safety glasses, and safety work boots is expected except for areas such as office trailers, break and lunch areas, or other areas designated as having no known or anticipated hazards. Operational support activities and equipment storage and maintenance areas are located in the support zone. No equipment or personnel should go from the exclusion zone to the support zone without passing through the CRZ and being decontaminated in accordance with the site HSP.

Mobile Work Zone – For those projects that involve brief periods of work in multiple locations, a specific area may be designated as the exclusion zone for the duration of the work performed in that area. The exclusion zone can be terminated (provided there are no ongoing hazards or potential exposures to contaminants) and moved to the next area of work. For example, during soil borings or well installation, the exclusion zone can be defined as, "1.5 times the mast height" of the drill rig. Once the boring has been closed, or well installed and secured, and all drill cuttings have been secured, the area can be opened up and a new exclusion zone established around the next boring location.

16.20.3 Considerations when Establishing Work Zones

Work zones should be large enough to perform tasks within the zone safely, with no exposure to hazards to personnel outside the zone, but they should also be small enough to be able to secure and control access. Some considerations in establishing work zones include:

- Physical and topographical features of the site
- Dimensions of the contaminated area
- Weather
- Physical, chemical, and toxicological characteristics of contaminants and chemicals used in the zone
- Potential for exposure to site contaminants
- Known and estimated concentrations of contaminants
- Air dispersion of contaminants
- Fire and explosion potential
- Planned operations and space needed to perform the work safely
- Surrounding areas
- Decontamination procedures
- History of job site

16.20.4 General Hazardous Waste Site Work Practices

- **Buddy System** - Work should be scheduled so that no person works unobserved within the exclusion zone at any time. Each worker within the exclusion zone should maintain visual contact with at least one other worker on the site. All site personnel should remain aware of each other and monitor each other's condition.

- **Eating, drinking, chewing gum or tobacco, and smoking** are prohibited within the contaminant reduction and exclusion zones. (**Exception for heat stress:** Squirt bottles of water, Gatorade, or other fluids may be consumed via squirt bottles in the contaminant reduction zone with the approval of the HSM. Open bottles, cups, etc. should not be permitted.)

- Sitting or kneeling should be avoided in areas of known or suspected areas of contamination.

- Hands and face should be thoroughly washed when leaving the work area.

- Defective PPE should be repaired or replaced immediately.

Sections 5, 6, 7, 9, and 11 of this manual are particularly applicable to H&S at hazardous waste sites.

16.21 Decontamination at Hazardous Waste Sites

Proper decontamination helps protect employees and prevents the contamination of uncontaminated areas. Decontamination protects all site personnel by minimizing the transfer of harmful materials into clean areas. It helps prevent mixing of incompatible chemicals and protects the community by preventing uncontrolled transportation of contaminants from the site.

16.21.1 Prevention of Contamination

To prevent contamination, crew members should:

- Follow procedures for proper dressing before entry into the exclusion zone. Proper dressing will minimize the potential for contaminants to bypass the PPE and escape decontamination.
- Protect monitoring and sampling instruments by bagging. Make openings in the bags for sample ports and sensors that must contact site materials, or cover equipment and tools with a strippable coating, which can be removed during decontamination.
- Encase any source of contaminants on the site with barriers (e.g., plastic sheeting or over packs).
- Stress work practices that minimize contact with hazardous substances. Use remote sampling, handling, and container-opening techniques.

16.21.2 Decontamination Equipment Selection

In selecting decontamination equipment, consider whether the equipment must be decontaminated for reuse or can be easily disposed. Recommended equipment for decontamination includes:

- Storage tanks or appropriate treatment systems
- Drains or pumps
- Long-handled brushes
- Wash solutions appropriate for the contaminants present
- Rinse solutions appropriate for the contaminants present
- Pressurized sprayers for washing and rinsing
- Curtains, enclosures, or spray booths
- Long-handled rods and shovels
- Containers to hold contaminants and contaminated soils
- Wash and rinse buckets
- Brooms
- Containers for the storage and disposal of contaminated material

16.21.3 Decontamination Design

Decontamination facilities should be located in the CRZ, i.e., the area between the exclusion zone (the contaminated area) and the support zone (the clean area), and described in the site HSP.

- Site-specific factors that affect the decontamination facility design must be considered. Typical factors include:
  - The chemical, physical, and toxicological properties of the wastes
  - The pathogenicity of infectious wastes
  - The amount, location, and containment of contaminants
  - The potential for and location of exposure based on assigned worker duties, activities, and functions
  - The potential for wastes to permeate, degrade, or penetrate materials used for personal protective clothing and equipment, vehicles, tools, buildings, and structures
  - The proximity of incompatible wastes
  - The movement of personnel and/or equipment among different zones
  - The emergencies that may arise
  - The methods available for protecting workers during decontamination
  - The impact of the decontamination process and compounds on worker H&S

- Decontamination Line
  - Decontamination should be an organized process by which levels of contamination are reduced.
  - The decontamination process consists of a series of steps performed in a specific sequence. For example, outer, more heavily contaminated items are decontaminated first, followed by the decontamination and removal of inner, less contaminated items.
  - Each step should be performed at separate stations to prevent cross contamination.
  - Decontamination stations should allow enough separation to prevent cross contamination and should be arranged in order of decreasing contamination.
  - Separate decontamination areas should be provided to isolate workers from different contamination zones containing incompatible wastes or decontamination processes.
  - Entry and exit points should be conspicuously marked. Preferably the entry to the CRZ from the exclusion zone should be separate from the entry to the exclusion zone from the CRZ.
  - Dress-out stations for entry to the CRZ should be separate from redressing areas for exit from the CRZ.
  - Personnel who wish to enter clean areas of the decontamination facility, such as locker rooms, must be appropriately decontaminated first.
  - Examples of decontamination lines and procedures for personnel wearing various levels of protection are provided in Exhibits 16A and B.

16.21.4 PPE for Decontamination Workers

A rule of thumb is that decontamination workers wear a level of protection one level below the level of protection worn in the exclusion zone. However, consideration should be given to the following when determining the level of protection for a given project.

- The nature of site contamination
- Degree of contamination expected on workers leaving the exclusion zone
- The results of wipe tests and onsite air monitoring

Some site-specific cases may require that decontamination personnel wear the same level of PPE as workers in the exclusion zone. Cases include:

- Workers using a steam jet may need a different type of respiratory protection than other decontamination personnel because of the high moisture content of the steam jets.

- Cleaning solutions used and wastes removed during decontamination may generate harmful vapors, requiring a different type of respiratory or clothing protection.

16.21.5 Decontamination Methods

All personnel, clothing, equipment, and samples leaving the contaminated area of a site should be decontaminated to remove any harmful chemicals, radioactive material, or infectious organisms that may have adhered to them. The extent of decontamination will vary depending on the nature of site activity, site contamination, and other factors.

- Decontamination methods available include:
  - Physical removal
  - Chemical detoxification or disinfections/sterilization
  - A combination of both physical and chemical methods

- The selected decontamination method should be reviewed for any safety and health hazards. If the selected method poses a direct health hazard, measures shall be taken to protect both the decontamination personnel and the workers to be decontaminated.

- Physical Removal
  - Physical methods using high pressure and/or heat should be used with caution.
  - Loose contaminants can be removed by using a soap and water rinse with a soft bristle brush to remove dust and vapors that cling to equipment and workers, or that are trapped in small openings, such as clothing or fabric weaving.

- Adhering contaminants can be removed by:
  - Scraping, brushing, and wiping.
  - Solidifying.
  - Freezing (using dry ice or ice water).
  - Adsorption or absorption (e.g., kitty litter or powdered lime).
  - Melting.

  - Volatile liquid contaminants can be removed from PPE or equipment by evaporation followed by a water rinse. Evaporation may be expedited by the use of steam jets.

- Chemical Removal

  - Decontamination using chemicals should only be done if recommended by an industrial hygienist or other qualified professional.
  - Any chemical used in the decontamination process must be chemically compatible with the equipment or clothing being decontaminated.
  - Halogenated solvents should only be used for decontamination in extreme cases where other cleaning agents will not remove the contaminant.

- Chemical removal types include the following:

  - Surface contaminants can be dissolved in a solvent.
  - Solidification of liquid or gel contaminants can enhance their physical removal. Typical solidification processes are moisture removal using adsorbents such as grounded clay or powdered lime; and chemical reactions using polymerization chemicals and/or chemical reagents.

16.21.6 Personnel Decontamination

Different levels of personnel protection, as discussed in the PPE guidelines, may be used at any given site. The following is a description of the decontamination process for each level of protection.

- **Level D**

  - An area should be designated for the gross removal of dirt and mud from gloves and boot covers. Paper towels and buckets of rinse water can be made available for this purpose.
  - Typical decontamination steps for Level D operations are provided in Exhibit 16-B.
  - Soap and water should be used to wash hands and face before leaving the site.
  - Laundering of personal clothing should be completed as soon as possible once offsite.

- **Level C and B**

  - A decontamination line should be established.
  - Site-specific procedures should be outlined in the site HSP. The recommended procedure for this layout is listed in Exhibit 16-C.

- **Level A** - It is not anticipated CDM Smith will directly participate in Level A operations. If required, site-specific procedures will be developed in coordination with the division HSM.

16.21.7 Sampling and Monitoring Equipment Decontamination

Sampling equipment often becomes grossly contaminated. Often trowels or drum thieves (coliwassas) are dedicated to a particular site. These should be left in the exclusion zone and disposed of as contaminated waste at the end of site work. Sampling equipment such as split spoons or other equipment that is used to collect several samples must be cleaned and decontaminated between samples to prevent cross contamination. These items should be cleaned and decontaminated in accordance with the project operations or sampling plan. Dirt and wash solutions from sampling equipment decontamination should be collected and disposed of as investigation-derived waste.

Once grossly contaminated, testing and monitoring instrumentation can be difficult to decontaminate without causing damage to the instrument. Care should be taken in the field to prevent gross contamination of field instruments by avoiding direct contact between the instrument and contaminated soils, water, or surfaces. In some cases it may be necessary to place instruments in plastic bags, leaving small openings for sampling ports, detectors, and exhaust ports. The plastic bags can then be removed as the instrument comes out of the exclusion zone. The outside of instruments can be wiped down with paper towels or brushed off with clean soft brushes.

16.21.8 Heavy Equipment Decontamination

Drill rigs, trucks, backhoes, and other heavy equipment can be difficult to decontaminate. The method generally used is to wash them with water under pressure and scrub accessible areas with soap and warm water. Hot water and steam systems can be effective but may increase air concentrations of contaminants, exposing decontamination workers. Particular care should be taken where equipment comes into direct contact with contaminated soils such as tires, buckets, or treads. In severe cases, tires may need to be replaced or parts sand blasted clean or disposed of. Equipment should be visually inspected to be sure it is free of any visible signs of contamination. In some cases, wipe tests or other methods may be needed to confirm equipment has been adequately decontaminated before leaving the site.

16.21.9 Decontamination Solutions, Disposable PPE, and Site Wastes

Potentially contaminated equipment, disposable PPE, respirator cartridges, disposable sampling equipment, brushes, buckets, waste decontamination solutions, etc. should be secured in drums and labeled. Disposal methods for these materials may depend on client requirements and/or results of site investigation data. The confirmed presence of hazardous materials on the site may require disposal of investigation-derived wastes as hazardous wastes.

Care should be taken during work and decontamination activities to minimize waste materials generated.

Exhibit 16-B
Minimum Measures For Level D Decontamination

Station 1 - Equipment Drop	Deposit equipment used on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather, a cool down station may be set up in this area.
Station 2 - Outer Garment, Boots, and Gloves Wash and Rinse	Scrub outer boots, outer gloves, and suit with decon-tamination solution or detergent/water. Rinse off using copious amounts of water.
Station 3 - Hard Hat, Outer Boot, and Glove Removal	Remove hard hat, outer boots, and gloves.
Station 4 - Boots, Gloves, and Outer Garment Removal	Remove boots, suit, and inner gloves and deposit in separate containers lined with plastic.
Station 5 - Field Wash	Wash hands and face.

Exhibit 16-C
Minimum Measures For Level B, And C Decontamination

Station 1 - Equipment Drop	Deposit equipment used on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather, a cool down station may be set up in this area.
Station 2 - Outer Garment, Hard Hat, Boots, and Gloves Wash and Rinse	Scrub outer boots, hard hat, outer gloves, and suit with decontamination solution or detergent/water. Rinse off using copious amounts of water.
Station 3 - Tank/Air Canister Change	If a worker leaves the exclusion zone to change an air tank, air canister, or mask, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boots donned, and joints tapped. Worker returns to duty.
Station 4 - Outer Boots, and Glove Removal	Remove outer boots and gloves. Deposit in container with plastic liner.
Station 5 - SCBA/Respirator Removal	SCBA backpack and facepiece/respirator is removed (avoid touching face with fingers). SCBA or respirator is deposited on plastic sheets.
Station 6 - Inner Gloves and Outer Garment Removal	Remove suit and inner gloves and deposit in separate containers lined with plastic.
Station 7 - Field Wash	Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to be present. Wash hands and face.

16.22 Traffic and Work Zone Safety

These guidelines apply whenever CDM Smith employees or subcontractors work in areas exposed to vehicular traffic on public streets or highways.

- Where vehicular traffic hazards exist because of work at locations near public streets or roads, a system of traffic and work zone controls should be developed to mitigate the hazard. The system should meet the requirements of Part 6 of the Manual of Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration, or the applicable state version of the MUTCD.

- In general, when the MUTCD allows the use of traffic safety direction devices, such as cones, CDM Smith will supplement those direction devices with a physical barrier, such as a truck.

- All traffic control systems on public roads must be coordinated with local traffic control officials as required by applicable law.

- Periodically evaluate effectiveness of temporary traffic control setups by walking or riding the job area looking for evidence of poor controls and near misses such as swerving traffic, motorists braking quickly, skid marks, blind spots, etc.

- Give motorists plenty of advanced warning of upcoming work zones.

- All employees working within designated work zones or near vehicular traffic should wear high-visibility clothing such as orange, yellow, or yellow-green shirts, jackets, or vests. During wet or inclement weather, similarly colored rainwear should be worn.

- During night work, between the hours of sunset and sunrise, high-visibility clothing should incorporate reflective striping or fabric and be visible at a distance of 1,000 feet. This clothing should meet ANSI standard #107 for High Visibility Safety Apparel.

- All employees working near traffic and vehicles must maintain situational awareness at all times. Stay mindful that warning signs and cones inform drivers to take action but that some drivers may not pay attention, and vehicles may still enter the work zone.

16.24 Distracted Driving and Cell Phone Safety

Anything that distracts you from the primary task of driving can put your life at risk. These distractions may include:

- Texting
- Using cell phones or smartphones
- Using other devices, such as tablets or laptops
- Using a navigation system
- Eating and drinking
- Talking to passengers
- Grooming
- Using audio or video systems

National Highway Traffic Safety Administration (NHTSA) data from 2010 shows that 17% (899, 000) of all police-reported vehicle accidents involved driver distraction in some form. Of these, 26,000 involved distraction by devices or vehicle controls while driving.

An NHTSA survey in 2011 estimates that at any given daylight moment 660,000 vehicles are driven by people using hand-held cell phones.

16.24.1 Cell Phone Use and Driving

Cell phone use and text messaging comprise two of the primary sources of distracted driving. According to a 2011 study by the Centers for Disease Control and Prevention (CDC), 69 % of U.S. drivers aged 18-64 reported use of cell phones while driving in the previous 30 days - and 31% reported they had read or sent texts or emails while driving at least once. Since text messaging involves all of the major types of distractions - visual, physical, and mental – it is clearly one of the most dangerous.

Many organizations, including the U.S. Department of Transportation, NHTSA, Federal Motor Carrier Safety Administration, and CDC have published guidance regarding the use of cells phones while driving. State laws also regulate distracted driving, and can be found at the following: http://www.ghsa.org/html/stateinfo/laws/cellphone_laws.html.

In order to minimize risks and help protect the lives of employees and others, CDM Smith has implemented a policy for cell phone use while driving. Employees are expected to comply with the following while engaged in CDM Smith activities:

- Minimize the use of cell phones while driving. To the extent possible, place calls ahead of time while in the office or at home. If on the road, pull over to a safe location and then make your calls.
- Avoid answering incoming calls while driving. Let your voice mail answer it and call the person back after you have parked the vehicle at a safe location.
- Do not text by hand while driving. Texting by hand is prohibited for all drivers engaged in CDM Smith activities. This includes both sending and reading texts. Although phones and devices with hands-free texting are available, this is not considered a safer option and is strongly discouraged by CDM Smith. A Texas A&M Transportation Institute study reported that texting by hand or texting by voice were equally dangerous while driving, and showed similarly delayed response times during each.
- Use a hands-free system and limit the time of the call when cell phones are absolutely

necessary while driving. All non-critical communications should be resumed at a more convenient time. Note that many jurisdictions prohibit the use of hand held phones, and that many clients prohibit any use of cell phones while driving for their work. Employees are required to comply with all local laws and client contract requirements.

- Engage in short conversations. If lengthy discussions are required, suspend the conversation and find a safe place to stop and park before continuing the discussion.
- Do not take notes while talking on the phone and driving. (This may seem silly, but was not an uncommon observation made by the authors of an NHTSA report.)

16.24.2 Other Distractions While Driving

Cell phones are not the only distractions encountered while driving. Navigation systems, which provide global positioning system (GPS) assistance, are commonly used during work activities. Much like a cell phone, they can cause you to lose focus if used while driving. So, too, can video displays, audio systems, and a variety of other distractions. Employees are expected to comply with the following policy regarding other distractions while driving:

- Obtain directions from navigation systems while parked in a safe location. Do not attempt to search or find new locations on the device while driving.
- Place navigation devices in a location that easily allows you to see the screen, but does not block your line of site or view of oncoming traffic.
- Review state laws for use of navigation systems. Some states restrict their use.
- Limit your adjusting of audio systems (e.g., radio, CD player, device, etc.) while driving. Wait to change devices or perform adjustments until parked in a safe location.
- Do not eat or drink while you are driving. Plan for meals and snacks beforehand. It is worth the extra time to stop if it means you will arrive safely.
- Only read maps while parked, and memorize the directions you need. If necessary, have a passenger explain the directions to you.
- Do not attempt to read any other material (e.g., documents, reports, drawings, books) while driving.
- Avoid engaging in personal grooming or hygiene. Again, this can be performed when parked in a safe location.

Additional information related to distracted driving can be found at the following websites:

http://www.distraction.gov/get-the-facts/facts-and-statistics.html

http://www-nrd.nhtsa.dot.gov/Pubs/812012.pdf

http://www.nhtsa.gov/Research/Human+Factors/Distraction

http://www.cdc.gov/Motorvehiclesafety/Distracted_Driving/

16.24.3 Cell Phone Use While Working

Although helpful during work activities, using cell phones can also distract users and limit their ability to safely perform other tasks at the same time. Employees are expected to follow these basic principles when using cell phones during work:

- Avoid walking around job sites while using a cell phone. Cell phone use can impair your ability to identify and prepare for hazards – e.g., construction sites have constantly moving equipment and require your full attention.

- Do not use your cell phone while engaged in physical tasks, unless it is critical.
- Use hands-free devices when possible, but remember that research has shown hands-free conversation still causes mental distraction, and may impact your ability to focus on mental and physical cues.
- Keep your eyes focused on the path you are traveling, and stay alert for moving traffic, persons, and equipment.

16.24.4 Radio Frequency Radiation

Peer reviewed journals and government agencies have evaluated the link between radio frequency exposure and cell phone use. Some of the conclusions are listed below:

- Numerous studies looking at the use of hand-held cell phones and risk of brain cancer have indicated no association between the use of cell phones and risk of brain cancer. This includes two studies published in the Journal of the American Medical Association and the New England Journal of Medicine (NEJM).
- Some of the studies conducted have indicated there are biological effects associated with exposure to the types and levels of radio frequency radiation associated with cell phone use; however, there is no consensus that these effects are harmful to people.
- An editorial published in the NEJM referencing a study published in its January 2001 issue concluded, "This study allays fears raised by alarmist reports that the use of cell phones causes brain tumors. Of course, we do not have the final word on this question, and results of future investigations may modify our perspective. Nevertheless, we believe that it is highly unlikely that the use of cell phones substantially increases the risk of brain tumors."

Based on the information currently available, there is not a significant health hazard associated with radio frequency radiation exposure related to cell phones.

16.26 Fatigue Management

16.26.1 Background

Fatigue plays a part in many, if not most, accidents, but OSHA publishes no standard for its control. Industry-standard recommendations for controlling fatigue-related injuries are published by the Nuclear Regulatory Commission, the American Petroleum Institute, and the US Army Corps of Engineers. To protect everyone involved with CDM Smith projects, the following rules apply.

16.26.2 Maximum Normal Work Hours

Project managers whose employees to work longer hours than those shown below must take steps to control fatigue and associated injuries. The steps should be documented in a formal or informal Fatigue Management Plan.

- 10-hours a day for more than 4 consecutive days;
- 50-hours in a 7-day work week;
- 12-hours a day for more than 3 consecutive days

16.26.3 Fatigue Management Plan

The project manager should plan for:

- Controls for fatigue that may include:
  - Work scheduling (e.g. limiting the number of consecutive night shifts)
  - Rotating jobs to prevent repetitive work
  - Breaks at critical times in the work cycle,
  - Control of environmental factors (e.g. heat, cold, use of personal protective equipment)
  - Buddy check-in for individuals working alone
  - Alternate transportation for long commutes
- Training or a discussion of:
  - Symptoms of fatigue
  - Habits and actions the worker may take to avoid fatigue
  - Actions workers should take if they observe fatigue in a co-worker
  - Driving to and from work as a factor of fatigue.

16.26.4 Rest Periods

The Fatigue Management Plan (whether documented or not) shall include

- A minimum of 8 hours of rest between shifts no longer than 12 hours each for operators of powered equipment.
- A minimum of 8 hours of rest between shifts no longer than 10 hours each for operators of motor vehicles, while on duty.

- No employee may operate a motor vehicle for CDM Smith after working more than 12-hours without 8 hours of rest.
- **Rest** means time during which the person concerned is not performing any work and is afforded the opportunity for uninterrupted sleep. This does not include time for breaks, meals, or travel time to/from work.

Appendix C

Safety Data Sheets

SAFETY DATA SHEET

Issuing Date August 24, 2015 **Revision Date** February 21, 2019 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name **Clorox® Performance Bleach**

Other means of identification

EPA Registration Number 5813-102

Recommended use of the chemical and restrictions on use

Recommended use Disinfecting, sanitizing, and laundry bleach

Uses advised against No information available

Details of the supplier of the safety data sheet

Supplier Address
The Clorox Company
1221 Broadway
Oakland, CA 94612

Phone: 1-510-271-7000

Emergency telephone number

Emergency Phone Numbers For Medical Emergencies, call: 1-800-446-1014
For Transportation Emergencies, call Chemtrec: 1-800-424-9300

2. HAZARDS 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

GHS Label elements, including precautionary statements

Emergency Overview

Signal word **Danger**

Hazard Statements
Causes severe skin burns and eye damage
Causes serious eye damage

Appearance Clear, pale yellow **Physical State** Thin liquid **Odor** Bleach

Precautionary Statements - Prevention
Wash face, hands and any exposed skin thoroughly after handling.
Wear protective gloves, protective clothing, face protection, and eye protection such as safety glasses.

Precautionary Statements - Response
Immediately call a poison center or doctor.
If swallowed: Rinse mouth. Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
Wash contaminated clothing before reuse.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
Specific treatment (see supplemental first aid instructions on this label).
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary Statements - Storage
Store locked up.

Precautionary Statements - Disposal
Dispose of contents in accordance with all applicable federal, state, and local regulations.

Hazards not otherwise classified (HNOC)
Although not expected, heart conditions or chronic respiratory problems such as asthma, chronic bronchitis, or obstructive lung disease may be aggravated by exposure to high concentrations of vapor or mist.

Product contains a strong oxidizer. Always flush drains before and after use.

Unknown Toxicity
Not applicable.

Other information
Very toxic to aquatic life with long lasting effects.

Interactions with Other Chemicals
Reacts with other household chemicals such as toilet bowl cleaners, rust removers, acids, or products containing ammonia to produce hazardous irritating gases, such as chlorine and other chlorinated compounds.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Weight %	Trade Secret
Sodium hypochlorite	7681-52-9	5 - 10	*

* The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

General Advice Call a poison control center or doctor immediately for treatment advice. Show this safety data sheet to the doctor in attendance.

Eye Contact Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

Skin Contact Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Inhalation Move to fresh air. If breathing is affected, call a doctor.

Ingestion Have person sip a glassful of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person. Call a poison control center or doctor immediately for treatment advice.

Protection of First-aiders Avoid contact with skin, eyes, and clothing. Use personal protective equipment as required. Wear personal protective clothing (see section 8).

Most important symptoms and effects, both acute and delayed

Most Important Symptoms and Effects Burning of eyes and skin.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically. Probable mucosal damage may contraindicate the use of gastric lavage.

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
This product causes burns to eyes, skin, and mucous membranes. Thermal decomposition can release sodium chlorate and irritating gases and vapors.

Explosion Data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

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.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Avoid contact with eyes, skin, and clothing. Ensure adequate ventilation. Use personal protective equipment as required. For spills of multiple products, responders should evaluate the MSDSs of the products for incompatibility with sodium hypochlorite. Breathing protection should be worn in enclosed and/or poorly-ventilated areas until hazard assessment is complete.

Other Information Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental Precautions This product is toxic to fish, aquatic invertebrates, oysters, and shrimp. Do not allow product to enter storm drains, lakes, or streams. See Section 12 for ecological Information.

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 Absorb and containerize. Wash residual down to sanitary sewer. Contact the sanitary treatment facility in advance to assure ability to process washed-down material.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes, and clothing. Do not eat, drink, or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage Store away from children. Reclose cap tightly after each use. Store this product upright in a cool, dry area, away from direct sunlight and heat to avoid deterioration. Do not contaminate food or feed by storage of this product.

Incompatible Products Toilet bowl cleaners, rust removers, acids, and products containing ammonia.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sodium hypochlorite 7681-52-9	None	None	None

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health.

Appropriate engineering controls

Engineering Measures 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 (or goggles) or face shield.

Skin and Body Protection Wear rubber or neoprene gloves and protective clothing such as long-sleeved shirt.

Respiratory Protection If irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice. Wash hands after direct contact. Do not wear product-contaminated clothing for prolonged periods. Remove and wash contaminated clothing before re-use. Do not eat, drink, or smoke when using this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical State	Thin liquid		
Appearance	Clear	**Odor**	Bleach
Color	Pale yellow	**Odor Threshold**	No information available

Property	**Values**	**Remarks/ Method**
pH	~12	None known
Melting/freezing point	No data available	None known
Boiling point / boiling range	No data available	None known
Flash Point	Not flammable	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
Upper flammability limit	No data available	None known
Lower flammability limit	No data available	None known
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Specific Gravity	~1.1	None known
Water Solubility	Soluble	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known
Explosive Properties	Not explosive	
Oxidizing Properties	No data available	

Other Information

Softening Point	No data available
VOC Content (%)	No data available
Particle Size	No data available
Particle Size Distribution	No data available

10. STABILITY AND REACTIVITY

Reactivity

Reacts with other household chemicals such as toilet bowl cleaners, rust removers, acids, or products containing ammonia to produce hazardous irritating gases, such as chlorine and other chlorinated compounds.

Chemical stability

Stable under recommended storage conditions.

Possibility of Hazardous Reactions

None under normal processing.

Conditions to avoid

None known based on information supplied.

Incompatible materials

Toilet bowl cleaners, rust removers, acids, and products containing ammonia.

Hazardous Decomposition Products

None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information .

Inhalation Exposure to vapor or mist may irritate respiratory tract and cause coughing. Inhalation of high concentrations may cause pulmonary edema.

Eye Contact Corrosive. May cause severe damage to eyes.

Skin Contact May cause severe irritation to skin. Prolonged contact may cause burns to skin.

Ingestion Ingestion may cause burns to gastrointestinal tract and respiratory tract, nausea, vomiting, and diarrhea.

Component Information

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium hypochlorite 7681-52-9	8200 mg/kg (Rat)	>10000 mg/kg (Rabbit)	-

Information on toxicological effects

Symptoms May cause redness and tearing of the eyes. May cause burns to eyes. May cause redness or burns to skin. Inhalation may cause coughing.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization No information available.

Mutagenic Effects No information available.

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Sodium hypochlorite 7681-52-9	-	Group 3	-	-

IARC (International Agency for Research on Cancer)
Group 3 - Not Classifiable as to Carcinogenicity in Humans

Reproductive Toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.
Chronic Toxicity Carcinogenic potential is unknown.
Target Organ Effects Respiratory system, eyes, skin, gastrointestinal tract (GI).

Aspiration Hazard No information available.

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)
54 g/kg
ATEmix (inhalation-dust/mist)
58 mg/L

12. ECOLOGICAL INFORMATION

Ecotoxicity
Very toxic to aquatic life with long lasting effects.

This product is toxic to fish, aquatic invertebrates, oysters, and shrimp. Do not allow product to enter storm drains, lakes, or streams.

Persistence and Degradability
No information available.

Bioaccumulation
No information available.

Other adverse effects
No information available.

13. DISPOSAL CONSIDERATIONS

Disposal methods
Dispose of in accordance with all applicable federal, state, and local regulations. Do not contaminate food or feed by disposal of this product.

Contaminated Packaging
Do not reuse empty containers. Dispose of in accordance with all applicable federal, state, and local regulations.

14. TRANSPORT INFORMATION

DOT	Not restricted.
TDG	Not restricted for road or rail.
ICAO	Not restricted, as per Special Provision A197, Environmentally Hazardous Substance exception.
IATA	Not restricted, as per Special Provision A197, Environmentally Hazardous Substance exception.
IMDG/IMO	Not restricted, as per IMDG Code 2.10.2.7, Marine Pollutant exception.

15. REGULATORY INFORMATION

Chemical Inventories

TSCA	All components of this product are either on the TSCA 8(b) Inventory or otherwise exempt from listing.
DSL/NDSL	All components are on the DSL or NDSL.

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. 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

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act
This product contains the following substances which are regulated 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
Sodium hypochlorite 7681-52-9	100 lb			X

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)

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Sodium hypochlorite 7681-52-9	100 lb	–	RQ 100 lb final RQ RQ 45.4 kg final RQ

EPA Statement
This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

> **DANGER: CORROSIVE.** Causes irreversible eye damage and skin burns. Harmful if swallowed. Do not get in eyes, on skin, or on clothing. Wear protective eyewear and rubber gloves when handling this product. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the restroom. Avoid breathing vapors and use only in a well-ventilated area.

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	Rhode Island	Illinois
Sodium hypochlorite 7681-52-9	X	X	X	X	
Sodium chlorate 7775-09-9	X	X	X		

International Regulations

Canada
WHMIS Hazard Class
E - Corrosive material

16. OTHER INFORMATION

NFPA	**Health Hazard** 3	**Flammability** 0	**Instability** 0	**Physical and Chemical Hazards** -
HMIS	**Health Hazard** 3	**Flammability** 0	**Physical Hazard** 0	**Personal Protection** B

Prepared By Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Revision Date February 21, 2019

Revision Note Updated date

Reference 1279533/164964.001

General 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

REVISION DATE: 28th June 2007

UNIVAR

SAFETY DATA SHEET
HYDROCHLORIC ACID >25%

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

PRODUCT NAME	HYDROCHLORIC ACID >25%
SYNONYMS, TRADE NAMES	Hydrogen Chloride Solution, , Muriatic Acid, , Vo - pH 8120,
SUPPLIER	UNIVAR LTD 46 Peckover Street BRADFORD West Yorkshire United Kingdom BD1 5BD Tel: +44 1274 377000 Fax: +44 1274 377001 sds@univareurope.com
SDS No.	H017
Emergency Contact Number (Office Hours)	+441274 377070
Emergency Contact Number (Outside Office Hours)	+441865 407333

2 HAZARDS IDENTIFICATION

Irritating to respiratory system. Causes burns.

CLASSIFICATION C;R34. Xi;R37.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Name	EC No.	CAS-No.	Content	Classification
HYDROCHLORIC ACID ...%	231-595-7	7647-01-0	>25%	C;R34 Xi;R37

The Full Text for all R-Phrases are Displayed in Section 16

EU INDEX NO.	017-002-00-2
EC (EINECS) NO.	231-595-7
CAS-NO.	7647-01-0

4 FIRST-AID MEASURES

INHALATION

Remove victim immediately from source of exposure. Rinse nose and mouth with water. Get medical attention.

INGESTION

Immediately rinse mouth and drink plenty of water (200-300 ml). Provide rest, warmth and fresh air. Get medical attention immediately!

SKIN CONTACT

Remove contaminated clothing immediately and wash skin with soap and water. Get medical attention immediately.

EYE CONTACT

Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyes wide apart. Continue to rinse for at least 15 minutes and get medical attention.

5 FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

Extinguish with alcohol-resistant foam, carbon dioxide, dry powder or water fog.

SPECIFIC HAZARDS

Hydrogen chloride (HCl).

PROTECTIVE MEASURES IN FIRE

Self contained breathing apparatus and full protective clothing must be worn in case of fire.

6 ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS

Follow precautions for safe handling described in this safety data sheet. Avoid contact with skin and eyes. Provide adequate ventilation.

ENVIRONMENTAL PRECAUTIONS

Spillages or uncontrolled discharges into watercourses must be IMMEDIATELY alerted to the Environmental Agency or other appropriate regulatory body.

SPILL CLEAN UP METHODS

Absorb with inert, damp, non-combustible material, then flush area with water. Collect spillage in containers, seal securely and deliver for disposal according to local regulations.

7 HANDLING AND STORAGE

USAGE PRECAUTIONS

Avoid spilling, skin and eye contact. Provide good ventilation. Eye wash facilities and emergency shower must be available when handling this product.

STORAGE PRECAUTIONS

Store in tightly closed original container in a dry and cool place.

STORAGE CLASS

Corrosive storage.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

PROTECTIVE EQUIPMENT

ENGINEERING MEASURES

Provide adequate ventilation, including appropriate local extraction, to ensure that the defined workplace exposure limit is not exceeded.

RESPIRATORY EQUIPMENT

If ventilation is insufficient, suitable respiratory protection must be provided.

HAND PROTECTION

Butyl rubber gloves are recommended.

EYE PROTECTION

Wear approved safety goggles.

OTHER PROTECTION

Wear rubber apron. Wear rubber footwear. Provide eyewash station and safety shower.

9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Fuming Liquid		
COLOUR	Colourless		
ODOUR	Acidic.		
SOLUBILITY	Soluble in water		
MELTING POINT (°C)	<-29	RELATIVE DENSITY	1.127 - 1.190
pH-VALUE, CONC. SOLUTION	1		

10 STABILITY AND REACTIVITY

STABILITY

Stable under normal temperature conditions and recommended use.

CONDITIONS TO AVOID

Avoid excessive heat for prolonged periods of time.

MATERIALS TO AVOID

Strong alkalis.

HAZARDOUS DECOMPOSITION PRODUCTS

Hydrogen chloride (HCl).

11 TOXICOLOGICAL INFORMATION

INHALATION

Irritating to respiratory system. May cause damage to mucous membranes in nose, throat, lungs and bronchial system.

INGESTION

Causes burns. Swallowing concentrated chemical may cause severe internal injury. May cause chemical burns in mouth, oesophagus and stomach.

SKIN CONTACT

Causes burns.

EYE CONTACT

Causes burns. Contact with concentrated chemical may very rapidly cause severe eye damage, possibly loss of sight.

MEDICAL SYMPTOMS

Extreme irritation of eyes and mucous membranes, including burning and tearing. Burning sensation in mouth. Sore throat.

12 ECOLOGICAL INFORMATION

ECOTOXICITY

Dangerous for the environment if discharged into watercourses.

LC 50, 96 Hrs, FISH mg/l	100 - 1000

MOBILITY

The product is soluble in water.

BIOACCUMULATION

The product is not bioaccumulating.

13 DISPOSAL CONSIDERATIONS

GENERAL INFORMATION

When handling waste, consideration should be made to the safety precautions applying to handling of the product. Do not puncture or incinerate even when empty.

DISPOSAL METHODS

Confirm disposal procedures with environmental engineer and local regulations.

14 TRANSPORT INFORMATION

UK ROAD CLASS	8		
PROPER SHIPPING NAME	HYDROCHLORIC ACID		
UN NO. ROAD	1789	UK ROAD PACK GR.	II
ADR CLASS NO.	8	ADR CLASS	Class 8: Corrosive substances.

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)

Product use : Synthetic/Analytical chemistry.

Synonym : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene)

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

Emergency telephone number (with hours of operation) : 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.
Contains gas under pressure; may explode if heated.
May cause frostbite.
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 : Never Put cylinders into unventilated areas of passenger vehicles. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use and store only outdoors or in a well ventilated place.

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. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.

Section 2. Hazards identification

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)

CAS number/other identifiers

CAS number : 115-11-7

Product code : 001031

Ingredient name	%	CAS number
2-methylpropene	100	115-11-7

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.

Section 4. First aid measures

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. 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 specialised 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).

Section 6. Accidental release measures

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 contact with eyes, skin and clothing. 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. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. 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.

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. Keep container tightly closed and sealed until ready for use. 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).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
2-methylpropene	**ACGIH TLV (United States, 3/2012).** 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

Section 8. Exposure controls/personal protection

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 : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. 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. [Liquefied compressed gas.]

Color : Colorless.

Molecular weight : 56.12 g/mole

Molecular formula : C4-H8

Boiling/condensation point : -6.9°C (19.6°F)

Melting/freezing point : -140.7°C (-221.3°F)

Critical temperature : 144.75°C (292.6°F)

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: -76.1°C (-105°F)

Burning time : Not applicable.

Burning rate : Not applicable.

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%

Section 9. Physical and chemical properties

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 : 0.263 g/l

Partition coefficient: n-octanol/water : 2.34

Auto-ignition temperature : 465°C (869°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not applicable.

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.

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: oxidizing materials.

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
2-methylpropene	LC50 Inhalation Vapor	Rat	550000 mg/m^3	4 hours

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Section 11. Toxicological information

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.
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.

Section 11. Toxicological information

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
2-methylpropene	2.34	-	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	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 

Section 14. Transport information

Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	<u>Limited quantity</u> Yes. <u>Packaging instruction</u> **Passenger aircraft** Quantity limitation: Forbidden. **Cargo aircraft** Quantity limitation: 150 kg <u>Special provisions</u> 19, T50	<u>Explosive Limit and Limited Quantity Index</u> 0.125 <u>ERAP Index</u> 3000 <u>Passenger Carrying Ship Index</u> Forbidden <u>Passenger Carrying Road or Rail Index</u> Forbidden <u>Special provisions</u> 29	-	-	<u>Passenger and Cargo Aircraft</u>Quantity limitation: 0 Forbidden <u>Cargo Aircraft Only</u> Quantity limitation: 150 kg

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

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 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act (CAA) 112 regulated flammable substances: 2-methylpropene

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

<u>SARA 302/304</u>

<u>Composition/information on ingredients</u>

No products were found.

SARA 304 RQ : Not applicable.

<u>SARA 311/312</u>

Classification : Fire hazard
Sudden release of pressure

Section 15. Regulatory information

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
2-methylpropene	100	Yes.	Yes.	No.	No.	No.

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.

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

WHMIS (Canada) : Class A: Compressed gas.
Class B-1: Flammable gas.

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.

Hazardous Material Information System (U.S.A.)

Health	1
Flammability	4
Physical hazards	2

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 are not required on SDSs 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 mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

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.

History

Date of printing	:	10/15/2014.
Date of issue/Date of revision	:	10/15/2014.
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Version	:	0.02

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 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health

Section 16. Other information

TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

Indicates information that has changed from previously issued version.

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.

HYDROCHLORIC ACID >25%

ADR PACK GROUP	II	HAZARD No. (ADR	80
ADR LABEL NO.	8	HAZCHEM CODE	2R
CEFIC TEC R NO.	80GC1-II+III	RID CLASS NO.	8
RID PACK GROUP	II	UN NO. SEA	1789
IMDG CLASS	8	IMDG PACK GR.	II
EMS	F-A, S-B	MFAG	See Guide
MARINE POLLUTANT	No.	UN NO. AIR	1789
AIR CLASS	8	AIR PACK GR.	II

15 REGULATORY INFORMATION

LABELLING

Corrosive

CONTAINS HYDROCHLORIC ACID 25%

RISK PHRASES

R34	Causes burns.
R37	Irritating to respiratory system.

SAFETY PHRASES

S24/25	Avoid contact with skin and eyes.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

STATUTORY INSTRUMENTS

Chemicals (Hazard Information and Packaging) Regulations.

APPROVED CODE OF PRACTICE

Safety Data Sheets for Substances and Preparations. Classification and Labelling of Substances and Preparations Dangerous for Supply.

GUIDANCE NOTES

Workplace Exposure Limits EH40. CHIP for everyone HSG(108).

16 OTHER INFORMATION

REVISION DATE	28th June 2007
REV. NO./REPL. SDS GENERATED	05
SDS NO.	H017

SAFETY DATA SHEET STATUS

Approved.

DATE	5th February 2007
SIGNATURE	Jitendra Panchal

RISK PHRASES IN FULL

R34	Causes burns.
R37	Irritating to respiratory system.

Appendix D

OSHA Poster

U.S. Department of Labor

Occupational Safety and Health Administration

Job Safety and Health
IT'S THE LAW!

All workers have the right to:

- A safe workplace.
- Raise a safety or health concern with your employer or OSHA, or report a work-related injury or illness, without being retaliated against.
- Receive information and training on job hazards, including all hazardous substances in your workplace.
- Request an OSHA inspection of your workplace if you believe there are unsafe or unhealthy conditions. OSHA will keep your name confidential. You have the right to have a representative contact OSHA on your behalf.
- Participate (or have your representative participate) in an OSHA inspection and speak in private to the inspector.
- File a complaint with OSHA within 30 days (by phone, online or by mail) if you have been retaliated against for using your rights.
- See any OSHA citations issued to your employer.
- Request copies of your medical records, tests that measure hazards in the workplace, and the workplace injury and illness log.

This poster is available free from OSHA.

Contact OSHA. We can help.

Employers must:

- Provide employees a workplace free from recognized hazards. It is illegal to retaliate against an employee for using any of their rights under the law, including raising a health and safety concern with you or with OSHA, or reporting a work-related injury or illness.
- Comply with all applicable OSHA standards.
- Report to OSHA all work-related fatalities within 8 hours, and all inpatient hospitalizations, amputations and losses of an eye within 24 hours.
- Provide required training to all workers in a language and vocabulary they can understand.
- Prominently display this poster in the workplace.
- Post OSHA citations at or near the place of the alleged violations.

FREE ASSISTANCE to identify and correct hazards is available to small and medium-sized employers, without citation or penalty, through OSHA-supported consultation programs in every state.

1-800-321-OSHA (6742) • TTY 1-877-889-5627 • www.osha.gov

OSHA 3165-04R 2015

Appendix E

Injury/Illness Report Form

CDM Smith

Injury/Illness Report Form

Effective: 1/3/2012 / Revision: 01

Information about Injured, Sick, or Involved Employee

First Name:		MI:		Last Name:	
Employee Number:		Unit:	Click to Select	Office:	
Phone Number:			Group Leader or Direct Manager		
Address:					

Employer:	☐ CDM Smith ☐ Subcontractor	Employee Status:	☐ Full Time ☐ Part Time
Name of Subcontractor Firm:		Subcontractor Phone No.	
Subcontractor Address:			

Information about Accident/Injury/Illness

Date of Accident:		Time of Accident:		Vehicle Involved?	☐ Yes ☐ No
Injury or Illness:	☐ Injury ☐ Illness	Property Damage?	☐ Yes ☐ No	Client Service Group:	Click to Select
Project and Location of Accident: (Project Name, City and State)					

Project Manager:		Witness(es):	Attach witness statement if available

(Attach additional information if needed, i.e pictures, diagrams, etc.)

Description of Accident:(Explain what happened).

Description of Injury(Identify body part and substance or object that caused harm)

Immediate Actions Taken or Required:

Injury/Illness Report Form

Did the injured employee receive medical treatment?*	☐ Yes ☐ No	Did the employee return to work?	☐ Yes ☐ No

***Note: If the employee receives medical treatment from an offsite medical facility they must get a "work status report" from the Doctor or Medical Professional that provides treatment.**

Name of Clinic/Medical Facility	
Name of Doctor:	
Clinic/Medical Facility Address:	
Phone No.:	

Current Status of Employee:

Signatures:

Employee	X	Date:	/ /
	Type or Print Name:		
Group Leader or Direct Manager:	X	Date:	/ /
	Type or Print Name:		
H&S Manager:	X	Date:	/ /
	Type or Print Name:		

For Office Use Only:

Case No.:	OSHA Recordable? ☐ Yes ☐ No
Project No.:	Accident or Diagnosis Date:

Injury/Illness Severity, based on initial evaluation:	OSHA Illness Code:
☐First Aid Only ☐Medical Treatment ☐Lost Workdays – Restricted Activity ☐Lost Workdays – Away from Work ☐Fatality Date: _____ ☐Total Number of Lost Days: _____	☐Occupational Skin Diseases or Disorders ☐Dust Diseases of the Lungs ☐Respiratory Conditions Due to Toxic Agents ☐Poisoning ☐Disorders Due to Physical Agents ☐Disorders Associated with Repeated Trauma ☐All Other Occupational Illnesses

Additional Comments: _____

Appendix F

Employee Meeting Record

CDM Smith
EMPLOYEE MEETING RECORD

Date:____________________________ Project # or office location:______________________

Time:____________________________ Instructor:_____________________________________

Duration of training:____

Topics discussed:____

____

____

____

Printed Name	Employee Number	Signature

Appendix C

Community Action Monitoring Plan

Table of Contents

List of Figures

Attachment

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Section 1

Introduction

The purpose of this plan is to develop a Community Air Monitoring Plan (CAMP) that describes the real-time air monitoring to be implemented during intrusive drilling and monitoring well installation activities within the boundaries of the New Process Cleaners Site. Continuous air monitoring for PM_{10} will be required during drilling and monitoring well installation activities.

Anticipated activities at the Site include the following major components:

- Mobilizing equipment and personnel
- Groundwater sampling and synoptic water levels
- Monitoring well installation and surveying
- Ground penetrating radar an electromagnetic survey of underground utilities and anomalies
- Soil boring and rock coring sampling
- Vapor intrusion sampling
- Demobilizing equipment and personnel

Continuous air monitoring for particulate matter 10 micrometers or less in size (PM_{10}) will be performed during ground intrusive drilling and monitoring well installation activities in known or suspected zones of contamination. The CAMP has been developed to provide a measure of protection for the downwind community (i.e., off-site receptors including residences, businesses, and off-site workers not directly involved with construction activities) from potential airborne particulate releases as a direct result of these activities. Additionally, the CAMP will provide the necessary data to help confirm that these activities did not result in particulate releases through the air to the off-site receptors.

The CAMP has been prepared in accordance with New York State Department of Environmental Conservation (NYSDEC) Technical Guidance for Site Investigation and Remediation (DER-10; NYSDEC 2010), specifically including the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan in Appendix 1A and the Fugitive Dust and Particulate Monitoring in Appendix 1B. The NYSDOH Generic Community Air Monitoring Plan Documentation is included in Attachment A.

1.1 Site Description

The New Process Cleaners Site is located at 115 North Market Street in the City of Johnstown in Fulton County, New York (Figure 1). The 0.11-acre property is zoned commercial and houses an active dry cleaner, New Process Cleaners. The building, its parking lot, and driveway occupies most of the parcel with little undeveloped space. It has a one-story building with a basement located in the front portion, while the rear of the building was constructed slab-on-grade. In general, the property is in a mixed commercial and residential area.

Based on a Site Characterization performed at the Site in 2018, the Site was found to be contaminated with chlorinated solvents, primarily tetrachloroethylene (PCE) and trichloroethylene (TCE) in both soil and groundwater. PCE, TCE and their associated degradation products are also found in groundwater at the south-west portion of the property, exceeding groundwater standards (typically 5 micrograms per kilogram (µg/L)), with a maximum PCE concentration of 15,000 µg/L and maximum TCE concentration of 6.6 µg/L. PCE and TCE were found at maximum concentrations in shallow soil at the Site, at concentrations of 40 milligrams per kilogram (mg/kg) and 0.13 mg/kg, respectively. In addition, 1,4-dioxane and per-and polyfluoroalkyl substances (PFAS) were found in the western portion of the site at low levels. 1,4-dioxane was detected at a maximum concentration of 0.34 µg/L, which is below the 1 µg/L screening level. PFOA was detected at a maximum concentration of 9.6 ng/L, which is below the 10 ng/L screening level; PFOS was detected at a maximum of 15 ng/L, which is slightly exceeding the 10 ng/L screening level. The maximum concentration of PFAS was PFPeA at 83 ng/L, which is below the 100 ng/L screening level. The total PFAS concentration was 189.75 ng/L, which is below the screening level of 500 ng/L.

Figure 1-1

Monitoring Wells
Sanitary Manhole
Active Sewer Lateral (Est.)
Fence (Est.)
Test Pit
New Process Cleaners Approximate Building Outline
Notes:
(1) Sewer lateral location estimated based on discussion with city officials and manhole locaiton.
(2) Aerial image from 2014 NYS Statewide Digital Orthoimagery Program http://gis.ny.gov/gateway/orthoprogram
0 Feet 50
New Process Cleaners Site Building
NPC-MW6
NPC-MW1
NPC-MW4
NPC-MW5
NPC-MW3
NPC-MW2
N Market Street
Former R & J Garage Property
Manhole

1.2 Remedial Investigation Schedule

The New Process Cleaners Site subsurface investigation activities will be performed early during 2022, for a duration of 7-10 days, intermittently, over a 30-day period.

Section 2

Air Monitoring Program

The air monitoring program for New Process Cleaners Site drilling and monitoring well include continuous particulate air monitoring during all intrusive activities performed at the site.

Continuous air monitoring (monitoring for PM_{10}) will be initiated at the start of drilling and monitoring well installation activities and will be evaluated against corrective action. Visual observation of dust will also be performed, implementing dust suppression techniques when necessary.

2.1 Air Monitoring Stations

Two fixed air monitoring stations for PM_{10} will be set-up based on the location of drilling and monitoring well installation activities, potential receptor locations, and consideration of daily wind direction. The air monitoring stations will be established no more than 200 feet from the work area.

An upwind (Upwind-1) and downwind (Downwind-1) station will be placed accordingly at the start of drilling and monitoring well installation activities, which is dependent on the wind direction to monitor for PM_{10}. The locations of the air monitoring stations will be documented on each daily report, as well as the predominant wind direction obtained from old trail road station # KNYFONDA3 located in Fonda, NY.

2.2 VOCs

Volatile Organic Compounds (VOCs) will be monitored in the breathing zone of workers using a PID (Photoionization Detector) meter at each site. The PID meter will be located within a few feet of activities.

2.3 Corrective Action Level and Actions for VOCs

The following is a list of actions that will be taken during drilling and monitoring well installation activities while monitoring VOCs:

- If the concentration of VOCs is 5 parts per million (ppm) the PID will alarm, work shall then be halted, and monitoring will continue.
- When the VOC concentration is between 5-10 ppm, work is halted until the VOC level decreases below 5 ppm. If levels do not decrease below 5 for a 15-minute period, corrective action must be taken.
- If VOC levels persist in excess of 10 ppm but less than 15 ppm the source of vapors will be identified, corrective action needs to be taken and continued monitoring. Work activities can resume after these steps if the PID reads VOC concentrations below 5 ppm for a 15-minute period.

- If the VOC levels are above 15 ppm around the perimeter of the work area, drilling and monitoring well installation activities will be shut down and determination of the source of VOCs identified. Corrective actions will be taken, such as implementing periodic monitoring for VOCs.

Any detections above 5 ppm on the PID meter will be noted.

2.4 Particulates

Particulate monitoring will be conducted using real-time meters for PM_{10} (i.e., DustTrak II Aerosol Monitor Model 8530 by TSI, Inc. or equivalent). The meters selected for use during these monitoring activities will be capable of calculating 15-minute running average concentrations. The meters will be equipped with alarms that will indicate if concentrations exceed an established level. Data from these meters will be checked at least once daily during activities. The meters also have the capability to notify on-site personal of exceedances by text message. This will allow exceedances to be investigated as quickly as possible. If visible dust is observed leaving the work area, the appropriate meters will be checked and corrective actions taken in accordance with NYSDEC's Generic CAMP (2010), if necessary.

2.5 Corrective Action Level and Actions for Particulates

The corrective action level has been established with respect to of the New York State Department of Health Generic Community Air Monitoring Plan provided in DER-10 (NYSDEC 2010). The corrective action level will apply at the downwind location only. A summary of the corrective action level is provided below.

- Particulate (PM_{10}) – 0.100 milligrams per cubic meter (mg/m^3) above upwind station for a 15-minute period:

  - If the downwind PM_{10} level is 0.100 mg/m^3 above the upwind station for the 15-minute period or if airborne dust is observed leaving the work area, then dust-suppression techniques will be employed. Work may continue with dust-suppression techniques provided that downwind PM_{10} particulate levels do not exceed 0.150 mg/m^3 above the upwind level and no visible dust is migrating from the workarea.

  - If, after implementation of dust-suppression techniques, the downwind PM10 levels are greater than 0.150 mg/m3 above the upwind station, work will be stopped, and site activities will be evaluated. Work may resume only if dust-suppression measures and other controls are successful in reducing PM_{10} levels to less than 0.150 mg/m^3 above the upwind levels and if no visible dust is observed leaving thesite.

  - An initial level of 0.100 mg/m^3 at any of the monitoring stations will be established as a conservative assessment level. Readings greater than this conservative assessment level will result in on-site personnel performing a review of the background (upwind perimeter) site level. If the downwind level is determined to be greater than 0.100 mg/m^3 above the upwind level, dust-suppression techniques will be employed to avoid an exceedance of the corrective action level.

Exceedances of the criteria will result in an immediate review of drilling and monitoring well installation activities with adjustments made as needed in consultation with the selected contractor. The first step of this review will be to evaluate the result to determine whether it is site related or an issue with the meter (e.g., high humidity impacting the meter and readings) or local conditions (e.g., mowing in the vicinity of the meter). Once an exceedance has been verified to be site related, the Project Manager will immediately be notified and an investigation will be performed to identify the conditions causing the exceedance (e.g., site conditions, contractor site activities, and weather conditions). The Project Manager will respond to the issue. As noted in the introduction to Section 2, such response actions may include additional dust suppression through watering, additional site work observations, and/or evaluation/modification of truck tarping procedures.

If initial monitoring results indicate no exceedances of the corrective action triggers listed above, CDM Smith may work with the Agencies to modify the frequency or duration of monitoring at certain locations.

2.6 Reporting

A summary of the air monitoring results will be provided to NYSDEC and NYSDOH personnel as results are available (typically daily) via email distribution.

VOCs

Only as noted in the field notes or exceeding the 5 ppm or 15 ppm alarm. If exceedances occur, the action taken will be reported.

Particulates

The report will include the monitoring period, predominant wind direction, identification of the upwind and downwind stations, daily wind rose, daily maximum 15-minute levels for PM_{10} at each station, and an assessment of the corrective action level, and any comments or notes.

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Section 3

References

NYSDEC. 2010. DER-10, Technical Guidance for site Investigation and Remediation, Division of Environmental Remediation. Appendix 1A – New York State Department of Health Generic Community Air Monitoring Plan; Appendix 1B – Fugitive Dust and Particulate Monitoring.

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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. APeriodic@ 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.

<u>VOC Monitoring, Response Levels, and Actions</u>

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.

<u>Particulate Monitoring, Response Levels, and Actions</u>

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.

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